

Encyclopedia of Organizational Knowledge, Administration, and Technology

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Information Resources Management Association, USA

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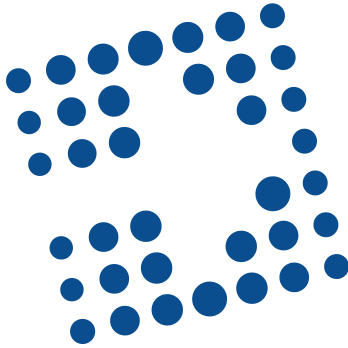
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Preface

Technological innovations of the past few decades have had significant impacts on modern organizations worldwide forcing many of them to reevaluate their current infrastructures in terms of both efficiency and effectiveness. As the opportunity for further innovation progresses the goal of any organization is to identify more advanced and streamlined methods for managing organizational resources, human resources, as well as structural aspects. Successful organizations have been able to design and implement technology-driven infrastructures allowing them to use the most updated information in managing their resources to the level of accuracy and efficiency that until a few years ago was not imaginable!

The ushering in of the Fourth Industrial Revolution has been a catalyst to those companies that have not been able to reap the benefits of integrating modern technological innovation in support of managing their organizations more effectively. In modern times, many firms have begun looking into Artificial Intelligence (AI) in managing vast organizational knowledge to identify the most effective solutions, techniques, and management practices. The application and utilization of AI can now be found in most industries such as healthcare, education, engineering, tourism, government, transportation, retail, finance, etc. and offers many innovative and cost-effective solutions which are ultimately making organizations in these industries much more efficient and competitive.

Becoming a technology-driven organization does not just happen simply by acquiring technology resources and equipment, but rather begins through visionary leadership. Specifically, leadership that provides clear direction for the creation of a very innovative technology-centered infrastructure where technological evolution can be turned into a driving force in managing the organization. To ensure that an organization stays technology-driven, all administrative and management practices within the organization need to be continually assessed and redesigned in support of ongoing progress and sustainability of the organization. Regrettably, many organizations fail to understand that to properly utilize and benefit from technological innovations, they must have a modern administrative and management infrastructure in place, otherwise a lack thereof is a recipe for disaster.

Over the years, there have been many failures of technology experts – including a failure to understand that technological resources are not just hardware and software, but also humanware which includes all human elements from those in management to the end users who plan, implement, and manage technology applications and utilization. Also, a failure to understand how important it is to organizational leadership to develop state-of-the-art management practices where all human needs for utilizing the technology are carefully planned and managed. Technology-driven organizations cannot become successful unless there are strong modern management practices in place to support technological deployments. Therefore, modern successful organizations need to revolutionize their administrative and management practices first to pave the way for technology to become the driving force within their organization.

During the past few decades, there has been much research conducted by experts all over the world in determining what the critical factors are for developing successful technology-driven organizations. Much of the research has been centered around the human elements, organizational structures, management leadership and vision, as well as the impacts of external forces such as the economy and government policies, continuously expanding the body of literature in their important research areas. To provide access to some of the most valuable research findings relevant to organizational knowledge, administration, and technologies, the need to create a single publication where all this research can be found is of paramount importance. As such, this comprehensive five-volume *Encyclopedia of Organizational Knowledge, Administration, and Technology (First Edition)*, was created and is designed to act as a single all-encompassing reference source on conceptual, methodological, and technical aspects of organizational knowledge and management and will provide insight into emerging topics including, but not limited to: organizational structure, strategic leadership, information technology management, business analytics, corporate social responsibility, supply chain management, and social networking. The chapters within this publication are aimed to provide researchers with contemporary research findings and results that are sure to pave the way for future research and discoveries pertaining to the creation of technology-driven organizations all over the globe.

The five-volume *Encyclopedia of Organizational Knowledge, Administration, and Technology (First Edition)* is organized into fifteen sections that provide comprehensive coverage of important topics. These sections are: 1) **Accounting, Finance, and Economics**, 2) **Business and Organizational Development and Research**, 3) **Business Digital Economy and Knowledge**, 4) **Business Information Systems**, 5) **Business Policy, Ethics, and Law**, 6) **Business Technological Innovations**, 7) **Cyber and Network Security**, 8) **E-Business**, 9) **Entrepreneurship and SMEs**, 10) **Hospitality, Travel, and Tourism Management**, 11) **Knowledge Management**, 12) **Management Science**, 13) **Marketing and Custom Relationship Management**, 14) **Operations and Service Management**, 15) **Organizational Management and Communications**.

Each of the focused sections include diverse chapters centered around a common theme, with each of the chapters then arranged by relevance to the theme and to each other. Two different tables of contents support the reader with navigating the contents by volume and alphabetically. Also, technical and managerial terms and their definitions are offered in addition to thorough reference sections.

SECTION 1: ACCOUNTING, FINANCE, AND ECONOMICS

This section opens this extensive reference source by highlighting the latest trends in the financial sector, from accounting practices to corporate finance and neuroeconomics. One of the initial chapters in the section, “**The Potential Role of Intellectual Capital in the Process of Accounting Convergence**,” authored by Prof. Ionica Oncioiu from Titu Maiorescu University, Romania, explores the importance of reviewing the fiscal policy of intangible assets in order to reestablish profit growth and promote business development. A following chapter, “**Technical Efficiency Through Innovative Methods and Estimations in Financial Markets**,” authored by Dr. Aikaterini Kokkinou from the Higher Military Academy, Greece, investigates technical efficiency estimation in financial markets, using both parametric and non-parametric techniques: parametric Stochastic Frontier Analysis (SFA) approach or non-parametric Data Envelopment Analysis (DEA). It focuses on reviewing the stochastic frontier analysis literature regarding estimating inefficiency in financial markets level, as well as explaining producer heterogeneity

along with the relationships with productive efficiency level. Another chapter featured in this section, **“Financing Digital Innovation for Sustainable Development,”** authored by Dr. Danilo Piaggese and Mrs. Helena Landazuri from K4D (Evidence and Knowledge for Development), United States, discusses establishing technical and financial support for the promotion of digital innovation and economic sustainability through the use of market development and efficient business models. The chapter that follows this, **“Auction-Based Pricing in Cloud Environment,”** authored by Ms. Branka Mikavica and Prof. Aleksandra Kostic-Ljubisavljevic from the University of Belgrade, Serbia, analyzes the benefits of allocation mechanisms using cloud resources, as well as the effects of improved bidding strategies within auction-based pricing methods. One of the closing chapters in this section, **“Neuroeconomic Perspectives for Economics,”** authored by Prof. Torben Larsen from the University of Southern Denmark, Denmark, outlines three macroeconomic focus points: 1) Equality by Universal Basic Income, 2) Environmental Protection by Carbon Emission Tax, and 3) Individualized Stress-Management.

SECTION 2: BUSINESS AND ORGANIZATIONAL DEVELOPMENT AND RESEARCH

This section includes chapters that investigate various business models and strategies that promote business development and a positive organizational culture. The first chapter in the section, **“Organizational Policy Learning and Evaluation using Monte Carlo Methods,”** authored by Prof. Clement Leung from the Chinese University of Hong Kong, China, Ms. Nikki Lijing Kuang of the University of California, San Diego, United States, and Prof. Vienne Sung from Hong Kong Baptist University, Hong Kong, explains the deployment of learning strategies in given organizational environments for reinforcing policy evaluation and review and promoting effective operation. Another noteworthy chapter found in this section, **“The Diversity Paradox,”** authored by Prof. J. Jacob Jenkins from California State University Channel Islands, United States, studies the false attainment of organizational diversity by emphasizing a singular form of individualism while neglecting alternative expressions. The chapter that follows this, **“Fab Labs, A Place for Innovation, Collaboration and Creation?”** authored by Prof. Diane-Gabrielle Tremblay from the University of Quebec, Canada and Prof. Arnaud Scaillerez from the University of Moncton, Canada, evaluates the implementation of digital workshops for developing organizational innovation and improving creativity among employees. The subsequent chapter, **“The Role of Networks in Local Governance,”** authored by Prof. Eugenio Salvati from the University of Pavia, Italy, identifies the characteristics of governmental networks in local communities and their connection to innovation in public administration. The final chapter in this section, **“A Model for Success in Agribusiness in the Portuguese Context,”** authored by Prof. Carla Negrão from the University of Coimbra, Portugal, supports developing a theoretical framework of achievement for agribusiness in today’s digital economy through the application of novel factors including e-commerce, internationalization, and strategic alignment.

SECTION 3: BUSINESS DIGITAL ECONOMY AND KNOWLEDGE

This section presents coverage on the novel transformation of business practices with the implementation of digital systems. One of the opening chapters, **“Continuous Assurance as Digital Transformation Enabler of Audit, Risk Management, and Business Compliance,”** authored by Prof. Rui Pedro

Marques from the University of Aveiro, Portugal, provides an overview of continuous assurance services and its role in the evaluation and design of information systems, as well as the overall effectiveness of organizations. Another noteworthy chapter found in this section, **“Artificial Intelligence as an Enabler for Developing Business Systems,”** authored by Dr. N. Raghavendra Rao from FINAIT Consultancy Services, India, reviews the creation and improvement of modern business models using artificial intelligence. One of the chapters that succeeds this, **“Augmenting Organizational Knowledge Management Using Geographic Information Systems,”** authored by Prof. Colbert Jackson from the University of the Witwatersrand, South Africa and Prof. Dickson Kibetu from Chuka University, Kenya, examines the role of GIS technology in developing effective and efficient knowledge management systems within an organization. Another chapter featured within this section, **“Big Data, Data Management, and Business Intelligence,”** authored by Prof. Richard Herschel from Saint Joseph’s University, United States, studies the application of big data in facilitating sound business intelligence, as well as key issues and effectiveness of data management in organizations. One of the last chapters presented, **“Data Discovery Systems for Not-for-Profit Organizations,”** authored by Prof. Joanna Palonka from the University of Economics in Katowice, Poland, discusses the integration of information and communication technologies, specifically data discovery systems, in nonprofit organizations to promote effective resource management methods and enhanced quality of services.

SECTION 4: BUSINESS INFORMATION SYSTEMS

This section discusses coverage and research perspectives on analytical approaches for integrating computing tools into corporate operations. The earliest chapter featured in this section, **“Research Trends in Information Systems from the Management Discipline Based on Co-Occurrence Analysis,”** authored by Prof. Beatriz Forés, Prof. Rafael Lapiedra, and Mr. José-María Fernández-Yáñez from Jaume I University, Spain, studies the impact of information systems in business practices and organizational performance based on the analysis of concurrences of key words used in publications of the specific topic. The next chapter, **“Organizations Operating in Real Time (Real-Time Enterprise) and the Role of IT as a Tool Supporting their Management Systems,”** authored by Prof. Jerzy Kisielnicki and Mr. Marek Markowski from the University of Warsaw, Poland, examines the benefits of implementing real-time information processing into an organization and its impact on the production of IT systems. Also included within this section is the chapter, **“An Approach for Estimating the Opportunity Cost Using Temporal Association Rule Mining and Clustering,”** authored by Prof. Reshu Agarwal from the G.L. Bajaj Institute of Technology and Management, India, which breaks down the application of data mining on evaluating penalty cost and determining opportunity cost for ensuring optimal inventory management and control. Following this chapter is, **“Systems, Services, Solutions of the Public Cloud,”** authored by Prof. Eduardo Correia from the Ara Institute of Canterbury, New Zealand. This chapter dissects the various models and platforms of the public cloud that are available for organizations, as well as highlights security risks and challenges that might arise. One of the final chapters found in this section, **“Automatic Detection of Semantic Clusters in Glossaries,”** authored by Ms. Marcela Ridao from the Universidad Nacional del Centro de la Provincia de Buenos Aires, Argentina and Prof. Jorge Doorn of Universidad Nacional del Oeste, Argentina, improves upon traditional visualization techniques in natural language models by applying a cluster detection method.

SECTION 5: BUSINESS POLICY, ETHICS, AND LAW

This section provides trending research on the latest best practices involving strategic planning and policy and examines corporate social responsibility initiatives. One of the opening chapters presented in this section, **“The Influence of Technology on the Strategic Planning Process,”** authored by Prof. Martin Mayer from the University of North Carolina at Pembroke, United States and Deputy Fire Chief Michael Martin of the Town of Cary (NC) Fire Department, United States, deliberates the transformation of public-sector strategic planning and organizational dynamics with the application of digital technology, as well as future opportunities and challenges. A proceeding chapter, **“Corporate Social Responsibility, Irresponsibility, and Citizenship,”** authored by Prof. Duane Windsor from Rice University, United States, addresses key issues in the field of corporate social responsibility, as well as analyzes its economic, ethical, and strategic influences. One of the concluding chapters presented in this section, **“What Can Organizations Do to Combat Human Trafficking?”** authored by Prof. Laura Dryjanska from Biola University, United States, converses effective organizational management techniques for fighting forms of modern slavery, including supply chain management and corporate social responsibility. Another closing chapter, **“A Guide to Cracking Down Cyber-Ethical Dilemmas,”** authored by Dr. Wanbil Lee from The Computer Ethics Society and Wanbil & Associates, Hong Kong, provides extensive research on cyber ethics and how to solve related issues using modern theories and technologies. A finishing chapter that follows this, **“Algorithms and Bias,”** authored by Ms. Julie Smith from the University of North Texas, United States, investigates the issue of discriminatory bias in algorithms as well as optimal solutions in the minimization of this problem.

SECTION 6: BUSINESS TECHNOLOGICAL INNOVATIONS

This section features the latest technological innovations including business intelligence, data mining, and decision support system applications that are being implemented in organizational practices. The first chapter featured in this section, **“ICT, Smart Systems, and Standardization,”** authored by Prof. Kai Jakobs from RWTH Aachen University, Germany, provides trending research on the relationship between standardization management strategies and the innovative sectors of smart systems and information and communication technologies. Another chapter that can be found within this section, **“Impact of Management Automation on the Processing of Business Information,”** authored by Prof. Alicia Martín-Navarro, Prof. María Paula Lechuga Sancho, and Mrs. Paula Algaba Berro from the University of Cádiz, Spain, analyzes the application of information systems into business management and its correlation to organizational development. Another noteworthy chapter, **“Quantification of Semantic Intelligence,”** authored by Prof. Maria Koleva from the Bulgarian Academy of Sciences, Bulgaria, discusses the various characteristics of semantic intelligence and speculates if there is a universal method for accurately measuring it. A closing chapter in this section, **“Data Mining for Fraud Detection,”** authored by Prof. Roberto Marmo from the University of Pavia, Italy, reviews the rising concerns of fraud as well as methods within data mining that provide viable solutions. The concluding chapter, **“Art Innovative Systems for Value Tagging,”** authored by Ms. Laurel Powell, Prof. Anna Gelich, and Prof. Zbigniew Ras from the University of North Carolina at Charlotte, United States, examines the use of big data analytics and recommender systems for accurately appraising specific artworks.

SECTION 7: CYBER AND NETWORK SECURITY

This section features in-depth analyses on contemporary findings in digital security methods. One of the initial chapters featured, **“Auditor Evaluation and Reporting on Cybersecurity Risks,”** authored by Prof. Jeffrey Zanzig from Jacksonville State University, United States and Prof. Guillermo Francia, III from the University of West Florida, United States, explores the implementation of guidance programs within audit agencies in order to understand modern cybersecurity risks and develop capable identification and defense techniques. The ensuing chapter, **“Threat and Risk Assessment Using Continuous Logic,”** authored by Profs. Aristides Dasso and Ana Funes from the National University of San Luis, Argentina, researches the use of logistical methods for assessing the threats and risks associated with computer systems in an organization. Another chapter included within this section, **“Phishing Attacks in Mobile Platforms,”** authored by Prof. Thangavel M., Miss Yaamine A.M., and Miss Nandhini J.T. from the Thiagarajar College of Engineering, India, studies the prominent hacking method of phishing and its modern assault on mobile operating systems. One of the concluding chapters, **“Blockchain Technology and Its Applications,”** authored by Mr. Ting Wang and Prof. Liguu Yu from Indiana University South Bend, United States and Prof. Yingmei Li from Harbin Normal University, China, dissects the fundamentals of blockchain technology as well as analyzes its impact on various industrial fields. Another closing chapter, **“Cyber Crime Threats, Strategies to Overcome, and Future Trends in the Banking Industry,”** authored by Prof. Atul Bamrara from the Indira Gandhi National Open University, India, examines the countless security risks that accompany electronic banking and enhanced protection and defense methods the financial industry can use against white collar crime.

SECTION 8: E-BUSINESS

This section presents informative chapters on electronic business models and the management of company websites. One of the opening chapters in this section, **“Digital Technologies in Wholesaling and Retailing,”** authored by Mr. Felix Weber from the University of Duisburg-Essen, Germany, investigates the effect of technological trends and their underlying elements in empowering the transformation of wholesaling and the retail industry. The following chapter, **“eLancing the Future Work Model: Opportunities and Challenges,”** authored by Prof. A. Mohammed Abubakar from Antalya Bilim University, Turkey, contemplates the idea of altering traditional work perceptions and regulations through the implementation of online freelance labor, or “eLancing”. Another chapter that can be found within this section, **“Crowdsourcing Maturity and Its Application in Public Organization Management,”** authored by Prof. Regina Lenart-Gansinieć from Jagiellonian University, Poland, proposes an original and modern method for measuring crowdsourcing maturity within public administration bodies. The chapter that succeeds this, **“Theory and Practice of Search Engine Optimization,”** authored by Mr. Dimitrios Giomelakis and Prof. Andreas Veglis from the Aristotle University of Thessaloniki, Greece, provides an overview of the evolution of search engines, as well as trending practices and techniques in optimizing Internet search programs. One of the last chapters, **“Techniques for Developing Mobile-Friendly Web Sites,”** authored by Prof. J. Sandvig from Western Washington University, United States, discusses the current state of accessing webpages via mobile devices, as well as current attributes, popular design methods, and remaining limitations of mobile-friendly web sites.

SECTION 9: ENTREPRENEURSHIP AND SMEs

This section includes trending material and real-world studies on strategic approaches in the development of entrepreneurship, start-ups, and small and medium enterprises. An initial chapter identified in this section, **“Avatar-Based Intellectual Managing for Innovation Technologies Transfer in Nationals Entrepreneurships of Armenia,”** authored by Prof. Vardan Mkrttchian from HHH University, Australia, Prof. Serge Chernyshenko from Open University for the Humanities and Economics, Russian Federation, Prof. Mikhail Ivanov, Financial University under the Government of the Russian Federation, Russian Federation, and Prof. Leyla Gamidullaeva, Penza State University, Russian Federation, explains the promotion of sustainable economic growth, industrial competitiveness, and business attractiveness by facilitating the transfer of intellectual and innovative Internet technologies in the Republic of Armenia. Another recognized chapter, **“The ISO/IEC 29110 Software Lifecycle Standard for Very Small Companies,”** authored by Prof. Rory O’Connor from Dublin City University, Ireland, offers viable software development and improvement strategies for small organizations and start-up companies. The subsequent chapter, **“Design of a Strategic Knowledge Management Model to Evaluate Sales Growth in SMEs,”** authored by Prof. Leonardo Bermon-Angarita and Mrs. Lyda Rueda-Caicedo from the National University of Colombia, Colombia, proposes a knowledge management model for small and medium enterprises that analyzes marketing trends, promotes organizational learning in competitiveness, and evaluates the potential growth in sales. A chapter that follows this, **“A Theoretical Approach to Exploring Knowledge Transmission Across Generations in Family SMEs,”** authored by Prof. Filippo Ferrari from the University of Bologna, Italy, explores how knowledge is shared between the generations involved in business succession, along with cognitive and cultural insights on how this process can be improved. One of the final chapters presented, **“Role of Technology Startups in Africa’s Digital Ecosystem,”** authored by Mr. Benjamin Assay from Delta State Polytechnic Ogwashi-Uku, Nigeria, examines the overarching role that technology startup companies have in the progression and growth of digital systems and mobile Internet adoption in Africa.

SECTION 10: HOSPITALITY, TRAVEL, AND TOURISM MANAGEMENT

This section highlights the latest findings on marketing and branding strategies, as well as technological applications within the travel and tourism sector. The first chapter of this section, **“Internationalization in the Hotel Industry and Modes of Entry,”** authored by Profs. Anna Moskalenko, Inês Silva, Juliana Gonçalves, Mafalda Brito, and Antonio Carrizo Moreira from the University of Aveiro, Portugal, analyzes globalization methods of hotel chains in relation to principal theories of international business. Another featured chapter, **“The Integrated Tourism Analysis Platform (ITAP) for Tourism Destination Management,”** authored by Dr. Francisco Gutierrez from the Eurecat, Centre Tecnologic de Catalunya, Big Data & Data Science Unit, Spain and Mr. Pedro Gomes, Secretary General for Environment and Energy Transition, EEA Grants Unit, Portugal, demonstrates specific aspects of integrated geographical data within tourism planning for the promotion of interactive and innovative visitation experiences for travelers. Another chapter found within this section, **“Rapid Changes in Approaching First-Time Destination Historical Cities,”** authored by Profs. Annamaria de Rosa and Elena Bocci from Sapienza University of Rome, Italy and Prof. Laura Dryjanska from Biola University, United States, measures the social prominence of European cities by comparatively looking at a compilation of web-based media

information about these targeted areas from first-time visitors. The following chapter, **“An Exploratory Study of In-Flight Safety Videos and Airline Marketing Strategy,”** authored by Prof. Norita Ahmad and Mrs. Nawal AlAnsaari from the American University of Sharjah, United Arab Emirates, investigates the effectiveness of in-flight safety videos and analyzes them through a marketing approach in order to gauge passenger attentiveness. The concluding chapter presented in this section, **“Model/Anti-Model Advocacy Responses to Hospitality Industry Sexual Harassment,”** authored by Profs. Jeffrey Brand and Gayle Pohl from the University of Northern Iowa, United States, studies how organizations and industries can address accusations against members (anti-model) and also propose and advocate for changes (model) to improve symbolic and material conditions for their industry, their employees, and their stakeholder communities.

SECTION 11: KNOWLEDGE MANAGEMENT

This section provides extensive chapters on knowledge harvesting, sharing and transfer. A preliminary chapter in this section, **“State of the Art in Semantic Organizational Knowledge,”** authored by Prof. Mamadou Kone from the International University of Grand-Bassam, Ivory Coast, studies the use of semantic web and linked data technologies in supporting the creation and distribution of knowledge within organizations. The subsequent chapter, **“Influential Factors on Reverse Knowledge Transfers in Multinational Organizations,”** authored by Ms. Rita Castro, Miss Sara Neves, and Prof. António Moreira from the University of Aveiro, Portugal, provides extensive research on the transfer of knowledge within multinational organizations from subsidiary companies to the headquarters which can lead to the promotion of productivity, performance, and global strategy formulation. Another prominent chapter found in this section, **“Knowledge Harvesting Concept Paves Way for Open Innovation Initiatives,”** authored by Dr. N. Raghavendra Rao from FINAIT Consultancy Services, India, investigates the relationship between collaborative knowledge sharing within organizational networks and the development of open innovation initiatives. Following this chapter is **“Information Overload”** authored by Prof. Tibor Koltay from Eszterhazy Karoly University, Hungary, which reviews the nature and types of information overload, as well as provides measures for prevention and mitigating symptoms using information management and literacy capabilities. A closing chapter, **“Big Data Analytics and Mining for Knowledge Discovery,”** authored by Prof. Carson Leung from the University of Manitoba, Canada, focuses on the discovery of organizational knowledge by mining through large collections of data, as well as discussing various methods that would assist in achieving this task.

SECTION 12: MANAGEMENT SCIENCE

This section provides global perspectives on current advancements within managerial methods in enterprises. One of the first chapters in this section, **“The Use of Design Thinking to Develop Corporate Skills and Competencies,”** authored by Miss Lucia Cuque from Pontifícia Universidade Católica de São Paulo, Brazil and Prof. Joao Mattar from Pontifícia Universidade Católica de São Paulo (PUC-SP) and Centro Universitário Internacional Uninter, Brazil, discusses the promotion and development of 21st century skills for in the corporate environment using design thinking methodologies along with information and communication technologies. One of the ensuing chapters, **“Global Project Manage-**

ment: Achieving Sustainability in Diverse Multinational Organizational Development Initiatives,” authored by Profs. Emad Rahim and Terrence Duncan from Bellevue University, United States, examines the benefits of project management initiatives within an international context in order to improve organizational development. Following this chapter is **“Managing Workplace Conflicts Through Self-Mediation”** authored by Prof. Ndifon Obi from the University of Calabar, Nigeria, which researches how to effectively control conflict within the workplace by implementing self-mediation principles. Another highlighted chapter, **“Modern Downsizing,”** authored by Prof. Grzegorz Wojtkowiak from the Poznan University of Economics and Business, Poland, provides an in-depth review on the concept of downsizing which includes the evolution of the term, various directions of development, and future research trends of its use within the management field. The finishing chapter of this section, **“Women at Leadership Positions in Bangladesh Civil Service,”** authored by Prof. Fardaus Ara from Rajshahi University, Bangladesh, investigates the consistent lack of power and influence women have within the government of Bangladesh, despite their increasing presence in leadership roles.

SECTION 13: MARKETING AND CUSTOMER RELATIONSHIP MANAGEMENT

This section discusses explorative approaches and research perspectives on current innovations in promotional strategies and advertising. The opening chapter of this section, **“Green Marketing,”** authored by Prof. Teresa Paiva from Guarda Polytechnic Institute, Portugal, explores the evolution of marketing practices in order to achieve environmental sustainability while maintaining organizational success and customer satisfaction. A proceeding chapter that is featured, **“Intelligent Assistants and the Internet of Things as the Next Marketing Landscape,”** authored by Profs. Edward Forrest, Christina McDowell-Marinchak, and Bogdan Hoanca from the University of Alaska Anchorage, United States, examines the current adoption of smart technologies and the Internet of things within the business and marketing industry through the analysis of prominent applications of digital assistants in the field. Also found in this section is the chapter, **“The New Technological Trends in Customer Relationship Management (CRM) to Unveil Opportunities for Developing Countries,”** authored by Prof. Cagla Seneler and Miss Rana Kadioglu from Yeditepe University, Turkey, which discusses how the use of technological concepts including artificial intelligence, cloud computing, and the Internet of things are transforming the way organizations manage their relationship with customers, specifically in developing regions of the world. Following this, is the chapter, **“The Ubiquitous Role of Mobile Phones in Value Co-Creation Through Social Media Marketing,”** authored by Mr. Syed Hossain, Ms. Xu Shan, and Mr. Abdul Qadeer from Xi’an Jiaotong University, China. This chapter evaluates the contemporary function of mobile phones and social media in developing value co-creation and customer engagement strategies by surveying various universities in China and compiling primary data. A concluding chapter, **“Emotional Intelligence and Customers Satisfaction of Online Health Information,”** authored by Dr. Ionica Holban from the European Academy of the Regions, Belgium, Profs. Ioana Duca and Diana Andreea Mândricel from Titu Maiorescu University, Romania, Prof. Rodica Gherghina of The Bucharest University of Economic Studies, Romania, and Prof. Elena Nicolescu from Valahia University, Romania, researches online health service qualities that influence consumers’ behavioral intentions toward using health information systems in Romania and analyzes the congruence of digitalization in healthcare and the improvement of customer satisfaction.

SECTION 14: OPERATIONS AND SERVICE MANAGEMENT

This section presents extensive research and reportage on systematic advancements in operational tasks, supply chain management, and the service industry, as well as initiatives to reduce a company's carbon footprint. A primary chapter found in this section, **“Artificial Neural Network in Operation Management Regarding Communication Issue,”** authored by Mr. Ayan Chatterjee from S.P. Jain Institute of Management and Research, India, Miss Susmita Sarkar and Prof. Mahendra Rong from Bangabasi Evening College, India, and Prof. Debmallya Chatterjee of S P Jain Institute of Management & Research (SPJIMR), India, explores the different models of artificial neural networks and their ability to solve key communication issues in the operation management area. Another featured chapter, **“Decision Support for Smart Manufacturing,”** authored by Prof. Marzieh Khakifirooz from Tecnológico de Monterrey, Mexico, Prof. Mahdi Fathi from the University of North Texas, United States, Prof. Panos M. Pardalos from the University of Florida, United States, and Prof. Daniel J. Power from the University of Northern Iowa, United States, reviews the implementation of decision-making templates based on operations research modeling and optimization techniques in smart manufacturing environments. It aims to provide insights into the system engineering design, emphasizing system requirements analysis and specification, the use of alternative analytical methods and how systems can be evaluated. The next chapter, **“Green Supply Chains and Enabling RFID Technology,”** authored by Prof. Alan Smith from Robert Morris University, United States, studies the promotion of environmentally conscious business practices by incorporating radio-frequency identification tactics. Another chapter contained within this section, **“A Review of Future Energy Efficiency Measures and CO2 Emission Reduction in Maritime Supply Chain,”** authored by Profs. Muhamad Fairuz Ahmad Jasmi and Yudi Fernando from Universiti Malaysia Pahang, Malaysia, evaluates the adoption of low carbon technologies and other energy efficient practices within the shipping industry in order to reduce harmful emissions and preserve marine ecosystems. One of the concluding chapters, **“Big Data Analytics in Supply Chain Management,”** authored by Prof. Nenad Stefanovic from the University of Kragujevac, Serbia, discusses applications, challenges and new trends in supply chain big data analytics and background research of big data initiatives related to supply chain management is provided.

SECTION 15: ORGANIZATIONAL MANAGEMENT AND COMMUNICATIONS

This section contains integral research on novel communicative practices within professional firms and trending management perspectives. This section starts with the chapter, **“Types and Challenges of Expatriation,”** authored by Miss Carla Morence, Miss Marta Esteves, Miss Núria Silva, and Prof. António Moreira from the University of Aveiro, Portugal, which covers research on the contemporary perspectives of corporate migration and relocation within multinational enterprises. Another chapter found within this section, **“Strategic HRM and Organizational Agility Enable Firms to Respond Rapidly and Flexibly to the Changing Environment,”** authored by Prof. Nibedita Saha from Tomas Bata University in Zlín, Czech Republic, demonstrates how companies use agile capabilities including knowledge development and strategic human resource management to react and adapt to modern challenges within the business industry. Following this chapter is **“Social Media and Organizational Communication”** authored by Profs. Victor Briciu and Arabela Briciu from Transilvania University of Brasov, Romania, which studies the transfer of professional activity and organizational interaction into

online environments through the use of social networking. Also presented in this section is the chapter, **“Examination of Quality of Life in Workplace Environments,”** authored by Prof. Lesley Clack from the University of Georgia, United States, which breaks down the numerous factors that impact the quality of life of workers in healthcare, and provides effective management solutions to improve the overall well-being of medical professionals. One of the final chapters of this section, **“Leader Ambidexterity in Research Teams,”** authored by Prof. Montserrat Boronat-Navarro and Ms. María P. Mora-Crespo from Jaume I University, Spain, builds on organizational ambidexterity literature to determine the antecedents at the individual level of the main researcher to successfully achieve both research and commercialization activities. The authors review the ambidexterity literature to identify these antecedents and illustrate their framework with two research teams at different Spanish universities that have achieved scientific- and commercial-oriented results.

In summary, the authoritative contents included in this comprehensive reference publication is intended to provide a much better understanding of the issues, challenges, trends, solutions, and opportunities surrounding the themes of its fifteen sections; delivering thorough coverage of the most recent research conducted by various experts all over the world. Collectively, the authors of the chapters in this encyclopedia bring about the most current thoughtful and comprehensive overviews of many important topics related to organizational development and advancement in light of modern emerging technological innovations, providing a much better understanding of this particular area of research. We hope that their diverse and comprehensive coverage offered within their chapters will contribute to a broader awareness of all topics, research, discoveries, opportunities, and solutions in developing dynamic and progressive organizations that can survive and thrive in our modern competitive global economy with all its recent challenges. We are also hopeful that the contents of this publication will inspire other researchers to further explore the expansion of existing research to discover new ways of stretching beyond the current boundaries and identify new opportunities in the field that can be further developed to better serve the inhabitants of our planet and organizations worldwide.

Mehdi Khosrow-Pour

Editor-in-Chief

Encyclopedia of Organizational Knowledge, Administration, and Technology

User's Guide

The *Encyclopedia of Organizational Knowledge, Administration, and Technology (First Edition)* is a five-volume set comprised of 188 chapters. All chapters are divided into categories relevant to their topical coverage. There are fifteen different category sections, with each volume containing multiple categories. All category sections are arranged alphabetically across the five volumes. Within each category section, the chapters are arranged by their relevance to the theme and to each other. As each new category section is introduced, section dividers represent the transition from one category section to the next. Tabs on the right-hand side of each of the pages have numbers representing each corresponding category section number.

To assist with easy navigation, there are two different tables of contents compiled at the beginning of each volume. The first represents the “Contents by Volume,” which displays the arrangement of the content in its respective category sections, and the second represents the “Contents in Alphabetical Order,” which displays the arrangement of content from A to Z by the chapters’ titles.

EACH VOLUME CONTAINS

- A **preface and user’s guide**.
- The **Editor-in-Chief’s biography and acknowledgment**.
- **Two different tables of content** are compiled at the beginning of each volume: “Contents by Volume” and “Contents in Alphabetical Order.”
- **Several authoritative, research-based chapters** contributed by researchers and experts from all over the world.
- A **comprehensive index** supporting the extensive system of cross-references.

EACH CHAPTER INCLUDES

- A brief **introduction to the topic area** describing the general perspective and objectives of the chapter.
- A **background** providing the broad definitions and discussions of the topic and incorporating the views of others (i.e., a literature review) into the discussion to support, refute, or demonstrate the author’s position on the topic.

- Various perspectives examining the **issues, controversies, and problems** as they relate to the theme. Also provided are arguments supporting the position as well as a comparison and contrast with regards to what has been and/or is currently being done as it relates to the chapter's specific topic and the overall theme of the encyclopedia.
- A discussion of **solutions and recommendations** in dealing with the issues, controversies, or problems presented in the preceding section.
- **Charts, graphs, tables, and formulae** are included as illustrative examples whenever appropriate.
- A discussion of **future research directions**.
- A **conclusion** to discuss the overall coverage of the chapter and present concluding remarks.
- An extensive **list of references** so that readers can benefit from the sources cited within the text.
- An **additional reading section** consisting of sources that complement the topical coverage within the chapter.
- A **key terms and definitions section** providing 7-10 terms related to the topic of the chapter with a clear and concise definition for each term.

Acknowledgment

Editing and completing an authoritative and comprehensive scholarly research publication such as the five-volume *Encyclopedia of Organizational Knowledge, Administration, and Technologies (First Edition)* requires tremendous contributions and a great deal of assistance from large groups of scholars, researchers, and professional staff. The primary objective of this encyclopedia is to provide the most up-to-date scholarly coverage of all topics related to the conceptual, methodological, and technical aspects of organizational knowledge, management, and technologies.

The contributed chapters from expert researchers from all over the world provide an in-depth look into topics such as organizational structure, strategic leadership, information technology management, business analytics, corporate social responsibility, supply chain management, social networking, and much more. I am indebted to all the authors for their excellent contributions to this publication.

All submitted chapter manuscripts to this publication underwent a double-blind peer review process in order to achieve the highest level of validity, reliability, accuracy, and quality of the submitted research. I am thankful to all the reviewers of this encyclopedia for providing their expertise and their rigorous, unbiased assessment of the chapter manuscripts assigned to them on a double-blind basis, as well as the members of the Editorial Advisory Board for their wisdom, guidance, and assistance with various decisions throughout the editorial process.

I would also like to convey my deepest appreciation and gratitude to all those individuals who assisted me in editing this publication, which include Lindsay Wertman, Managing Director of IGI Global, Jan Travers, Director of Intellectual Property and Contracts at IGI Global, Melissa Wagner, Managing Editor of Acquisitions at IGI Global, Maria Rohde, Assistant Development Editor at IGI Global, Crystal Moyer, Assistant Development Editor at IGI Global, Eric Whalen, Assistant Development Editor at IGI Global, Josh Christ, Assistant Development Editor at IGI Global, Chris Shearer, Copy Editing Manager at IGI Global, Michael Brehm, Managing Editor of Book and Journal Production at IGI Global, and Deanna Zombro, Production Assistant at IGI Global. Additionally, I would like to thank the IGI Global Sales and Marketing Department, especially Nick Newcomer, Senior Director of Marketing and Sales at IGI Global, Caroline Campbell, Marketing Manager at IGI Global, Brittany Haynes, Marketing Editorial Assistant at IGI Global, and Tori Parks, Graphic Design Coordinator at IGI Global, for their endless support in promoting this invaluable reference source.

Thanks to everyone who has provided me immeasurable amounts of knowledge, wisdom, and support over the last 30 years.

Mehdi Khosrow-Pour

Editor-in-Chief

Encyclopedia of Organizational Knowledge, Administration, and Technologies

About the Editor

Mehdi Khosrow-Pour, D.B.A., received his Doctorate in Business Administration from the Nova Southeastern University (Florida, USA). Dr. Khosrow-Pour taught undergraduate and graduate information system courses at the Pennsylvania State University – Harrisburg for almost 20 years. He is currently Executive Editor at IGI Global (www.igi-global.com). He also serves as Executive Director of the Information Resources Management Association (IRMA) (www.irma-international.org) and Executive Director of the World Forgotten Children Foundation (www.worldforgottenchildren.org). He is the author/editor of more than 100 books in information technology management. He is also currently the Editor-in-Chief of the *International Journal of E-Politics (IJEP)* and the *International Journal of Semiotics and Visual Rhetoric (IJSVR)*, and is also the founding Editor-in-Chief of the *Information Resources Management Journal (IRMJ)*, *Journal of Electronic Commerce in Organizations (JECO)*, *Journal of Cases on Information Technology (JCIT)*, and the *Journal of Information Technology Research (JITR)*, and has authored more than 50 articles published in various conference proceedings and scholarly journals.

Section 1

Accounting, Finance, and Economics

Managerial Accounting and Organizational Performance: Evidence From Romanian Healthcare Companies

1

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INTRODUCTION

In a performance oriented time, organizational efficiency holds a primordial part, no matter what the sector of activity might be (Guo et al., 2017). One of the most important challenges is achieving it through developing and implementing performing management on a permanent basis (Wickramasinghe & Alawattage, 2007). Organizational efficiency has become an activity assessment management factor, bearing an important role in decision making in order to fully use the available resources (Gurd & Thorne, 2003).

A decision-making process taking place on various organizational, operational and strategic levels needs to rely on data regarding the costs borne as well as other reliable analyses from within the organization, supplied by a managerial accounting process which must provide answers to the information needs signaled by the management of that company (Chenhall & Langfield-Smith, 2003).

The role of managerial accounting consists in detailing, analyzing and interpreting the information provided by the general accounting, presenting it in a form that is accessible to the company management (Rowe, Birnberg & Shields, 2008). Financial information is confidential, addressed to the internal environment of the company, and presented as no standardized periodical reports adapted to the internal management needs (Abdel-Kader & Luther, 2008).

As a support for the managerial decision, managerial accounting information accompany the managerial process along its entire action flow: planning, the launching of new products or the creation of new activities, selecting clients or orders, substituting production factors, controlling the accounting management during all its stages (Baines & Langfield-Smith, 2003).

Romanian healthcare companies have stated that organizations have a problem with anticipating and adapting to what happens in their environments (Bostan, 2016). This inability to recognize changes in the

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business environment can be a factor that determines the lack of performance in the field of competitiveness. To succeed, organizations need to adopt a systematic approach to change. In this respect, they will have to simultaneously manage all the challenges of change. These changes at the organizational level have increased the importance of managing change and especially managing the experience of change in personnel (Jung et al., 2016; Rojon et al., 2015; Schulz, 2004). This is due to the fact that major changes have an impact on all the members of the organization because these changes can create new dimensions of uncertainty. Only through a good knowledge of the entity, transparency of the management processes in order to increase healthcare service quality, diversification and the creation of internal mechanisms to respond to disruptive forces, can one ensure that companies remain in the market.

The concepts surrounding the organizational performance in health care organizations incorporate also the knowledge, skills and motivation of work force; factors that directly influence the service quality (Allen & Seaman, 2007).

It should be mentioned that traditionally, there exist differences between output and outcome. In our opinion, for the health care organizations the outputs (results) may be used as synonym for outcome (performance), because qualitative health care services may be delivered only under performance circumstances, which take into consideration the organization's efficiency and the level of patient satisfaction.

In the investigative approach to new change management challenges in the contemporary economy, we used a complex strategy of research, combining quantitative and qualitative methods of investigation. Therefore, specific methods were used in the preliminary stage of design and preparation of the research analysis, now presented as tables that allow optimal concentration of information. Any entity goes through processes of change and adaptation to changes in the business environment, which should be perceived, analyzed and evaluated by the management performance. All the scientific process involved taking into account all the parameters/variables considered useful in identifying the answer to the central research question. The entire research process involved completing specific rules, collection, analysis, and the selection of information that can be proven objectivity with a lot of rigor over a predetermined length of time. The results obtained are valid and reproducible because they are based on a methodology of well-chosen research that lends credibility to the conclusions we have reached at the end of the research period.

More importantly, the results of the present study suggest that a managerial accounting is important for the survival and success of any organization in today's business environment, which is extremely competitive and in a continuous evolution (Kemper et al., 2017). In the light of the apparent logical hole, the theories and approaches of managerial accounting that are available for theoreticians and practitioners often argue between themselves, and many of them lack the empirical evidence supported by incontestable hypotheses regarding the nature of contemporary organizational management of change (Hassan, 2005).

The rest of the article is organized as follows: first, we discuss the materials and methods development. Then, in Section 2, we present our results and discuss our findings. Finally, in Section 3, we provide the conclusion and suggest some future research directions.

BACKGROUND

The management of organizational change is a continuous process of experimentation and adaptation that has as its main target the correlation of capabilities of an organization to adapt to a volatile, changing environment (Gong et al., 2009; Popa, 2012). By the same token, Verbeeten (2010) saw organizational change as a transforming adaptive and complex change performed with the help of a system change

model composed from three stages: raising of the organization, the appearance of tension in the activity of the organization and a threshold, and the newly emerged configuration.

For a long time, the concept of organizational change has attracted the attention of both theoreticians and practitioners. Abernethy and Brownell (1999) claimed that in spite of the complexity of problems of change, and can be identified by the notion of transforming and the traditional dynamic inherent in the efforts for a successful change. Barnett and Carroll (1995) suggested that the fundamental changes in organizations can be classified into two major categories: changes in culture and changes in structure. Regarding the structural change in the organization, Fenton and Pettigrew (2000) studied the evolution of the theoretical concepts regarding organizations, from the bureaucratic organization (Dibrell & Miller, 2002) to the network organization (Hyvönen, 2007). However, Burns and Vaivio (2001) noted that the importance of change management can be better understood if it is regarded in the context of the expansion, shrinkage, and restructuring of the corporation.

In the studies regarding the management of change, the problem of resistance to change has always been considered an essential element of finding ways to obtain advanced management. Edwards (2010) argued that employees do not resist all change, only the changes that they do not understand or they see as a psychological or economic threat. As such, usually, they answer with adequate behaviors: dissatisfaction, frustration, confusion, and anxiety. The resistance to change can provoke the reduction of productivity, the slowdown of activity, hostility, and pessimism regarding the achieving of an aim. The causes are multiple: political, cultural, legal, and individual. In terms of understanding the notion of resistance to change, Lee, Yang and Chen (2016) stated that a person has to identify the factors underlying this resistance: self-interest, fear, peer pressure, and inertia. When leaders are able to pass on their values, the organization develops, and they are mastered and accepted by other employees as the right way to think and act. Piderit (2000) postulated that there are three different aspects of the conceptualization of resistance to change: as a cognitive state, as an emotional state, and as a behavior. In other words, the resistance to change is manifested both at an individual level and the level of the organization.

After examining the force of change and the possible resistance to change within an organization, formulating strategies of change is the next important step. Depending on the distribution of power in the organization, there are various ways to formulate strategies of change according to the size of the possible change and to the available time and information.

Accounting managers shall change the determination methods of costs when improve organizational performance takes place within a sanitary unit. To this end, the accounting manager is charged with further duties such as: to determine and register the cost of quality (Gerdin & Greve, 2004); to incorporate the quality cost in the account plan used (Chenhall, 2008); to develop the cost system which is based on the quality management (Andon, Baxter & Chua, 2007).

On the other hand, accounting managers must help the management team to use their capacities and skills in order to implement the organizations changes in the sanitary unit and more, to continuously improve quality (Choe, 2004). Including the organizations changes principles in the account management shall be done by supplying accountancy services afferent to the internal departments (Hassan, 2005), by identifying internal or external clients and satisfying the informational requests they have (Smith, 2003).

RESEARCH METHODOLOGY

Although there is in the specialty literature a degree of consensus regarding the relationship between management accounting and organizational change, few researches have been conducted regarding this

relationship in healthcare organizations in Romania. From this point of view, this work explores the relationship between management accounting and performance in healthcare organizations in Romania, using a questionnaire as a research tool.

The logical structure of the questionnaire allowed us to quantify each item from the process of implementation of change by subdividing the components and classification of variables according to the criterion of causality. To avoid reluctance from respondents in expressing their opinion, the evaluation of appreciation was done with the help of a Likert scale with five levels: strongly agree, agree, indifferent, disagree, and strongly disagree. All questions were closed-ended questions and was designed to cover two major areas within the conceptual model and developed hypotheses. The distribution and filling of the questionnaires were conducted from June 2017 to December 2017 in Romanian healthcare companies (MEDICOVER, Regina Maria, SANADOR, IOWEMED MEDICAL CENTER, MedLife, AMERICAN MEDICAL CENTER, POZIMED). To ensure the objectivity of the answers, the respondents were provided with a climate of anonymity.

The results of the analysis and interpretation of data will be done in two stages: the first step is to identify the strong and weak points of the management of change in Romanian healthcare companies from the perspective of the importance of management accounting practices in the success of change and the attitude toward change. The second step is to analyses and interpret, based on the statistical and econometric methods, the items for determining the management of change in Romanian healthcare organizations according to H_1 and H_2 .

Therefore, the following hypotheses are proposed:

H_1 : There is a significant positive interaction between management accounting information and performance

H_2 : There is a positive association between managing change in organizational development and increase organizational performance

In order to verify the hypothesis we used as statistical method the multivariate analysis. The analysis of variance MANOVA (multivariate analysis) is a technique used to compare the averages of two or more groups. Traditionally, the MANOVA technique is used to test differences between more than two groups, based on the linear combination of quantitative variables, while offering the possibility of multiple dependent variables (Grice & Iwaski, 2007). According to Table 1, by using Roy's Largest Root, one could identify a significant impact of the implementation month on the effects of the management accounting on the organizational performance and on patients' and human resources' satisfaction; this result allowing us to perform the MANOVA analysis.

Further, Table 2 highlights, that F statistic has an associated probability of less than 0.05 (Sig.<0.05), only for the first question regarding the effects of the organizational change on performance in a health care organization.

According to Table 2, although there exist significant differences only regarding the first dimension, one could identify differences between the dimensions referring to the effects of the organizational change implementation in health care organizations by comparing the means of each dimension associated with the month of implementation.

The other effects are not necessary related to the implementation month, but mainly to the health care organizations and refer to: the communication between the accounting department and other departments, the communication with the suppliers, the patient's satisfaction with the processes of diagnosis, treatment and procedures and the patient - doctor relationship (e.g. transparency and accuracy of information regarding diagnosis).

Table 1. Multivariate tests

	Effect	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.997	908.373 ^a	10.000	29.000	.000	.997
	Wilks' Lambda	.003	908.373 ^a	10.000	29.000	.000	.997
	Hotelling's Trace	313.232	908.373 ^a	10.000	29.000	.000	.997
	Roy's Largest Root	313.232	908.373 ^a	10.000	29.000	.000	.997
Month	Pillai's Trace	.610	4.528 ^a	10.000	29.000	.001	.610
	Wilks' Lambda	.390	4.528 ^a	10.000	29.000	.001	.610
	Hotelling's Trace	1.561	4.528 ^a	10.000	29.000	.001	.610
	Roy's Largest Root	1.561	4.528 ^a	10.000	29.000	.001	.610

The authors found that 85.02% of the total number of all items were validated. Thus, all the hypotheses were validated, and there was no need to reformulate them. The findings point once again to the need for a model of change implementation in Romanian healthcare companies.

SOLUTIONS AND RECOMMENDATIONS

Inconsistency in institutional decision-making, continuous experimentation and the uncertainty in the public healthcare policies require quick and efficient alternative solutions such as: establishing multi-functional centers which should develop according to local needs and be supported by local communities and authorities, bringing together diverse medical specialists, community nurses, pharmacists, dentists, specialists in palliative care in home care, endowed with diagnosis and appropriate intervention equip-

Table 2. Test of Between – Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Month	Total quality management	10.025	1	10.025	10.589	.002
	Operating income	4.602	1	4.602	5.239	.028
	Return on investment	3.088	1	3.088	3.576	.066
	Workplace relations	.814	1	.814	1.900	.176
	Benchmarking	.843	1	.843	1.114	.298
	Cash flow from operations	1.011	1	1.011	2.436	.127
	Market development	.627	1	.627	1.229	.275
	Cost reduction programs/ cost control	1.544	1	1.544	1.535	.223
	Employee health and safety	.577	1	.577	.877	.355
	Customer profitability analysis	.530	1	.530	2.042	.161

ment, as an alternative model to closing hospitals; hospital management should be done professionally, involving those who acknowledge the medical process, outside central or local political influences, by monitoring activity on the basis of credible and measurable indicators to eliminate arbitrariness in the assessment activity; development of services in one-day hospital admission system (chemotherapy, surgery day etc.); outsourcing some services only if they reduce costs, with verifiable quality conditions; hospitals subordinated to local authorities should be encouraged to associate to cost – efficiently acquire common services (laundry, catering, security, etc.); transferring certain care services for chronic patients (diabetes, hypertension, asthma) to outpatient hospital and primary care management through the development of integrated models of chronic patients; supporting private investment in new hospitals and facilities by state guaranteed loans and by partial support of interest loans; reviewing, completing and improving the legislation, especially on decentralization in the health system to avoid blockages and to allow adequate funding of services, cost control and effective decentralized management.

The management team has the obligation to create and supervise these processes and its success depends on the continuous improvement of services that ensures good management as well within the organization. This management philosophy aids the medical units to improve their performances by eliminating the poor quality of services and requires constant assessment and innovation within the organization. At the basis of this philosophy lie some techniques of settling the characteristics for the processes in progress within the organization, the monitoring of performances as compared with the characteristics, determination of the causes for inadequate variations (including the waste of quality and insuring productivity of employees, also settling the necessary environment for communication around the quality concepts and improving productivity.

FUTURE RESEARCH DIRECTIONS

In the next years, the authorities will manifest in a desire to accelerate change for Romanian healthcare companies to improve: managerial measures to strengthen the determining features to become dominant must be an objective, even if there are certain individual differences; these measures could include achieving knowledge that will complete the determining features of the strategy, and creating an inter-organizational coherence in which the customers, suppliers, distributors, and collaborators of the organization should be included; successive changes have to be managed through networking; complementarity, correlation, and implementation of the two main elements of each factor; the initial determining conditions; and the consecutive mechanisms empower Romanian healthcare companies to ensure their success in the market, which is an uncertain and consecutive process.

In any case, the leaders of the future need to understand the depth and impact of what managing change in organizational development means in their pursuit of performance, productivity growth, and selection and motivation of the human resource appropriate to the specific business.

CONCLUSION

The major problem healthcare systems today is the efficient management of the initiatives of strategic change, and the fundamental difference between successful organizations and those that fail is the ability to keep up with change (Briggs et al., 2012; Guillén & Saris, 2013; Pieper et al., 2017). In other words,

organizations in health system have to monitor and study external environments to anticipate and adapt quickly to change (Ericksen & Dyer, 2005; Meuer, 2017).

As long as the reality and the accuracy of the information supplied by managerial accounting are checked periodically, this guarantees the provision of good quality information to the management. This managerial accounting procedure is carried out primarily by comparing the expenses recorded by the general accounting with those recorded by the managerial accounting and incorporated in the marketing costs and prices, and by comparing the global results obtained according to the general accounting with the aggregate analytical results obtained based on the data recorded by the managerial accounting, and explaining the possible differences.

Using a qualitative model design, we demonstrate that no matter how well the strategies of change are formulated, the implementation of change is a decisive step in its successful realization. Managerial practice has shown that strategy implementation failure is the basic reason why people are anxious about organizational change. More specifically, the diversity of views expressed in the literature specifically referring to organizational change and management accounting practices helped us determine the best approach for positioning our scientific research on the new change management challenges in the contemporary economy.

Continuous quality improvement of a healthcare organization should focus on the following dimensions: cultural (emphasizing those aspirations, values, norms and behaviors that support or, on the contrary, are a barrier to the improvement process within the organization); technical (training in the use of tools or at least to be familiar with the group decision-making process in order to improve the quality of the organization's information system and data analysis capability); strategy (refers to the degree to which quality improvement efforts are focused on key strategic priorities and the strategic plan of the organization. At this level we look for answers to the following questions: Where does the organization want to reach? Is quality a priority?); structure (the presence of a coordinating committee, councils, working groups, existing mechanisms for reporting and analysis). This dimension binds all the others.

At the same time, the environment surrounding the transition to a market economy involves changes in the Romanian healthcare organization, changes that in turn affect the performance measurement system. Considering the current state of the relationship - strategy - organizational culture, the management tools that best meet the new challenges are reunited under the synergy of economic performance.

Each of us has the capacity to become a master of change. The paradigm is easily understood by those outside healthcare companies than by their members because the elements that compose self-explanatory are understood by itself. Managers receive a plurality of signals that are often contradictory and that they interpret through the paradigm. In this context, the paradigm is both an interpretation instrument and a formula of action, and Romanian healthcare companies use it to form their strategies.

In conclusion, one could admit that the implementation of a total quality management system has positive effects on the management accounting and on human resources' satisfaction. These effects are related on the hand to the cost structure and performance of health care organizations and on the other hand to the human resources' satisfaction and performance. It is important to note, that the patients' satisfaction and its' relationship with doctors are not necessary related to the quality management system, but rather to the organizations' politics and structure. However, the implementation of a quality management system is a strategic decision in order to standardize all the organizational processes and their better management in a health care organization and is based on principles that refer to: continuous improvement and alignment between process goals, customer goals and process management.

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KEY TERMS AND DEFINITIONS

Budget Accounting Management: Related not only to the accounting activity but is a true company administration technique, a company management philosophy involving three stages: estimation, budgeting, and control.

Cost: The money form of all material and labor expenses made by the company to produce and market material goods, execution works and service works.

Decision: A person or group of persons' social and deliberate act defining the purpose and the objectives of a certain action, the directions and the ways to achieve that action, all of them determined, according to a certain need, by a process of obtaining information, deliberation, and assessment of the means and consequences of carrying out that action.

Economic Management: The achievement of the budget objectives with minimum costs so that when the activity is completed the revenue exceeds the costs, namely there is a profit that ensures a level of profitability as high as possible both at general level and by product, department or service performed.

Financial Management: A tool in the decision-making relating to the collection and analysis of information in order to increase the performance level of the economic entity.

Managerial Dashboard: Contains a set of actual information presented in a predetermined form, relating to the main results of the company's activities or to some of them and to the main factors conditioning their effective and efficient progress.

Organization: A system, which includes employers and employees aiming at achieving common objectives.

The Potential Role of Intellectual Capital in the Process of Accounting Convergence

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INTRODUCTION

The value of intangible assets has been the main focus in the debates between international professionals and business world for many decades (Chen, Qu & Sun, 2017). Today, this concept interferes with the international process of assessment, but also with the convergence of accounting (Englund & Gerdin, 2018). The need to determine the value of these assets lies in the more virulent criticism brought to the traditional accounting system, placed face to face with an increasing vision of the financial assets of a company (Anson, 2008). In an uncertain world with imperfect and incomplete markets (financial crisis), no particular measurement objective should be regarded as having a monopoly, and different measurements should be regarded as complementing one another (Florou & Pope, 2012).

The problem is how to choose the best of them in the context of satisfying the requirements of the accounting information users, on the one hand, and complying with accounting principles and fundamentals, on the other (Vladu, Amat & Cuzdriorean, 2016).

Basically, because of different research directions, confusion can arise regarding the use of the following terms: intellectual capital, intangible assets, and knowledge assets. Thus, the term “intangible assets” is used especially in financial accounting, in the active knowledge economy and also the term “intellectual capital / human capital management” is being used particularly (Guthrie & Dumay, 2015).

Recently a number of classifications have refined the distinction between intangible and intellectual capital, separating the latter into several components (Matricano, 2016; Abeysekera, 2006): customer-related capital (external) structural human capital (internal).

It has been shown that various components of intangible values do not only have different significance, but they also have a complex interdependence and influence each other constantly. This makes it extremely difficult to evaluate each component separately. The view that each component of intangible values can be managed separately, without taking into account synergies, is both theoretically and practically wrong, while being legally and practically not feasible (Andreou, Green & Stankosky, 2007).

Meanwhile, the home values’ intangible image shows very clearly why it is less profitable as a company to worry about capital intensive innovation and capital investment, as long as there are significant deficiencies in the management of subordinate components. In this respect, the individual components are difficult, exclusive, and do not adequately reflect the overall context of the components and their cause-effect relationships (Abernethy, Bianchi, Labory, Lev, Wyatt & Zambon, 2003).

Accounting estimates of intangible assets being made by the management entity are a risk in the sense that they may not be correct, so we have to analyze and better understand the assumptions used for this purpose, to pursue compliance with the accounting standards and the concrete conditions of their application (Ball, Li & Shivakumar, 2015). Equally it is necessary to identify the real purpose of these accounting estimates, so that they ensure the credibility of the beneficiary’s recognition, measurement and disclosure of intangible value.

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Accountants, in their turn, reflect accounting estimates only in registers and certainly not at the value generated by the presentation of materials. There is a clear dichotomy between the historical cost accounting and fair value in accounting measurement, which creates a productive tension in discussions related to economy based on knowledge. However, it is more likely for a certain period of time to develop both paradigms in parallel and then become convergent, thus solving the paradox of intangible asset valuation.

BACKGROUND

In recent decades, in Europe and the United States, each intangible accounting entity leads under national laws and regulations for each country in which that entity operates (legal personality, subsidiaries and branches). In situations where time was written in a book on the situation of an entity, the assets of a European state established after that state's laws and regulations operate outside the legislation of other European countries or even overseas (Li, Qi, Tian & Zhang, 2017).

To overcome such problems, we should recognize internationally intangible assets at the end of each accounting year, their transparency, as well as prevent fraud and the violations of accounting principles, to help business people (investors) contribute to the Council of Europe (CoE), which brought changes in the accounting rules (national, European, and international) and contributed to the adoption of certain international accounting standards. These include accounting regulations which facilitate the investors' desire to expand business in other countries since before the adoption of IFRS; there were situations in which a U.S. investor wanted to open a business in a country in Europe or Asia and did not fail because of the existing accounting legislation in that country (Ahmed, Neel & Wang, 2013). These standards have been accepted by the European Parliament and the Council of Europe, thus creating the IFRS (International Financial Reporting Standards). By developing IFRS, the Council's objective was to find appropriate solutions to any entity anywhere in the world.

Also, many economists have stressed the importance of intellectual capital as a production factor in comparison with traditional assets (Cerbioni & Parbonetti, 2007; Alstete & Beutell, 2018). There are two theories on economic growth: the theory of neo-classical growth and the theory of exogenous and endogenous growth. Intangibles reflect different endogenous models (Braam & Nijssen, 2001).

According to the endogenous growth model, production is defined as a function dependent on the accumulation of immaterial (intangible). Over time, permanent growth is possible only if the intangible capital stock changes virtually forever. As a management problem, the intangible asset is not new, but the problem of "intellectual capital" is the last line developed in the knowledge management.

The Norwegian Government has funded a research project to develop a model of skill capital of the company, he was later involved in an ISO-type certification process that included intellectual capital.

In all these experimental projects prevailing the spirit of participation rather than a theoretical development, the current area of interest in intellectual capital research includes: the creation and management of intellectual capital, understanding how to best measure intellectual capital (Anson, 2008).

Cravera, Maglione and Ruggieri (2001) indicate that "the scientific literature and official texts do not have clear definitions for the notion of intangible asset. Most authors prefer to make a simple list of all the main components while accounting official texts in order to define this vague notion. In fact, the general definitions quickly become useless due to their very little analytical and more precise definitions prove to be too limited to particular cases".

Regarding the practical need of these measurements it can be supported by an international study on measuring the importance of intellectual capital in the businesses, led by Arthur Andersen in 1998

and held within the 368 companies in Europe, North America and Asia (Martory & Verdier, 2000). The results of this study can be summarized as follows:

- The majority of respondents are convinced that reports on intellectual capital will increase quantitatively;
- Almost three quarters of respondents have already tried the organizations they lead, at least two non-financial measurement models;
- The majority believes that the assessment firm's intellectual capital can be increased based on organizational performance;

Similar studies have been done so in 1998 a study conducted by Watherhouse and Svendsen (Measuring What People Know) and conducted on a sample of 114 top managers of the largest Canadian companies found that measuring intellectual capital is considered as a basic strategic condition and the company's management should constantly reported, as often as other non-financial measurements such as innovation, product quality, customer relationships with investors and business partners, community relations, the effects company activities on the environment (Lev,2001). Of all these non-financial measurements, the respondents were considered the least satisfied in terms of indicators that capture the firm's intellectual capital.

However, in the '90s, new methodologies for measuring expression and intellectual capital have been developed and applied, such as "Value Platform" – developed by Dow Chemical – "Intangible Assets Monitor" from Celemi, "Value Scheme" from Skandia, etc.(Lynn, 1999)

According to Sveiby (2010) a variety of metrics have been created to try to evaluate levels of intellectual capital in firms, both bottom-up (assessing individual employee knowledge and adding it all up) and top-down (calculating intangible assets as a remainder from financial statements). Preferences vary, but just note that measurement is a topic that has been explored in some depth and that dozens of potential choices are available to firms looking to evaluate and then better manage their own intellectual capital (Kwansa, Mayo & Demirciftci, 2008).

In general these models support the idea that intellectual capital components can be summarized in three groups: human capital, organizational capital and customer capital generated, the goal being to maximize the value of the company. A new emerging research trend seeks to apply the concept of intellectual capital to the field of entrepreneurship (Matricano, 2016).

CHALLENGES ACCOUNTING FOR INTELLECTUAL CAPITAL: STAKES, ADVANTAGES AND LIMITS

Intellectual capital, measured by education and training at work, he has developed (Roos, Roos, Dragonetti & Edvinsson, 1997). This happened the importance of intangible assets for the success of companies has increased significantly and traditional economic concepts and management proved not to be adequate. Thus, the latest economic and management studies have focused on developing tools to facilitate a better understanding and representation of intangible (Doppegieter & Zoller, 2008; Barth, Landsman, Young & Zhuang, 2014).

The main issue in terms of measuring systems is that it is not possible to measure social phenomena with scientific precision. Thus it tends, in the absence of appropriate tools to use traditional methods

based on the figures - financial indicators or remove the real cause of the phenomenon that caused the occurrence of these intangible assets.

Measure aims to discover opportunities for cost or value creation, which are otherwise hidden in traditional accounts. How much does the replacement of staff? What is the lesson learned when company staff interaction occurs with customers? What is the lost opportunity to create value where there is inadequate management systems knowledge? These are some questions to answer which is given by measuring intangible.

To meet new challenges, many companies, especially in Northern European countries, have focused attention on the concept of intellectual capital and the adoption of tools for classification and identification of new determinants of value (Campisi, 2006). Accordingly, they began to be used and linguistic terms such as “Intangibles Report” or “Intellectual Capital Report” (designate different models of identification and presentation of intangible assets).

Frustrations expressed by the studies mentioned on the measurement of intellectual capital are interesting and suggest, on the one hand, the need for tangible measurement of intangible assets in general and particularly intellectual capital, and on the other hand, that the attempt has been made now leaves room for improvement (Andriessen & Stam, 2004).

Considers that, before presenting in detail the different methods of reporting and measuring intangible are used so far, it is necessary to present a general classification will serve as a basis for analysis and will facility understanding of the specificity of each method (Sveiby, 2010). Sveiby proposed classification is presented in 2001 and is based primarily on the dichotomy that characterizes these methods and models: orientation atomistic/holistic orientation (e.g., models that measure and/or individual is intangible that models that measure and/or is intangibles overall available to organizations). Then, starting from this basic distinction is a distinction between methods of monetary and non-monetary:

- *Monetary methods are useful in mergers, acquisitions of new companies listing on stock exchanges*, comparisons made between companies in the same field of activity, moreover, the methods money have been developed based on accepted accounting rules so that they can be easily learned by accountants;
- *Non-monetary methods is the determination of innovation and performance management company* also may be noted that these methods have the advantage that it does not express the intangible assets in financial terms, so that they can be applied at any level of organization in non-profit, public companies, and/or organizations with social objectives.

According to these differences, results in a matrix with four categories of methods:

- *Cell A. – holistic and monetary methods*: A method includes using financial models and, on the one hand provides a general representation of the intellectual capital of organization supporting a determination of their money and, on the other hand, because of the nature their very general and brief no intangible enable administration for the purposes of creating value.
- *B cell - atomistic and monetary methods*: using monetary methods include but are applied to individual intangible assets. However, although these methods focus on individual assets do not provide a clear vision of the organization in total intangible assets of total assets.
- *Cell C - atomistic and non-monetary methods*: includes non-monetary atomistic methods, among them, being found most important innovations thousand and more in line with the “atmosphere” knowledge economy. But, and this presents some weaknesses, namely that it does not allow com-

parisons and that are not always able to accurately reflect the value of individual intangible assets and, therefore, often based on approximations.

- *Cell D - holistic methods, non-monetary*: it is observed that the literature does not provide such methods of measurement yet eloquent.

Another classification of the methods used so far was made all the Sveiby (2010), based on ideas suggested by Epingard (1999), is as follows:

- Direct assessment of intellectual capital methods (DIC). Estimating the value in cash of intangible assets by determining the various components. After these components are identified, they can be measured directly, either individually or with a compound coefficient.
- Market capitalization methods (MCM). Calculate the difference between a company's market capitalization and shareholder equity value as the value of its intellectual capital or intangible assets.
- Method returns on assets (ROA). Average pre-tax earnings of a company for a period of time are divided by average assets of the company's tangible. The result is ROA - return on assets of the company which then compares the average of its industry. The differences multiplied by the average of tangible assets of the company to calculate the average annual earnings from intangibles. Dividing the average earnings above the cost average capital company or the interest rate, you can estimate the value of intangible assets or intellectual capital thereof.
- Method scores (Scorecard - SC). Establish various components of intangible assets or intellectual capital and generate indicators or indices that are reported as scores (scorecards) or graphics. These methods are similar methods in that DIC is based on identifying components of intangible assets, but unlike, they do not consider the need for a financial estimate of the value of intangible assets.

Methods offer different advantages (Bontis, Dragonetti, Jacobsen & Roos, 1999). Thus the actual amount that provides evaluations (\$), such as ROA and MCM, are useful in cases of merger and acquisition and stock assessments. May be used to compare companies within the same industry and are useful to illustrate the financial value of intangible assets, feature that tends to draw attention to managers. Because they are based on counting rules long established and recognized them in different national laws or regulations can be easily communicated to the accounting profession. The disadvantage is the fact that all the terms, making money, they can be superficial (Li, Qi, Tian & Zhang, 2017).

DIC and SC methods advantages are that it can create a more complex organization in terms of health than financial metrics and ROA and MCM can be applied easily to any level of organization (Kaplan & Norton, 1992). Measurement is made closer to the event and so reporting can be more accurate and faster than financial measurements. Their disadvantage is that the indicators are contextual and must be adapted to each organization and each objective, which makes comparison difficult. Also, the methods are new and are not easily accepted by the companies and managers who are accustomed to seeing it only in purely financial.

From the perspective of global experience in evaluating intangibles, we can remember the following methods:

- Skandia Navigator, is probably the most well-known and analyzed intellectual capital measurement model that literature offers to date. Thanks to its innovative qualities it is considered a kind of archetype for the class of models for non-monetary atomist measuring. Among the advantages

of this model are: it initiated a series of efforts toward abandoning traditional ideas about the determinants of value in organizations and bringing to the fore the possibility of measuring intangible assets; it highlights the crucial role of customer relationships in business value creation and shows how the nature of the relationship between companies and their customers changed; for the first time a great importance is attached to the contribution that can bring renewal and development of the organization's value;

- the Intangible Assets Monitor is a model that can be applied to all companies and its indicators are chosen according to the characteristics of the company, industry, competitive variables, company's history, organizational culture and company management. According to the model, intangible income can be divided into: strengthening the company's image, strengthening the organization and enhancing its competence;
- the Balanced Scorecard model that Kaplan and Norton have designed does not present a general system of indicators to measure intellectual capital, the argument being that a general system of indicators could leave out certain aspects of each company related to its objectives, processes and the context in which it operates. Traditional indicators provide information about the past performance of the company, while non-financial indicators can measure, for example, customer satisfaction, corporate innovative activities and improvements to various processes of the company. Combining the two types of indicators allows managers to obtain a balanced image on company performance. Braam and Nijssen (2001) point out that diffusion of innovative practices of management or management accounting, such as the Balanced Scorecard, can bring a discrepancy between the "tag" of the implemented concept and its contents. Authors such as Guthrie and Dumay (2015) have shown that this model can be used for evaluating intellectual capital. Comparison made between Balance Scorecard and intellectual capital valuation methods reveal other similarities such as recognition strategy as an essential component of performance management need to find a concise and fully expressing the company's situation, attention to intangible assets and knowledge. In other words, it is possible that some organizations only claim that they use the Balanced Scorecard, while the implementation substance ignores the considered defining characteristics of Balanced Scorecard (connecting indicators to the strategy, causal relationships between indicators etc.). Therefore, to assess whether the Balanced Scorecard is used in practice is dependent on defining and clarifying the concept, ie the unequivocal identification of the characteristics that define a Balanced Scorecard;
- Lev's Knowledge Capital Formula Method for measuring knowledge capital is based on the traditional method for calculating goodwill. One difference is that, in Lev's model, additional revenues are replaced by residual income attributable to intangible assets. Based on these critical observations, in the scientific literature, the Value Chain Scoreboard has appeared, which is an atomistic method of measuring intangible assets which are pending completion;
- Criticism of the method Tobin's Q considered the volatility of the courses on the capital market, often beyond the control of management, which directly affect the market value of the intellectual capital of the company, and focused on the fact that this way of calculating the intellectual capital is not very robust. However, in his work, Stewart argues, by exemplifying, that both market value and book value may be diminished. Another weakness of the method is that the indicator "Q" may not be determined by the value of intangible assets;
- the Economic Value Added model was initially developed as an internal measure of performance used by managers to help them make decisions on investments. In practice, it has been demon-

strated that an investment project which causes higher income than the net cost of its funding and thus generates profit, does not necessarily lead to an increased company value;

- Technology Broker stated that it is itself an intellectual asset for organizations. But the main weakness of the model is considered to be related to the possibility of transforming the qualitative results in monetary results. For example, using market-based approach is likely to not be identified on the market any information on prices of many of the elements that form the intellectual capital. Income-based approach suffers from the bias of the estimates cash-flow;
- the Weighted Patents Citation model estimates a “technological factor” to identify the impact of research-development efforts leading to the creation of intellectual property and uses indicators such as research-development expenses / sales, number of patents, income / research-development expenses, etc. “The evaluation process of patents” is an effort that involves teamwork, in which specialists interact in marketing and research-development to decide the viability of abandoning or continuing the research-development process;
- being the world’s second-best managerial methods used by a leader in the process of organizational change in 2015, aiming to increase the performance of the entity, Benchmarking’s impact on the era of digitization promises to deliver concrete solutions to the challenges turbulent environment.

Based on this overview of the different methods of measuring intellectual capital of companies, we can say that the literature and practice offer several models, each with its strengths and weaknesses (Ahmed, Neel & Wang, 2013). Moreover, we can see that some of the intellectual capital valuation models are built on the same principles and using the same indicators, but they are named differently. For example, Skandia Navigator uses the term “human capital”, Technology Broker uses the name “people-based activities” (human-centered assets) and Intangible Assets Monitor uses “staff competence” to denote the same concept.

Andriessen and Stam (2004) on the other hand, have introduced significant changes, particularly with respect to organization. They break down each of the other IC groups between assets, investments, and effects. This approach is intuitively appealing as it provides a reading on the current stock of intellectual capital, its impact, and its potential for the future.

There are other versions, some adding categories, but most scholars stick with the three basic categories (and virtually all research includes the three in some form) (e.g. Andreou et al., 2007). If knowledge assets are the single most valuable asset available to a firm seeking to establish sustainable competitive advantage in the marketplace, per the resource-based/knowledge-based theory of the firm, there are clear implications for corporate governance. As a result, at the intersection of intellectual capital and corporate governance is an interest in disclosure. The art of managing knowledge assets is complex and, as previously noted, the payoff may be long in coming and difficult to tie directly to investment in knowledge. While the specifics disclosure are still early in development (Abeysekera, 2006), there have been some moves toward standardization. Managers recognize the value of showing investment and interest in developing intangibles, and voluntary disclosure rectifies issues such as information agency (Kwansa, Mayo & Demirciftci, 2008). Guthrie and Dumay (2015) reveals that interest in public sector and IC is alive and well and the major difference between public sector and mainstream IC research is a complete lack of normative research.

This demonstrates that the field is still at an early stage and no one wants to give up their own nomenclature borrowing aspects of the work of others, as long as it was shown that one method is generally valid. For this reason, an important aspect of research is to develop a common set of definitions and indicators that can be easily generalized.

An optimistic attitude regarding the chances of success of a development project will lead to the capitalization of development costs, with implications for the size of the result, the capitalization for the year (Florou & Pope, 2012). In future exercises, expenses recording with amortization will impact the result in the sense of decreasing it. If the enterprise has the interest payment of development costs in the profit and loss (expenditure) it will claim that at least one of the conditions stipulated by IAS 38 para. 43 is not met.

One criticism of the procedures above concerns that they contain a certain „dose” of creative accounting with the character of subjectivity with the realization that they change the presentation of accounts, but are nonetheless the result of an option, when selected from among more methods, which makes us say that they are within the accounting regulations (Chen, Qu & Sun, 2017).

Referring to development costs, for example, their positioning on the boundary between evaluation and accountability requires the existence of a bias caused by handling interest income. If the enterprise has a policy aimed at transferring these expenses in the profit and loss (expenditure) account, we can claim that at least one of the requirements for classification as an intangible asset development costs - which would affect the balance - is not met.

The Fourth Directive states that these expenses must be charged to the profit and loss, unless national law does not provide for their capitalization (Anson, 2008). These provisions were acquired differently by the EU countries, in Germany is forbidden to capitalize these expenses. France is the opposite, considering them capitalizable and depreciable in 5 years. In Belgium, Italy and the Netherlands, the capitalization of the costs of research is questionable, the trend being the exclusion of these expenses from the asset (Ball Li & Shivakumar, 2015). Development costs can both be capitalized and amortized within 5 years (Belgium and Italy) or during their useful life (the Netherlands). In Spain and the UK, research costs are non-capitalizable under certain conditions and can be amortized for a period of 5 years, respectively during the useful life.

All the measures against „fraudulent” accounting practices must have the purpose to ensure a capital accounting information on qualitative intellectual capital that faithfully represents reality and to allow decisions to ensure an optimal allocation between participants in value creation (Vladu, Amat & Cuzdriorean, 2016).

Prior to the introduction of the International Accounting Standards (IAS), asset valuation occurred at a historical cost reduced by the depreciation value at the time of the valuation, which did not always provide a fair value of those assets due to the impossibility to define a useful value for the exact use for each asset. Another method previously used was the valuation of assets based on the replacement value, which did not offer a fair value because of the difficulty of identifying accurate replacement values. Whether the valuation could be made at a historical cost or replacement value, this involved the use of professional judgment and estimates. These were the prerequisites for introducing fair value as the basis of assessment in the IAS.

The purpose of introducing fair value was to provide a fair representation of the amount of assets and liabilities of an entity presented in the financial statements that may be obtained if those assets or liabilities were disposed of at the preparation time of the financial statements. According to the fair value measurement, the most important component of the financial statements is the Balance Sheet. According to the recent studies, the use of fair value favors a realistic approach in favor of previous conservative approaches (Ball, Li & Shivakumar, 2015; Florou & Pope, 2012). At present, the fair value is the most popular method used among all permitted evaluation methods, but it still has a major disadvantage, namely subjectivity. Another disadvantage of using fair value is the lack of tools to verify it. Furthermore, it is still permitted to use the historical cost method as a fair value, which can lead to a significant distortion

of the results (Chen, Qu & Sun, 2017). Even if fair value is aimed at improving the balance sheet value measurement tools and reflecting a relevant and current business valuation, it is the engine for creating prerequisites for creative accounting, especially with regard to asset valuation.

FUTURE RESEARCH DIRECTIONS

Therefore, their representation in situations of intellectual capital value as intangible asset, to a value as close as possible to the real one, is essential for users since they ground their decisions based on its level (Matricano, 2016).

Moreover, the success of any company depends not least on whether the intellectual capital has recognized the important role of an examination over several years of the development of intangible values both in the construction of the house of intangible values and the annual evaluation, and if it has implemented this knowledge consistently in everyday decisions.

The main controversy raised by the aforementioned standards refers to the need for periodic reassessments and the possibility of choosing a method of measuring the value of assets, which creates premises for the practice of creative accounting (Englund & Gerdin, 2018; Guthrie & Dumay, 2015).

Regarding the revaluation of assets, the standards specify that if a revaluation of an asset of a particular class occurs, all assets belonging to that class need to be reassessed, which can lead to high costs for the entities.

The permissiveness of choice between two valuation methods is also regarded as confusing and unreliable, which may have an adverse effect on the objective of providing a basis for the comparisons between entities. The reliability of the information from an investor's perspective is also low due to fluctuations in the value of an investment portfolio.

The author believes that due to the high influence, both positively and negatively, of the intellectual capital on its value is necessary for conducting more detailed studies of diagnostic analysis to identify and measure them, and also to determine a set of evaluation methods that leads to a correct result, close to the market.

Of course, the appeal to intangible resources in order to create value remains a significant challenge for specialists because the country's competitive advantage should be interpreted in relation to the skills, talent and intellectual capital stock. Future research efforts of SMEs should turn those scales into operational parameters and promote the development of empirical methodological studies based on dialogue and the dissemination of knowledge and experience in interdisciplinary research teams.

CONCLUSION

Each company has its unique set of knowledge, skills, values and solutions, all intangible resources. Monitoring and management of these resources can be made with value creation efficiency analysis because it is a priority for managers to obtain and maintain productivity and efficiency in the enterprise.

Another aspect that can be observed is related to the fact that some researchers have developed theories based on reflection the results of case studies, others have developed some indicators that have applied in practice (as in the case of Skandia, for example) but without testing their validity in advance and others have developed sets of indicators were not tested. For this reason another challenge in the study of intellectual capital is the need for researchers to base their conclusions on several empirical

researches. And, to make conclusive statements about intellectual capital, we need to consider that a coherent field theory has positive effects in multiple areas such as accounting, human resources, finance, strategic management, etc.

Very important is that those who investigate aspects of intellectual capital to set realistic goals. As with many challenges, such as efforts to conceptualization of the field, trying to measure intellectual capital; setting causal relations - effect, demonstrating the accuracy of proxies, it happens that many companies have an intellectual capital management system its use in some individual indicators whose relevance is not fully justified.

It is therefore important to determine and establish relevant indicators, the group of them in specific categories (quantitative or qualitative aspects related to individual company's business - e.g. employees - or macro issues) and not I just put together, and also to assign each category a specific weight in calculating the final result.

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KEY TERMS AND DEFINITIONS

Assets: As future economic benefits controlled by a particular business entity and also as economic resources which are owned by a business.

Estimate: Opinion regarding the value.

Financial Accounting Standards Board (FASB): Set up and develop generally accepted accounting principles.

Intangible: Represent immaterial assets.

Organizational Performance: Elements affecting company performance such as financial and marketing factors, return on sales, return on investment, etc.

Valuation: The process of determining the value of an asset.

Manipulating Business Performances by Creative Accounting

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INTRODUCTION

The manipulation of accounting values or the practice of creative accounting is possible due to the gaps in the accounting regulations and due to the freedom to choose and decide between the accounting methods allowed for the treatment of different categories of balance sheet items or the profit and loss account. The risk of misrepresentation of results is not an easy to measure risk, which makes it difficult to compare the results of entities in the same industry or to perform other financial analyzes (Akpanuko & Umoren, 2018).

On the other hand, the interests determined by factors such as intensity of competition or increased pressure on businesses to communicate the „digestible” results, especially from investors and analysts, make the information collected by market valuation experts and accountants mitigate the possible effects of creativity (Chen, Qu & Sun, 2017). If the purpose of creative accounting is to improve the accounts (or the image created for the company), taking advantage of the weaknesses and deficiencies of accounting regulation, the authors consider that this concept is nothing new, because the principle of accounting options has been known for a long time (Holthausen & Watts, 2001; Baker & Bettner, 1997; Caylor, 2010).

The emergence of creative accounting was influenced by the flexibility of international accounting rules (Damayant, 2013). Creative accounting is treated in most cases negatively (negative creation), designed to lead to achieving value for intangible assets able to respond to the wishes of managers on the company's financial position and performance (Doukakis, 2014). Simultaneous treatment of creative accounting as a tool to achieve the interests of accounting and accounting engineering is based on the accounting policies adopted by a patrimonial entity to produce and communicate information (Richardson, 2011; Jackson & Liu, 2010; Ball, Li & Shivakumar, 2015).

Accountants who accept the ethic challenge of creative accounting should be aware of the abuse to both the choice of accounting policies and to the handling of transactions (Byard, Li & Yu, 2011). Such accounting has developed mainly in Anglo-Saxon economies due to the freedom of the accounting profession. It was placed on the edge of the legal form and economic substance of transactions and events (Barth et al., 2014). Discussed in terms of accounting practitioners, creative accounting has facilitated the emergence of basic and alternative treatments used to solve problems (Ahmed, Neel & Wang, 2013; Barth, Landsman & Lang, 2008; Fan, Li & Zheng, 2016). Of course, issues of evaluation of assets are cases of creative accounting practice that involve subjective reasoning as it applies to the professional

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accountant or expert appraiser. Using creative accounting for intangible assets, for example, especially in its gray area favored by accounting rules, makes it difficult or even impossible to guess the true value of these assets (Li, 2010; Ozkan, Singer & You, 2012; Barth, 2013).

In this context, the following questions arise: will we return to accounting at the initial cost, in which intangible assets are recorded at outdated values and are therefore not relevant or reliable? How important are the psychological factors in accounting measurement? Can a model of assessment ensure the maximum quality of the accounting information on intangible assets? The answer to these questions, as well as various controversial issues of the fair value concept of intangible assets, are presented in the current draft of the International Accounting Standards Board (IASB) and the American Accounting Standards Board (FASB). As a result, today, we perceive an accelerated rate of change, aggressive disruptive phenomena and emerging economies that are rapidly developing against the backdrop of a Digital Era (Chen et al., 2010; He, Pan & Tian, 2017).

BACKGROUND

The foundation of creative accounting is therefore the manipulation of the accounts by the voluntary increase or decrease of the accounting values recorded in them (Heald & Hodges, 2018). From the perspective of the existing risks, the actions of manipulation of the amounts recorded in the accounting accounts are influenced by the systematic and financial risk (Fan, Li & Zheng, 2016).

Even though the definition of creative accounting is not unique, all definitions have as main elements the use of knowledge and skills of accountants to manipulate results with the deficiencies existing in legislative normalization systems.

Moreover, theme creative accounting practices are addressed by several disciplines: accounting, information technology, psychology and management, but they have grown tremendously in recent decades throughout the entire spectrum of companies (Brown, 2010). Creative accounting is operating at shade where accusations substantiated by non-compliance with professional or legal norms can be brought, but where common sense logic notifies the presence of a certain dose of „forcing the note” (Bettner & Kate, 2013).

Entities may use creative accounting tools when listing stocks on their stock market and aiming towards maintaining a stable course of shares when there is an increased volatility in financial and capital markets, which creates a high economic and financial risk when the field of the economic operations is multinational and several regulatory bases are needed to work in harmonization, etc. (Ball, Li & Shivakumar, 2015) These are examples of practicing “positive” creative accounting, but given the very small boundary between the positive and negative nature of using the creative accounting tools, the examples mentioned above can lead to fraud and tax evasion.

From the managers’ perspective, there are several reasons behind their decision to practice creative accounting, namely: reaching internal targets, reaching expectations from the external environment, smoothing or standardizing incomes to provide a steady image of the performance, facilitating the conduct of takeover bids or contracting loans, reducing tax obligations, changes in management.

A number of authors have described creative accounting as such:

Parker notices that ‘all businesses hide their benefits. The published synthesis documents are based on registers that have been ‘delicately’ or even substantially altered. The figures presented to the investors have been entirely changed to protect those guilty. This is, in fact, a legitimate scam and is called creative accounting...’ (Parker, 2012). The practitioner, Ball, states that ‘the accounting process involves

operating with different opinions and resolving conflicts between them in order to present the results generated by transactions. Such flexibility facilitates manipulation, deception and distortion. These activities, practiced by some less scrupulous members of the profession, are becoming known as creative accounting... Creative accounting does not violate law and accounting rules. It respects the letter, but obviously not its spirit... There is no doubt about the negative nature of creative accounting. It distorts the results and the financial position of the enterprise, and if we lend credence to the theoreticians, it becomes an increasingly used practice...' (Ball, 2013). Lukka defines creative accounting as a communication technique that aims to improve the information provided to investors (Lukka, 2010). On the same line, Dennis believes that the creative accounting expression describes 'accounting practices, often at the limit of legality, practiced by some businesses that, taking advantage of the normalization limits, seek to embellish their financial position image and economic and financial performance' (Dennis, 2014).

The different methods of recording intangibles through creative accounting can be classified into four categories (Schleicher, Tahoun & Walker, 2010):

- Sometimes accounting rules allow a company to choose between different accounting methods. For example, a company can choose the accounting policy which gives the desired image (it is allowed to choose between treating development costs as expenses when incurred, or to absorb these costs throughout the project life);
- Some accounts of intangible assets involve a degree of estimation, reasoning and prediction, especially when there is no market for that asset. These estimates are usually made in the company or by an expert evaluator and the creative accountant is able to assume a position of caution and optimism in setting the estimate;
- Artificial transactions can be recorded to manipulate intangible amounts on the balance sheet and to transfer profits between accounting periods (sale and lease-back);
- And real transactions involving intangibles can be planned at various times in order to create the desired impression to accounting information users. Property entity management is free to choose the year when they will sell the intangible investment, increasing the profit in the financial statements.

The methods in which some processes reveal creative accounting for intangible assets can be grouped in:

- Processes which have the effect of modeling the result and management decisions;
- Processes and techniques meant to improve the effect of balance sheet information;
- Processes which impact the presentation of the results.

Besides, International Financial Reporting Standards have been introduced to facilitate the understanding of financial statements and to provide increased transparency but also to limit the possible opportunities offered by a creative accounting (Ozkan, Singer & You, 2012). While the purpose of the standards has been to protect all stakeholders by providing relevant, neutral, credible and verifiable information, certain irregularities are still likely to occur, in particular due to the replacement of the historical cost as a basis for fair value measurement. Even if fair value is aimed at improving the balance sheet value measurement tools and reflecting a relevant and current business valuation, it is the engine for creating prerequisites for creative accounting, especially with regard to asset valuation.

The techniques and practices used for intangible assets having as effect shaping the outcome, the authors mention:

First, an optimistic attitude regarding the chances of success of a development project will lead to the capitalization of development costs, with implications for the size of the result, the capitalization for the year. In future exercises, expenses recording with amortization will impact the result in the sense of decreasing it. If the enterprise has the interest payment of development costs in the profit and loss (expenditure) it will claim that at least one of the conditions stipulated by IAS 38 para. 43 is not met.

Second, undervaluation of assets acquired by the company leads to increased goodwill. Capitalization and amortization of goodwill over its useful life will influence the outcome in future years (goodwill amortization costs lead to diminished results, with consequences on the course of action and competitiveness of competitive stock takeover bids). Charging goodwill on equity to reduce their lead, results in their diminishing, the result of future exercises not being influenced by goodwill amortization expenses (Hou et al., 2015).

Regardless of the creative accounting method used, the result of its application is aimed at influencing the entities' results and altering the financial statements (Parker, 2012). Creativity when it comes to account balancing means presenting whichever information is desired without violating any international accounting or reporting standards or legal provisions.

Balancing accounts, even if it is not ethical, cannot be considered an accounting fraud because of the limitation of legality. The main reason for the appearance of account balancing is the conflict of interests of different users of the financial information, which have the same expectations as to the qualitative characteristics of the information, but different purposes when it comes to its use.

One of the main qualitative features of accounting information is credibility, which implies the absence of significant errors, lack of bias and fair and reasonable representation of reality, attributes that exclude the use of creative accounting practices. Neutrality is another qualitative characteristic at the opposite of account balancing.

RESEARCH METHODOLOGY

The procedures of financial engineering used have at their base the choices permitted by accounting regulation, the possibilities given by the weaknesses and deficiencies of the accounting norms, and the mechanisms through which accounting can intervene: the determination of accounting interpretation of a legally-financial transaction or the elaboration of a legally-financial mechanisms having the purpose the modification of results of financial situations (Florou & Pope, 2012; Allen & Ramanna, 2013).

Table 1 reviews some creative accounting methods, techniques and practices that have some influence on modelling the result:

As we can see in Table 1 the first effect of creative accounting is hiding fraud and masking financial scandals, as it is very difficult for users of financial statements to analyze the results they are offered in detail - whether they do not have the necessary knowledge or do not have access to the data necessary for the financial statements. According to studies, even the most sophisticated analytics users can ignore or misinterpret certain signals that indicate the practice of creative accounting (Azeita, Austin & Imuentinyan, 2019; Bettner & Kate, 2013; He, Pan & Tian, 2017).

The opportunity to choose accounting methods may be decreased by reducing the number of permitted accounting methods or by specifying the circumstances in which each method must be used. It is interesting to note that the auditors should step up their efforts to identify possible manipulations of the information provided by the financial statements (Cahan & Sun, 2015). In this respect, the audit function should include an assessment of the company's internal control system to prevent creative accounting

Table 1. Creative accounting methods, techniques and practices

Balance sheet item and / or profit and loss account	Mechanism and impact on result modelling
Fixed assets	The practice of 'subjective depreciation' of assets creates a field conducive to creativity in accounting. Based on the exercise of professional judgment, IAS 36 requires that at each balance sheet date, it is determined whether there is any indication that the asset underwriting has been impaired. If the enterprise's management considers the recoverable amount to be less than the net book value, the asset is considered to be impaired for the difference. In this situation, the result will be affected by recording a depreciation expense.
Development costs	An optimistic attitude regarding the chances of success of a development project will result in the capitalization of development expenditures, with consequences on the size of the result, in the capitalization exercise. In future exercises, the recording of depreciation expense will have an impact on the result to diminish it. If the enterprise has an interest in transferring development expenses to the income statement (at expense), it will be invoked that at least one of the conditions set out in IAS 38, paragraph 43 is not met.
Goodwill	Under-evaluation of the assets of the acquired company leads to the increase of the goodwill. Capitalization of goodwill and its depreciation over its useful life have an impact on the result of future exercises (amortization of goodwill leads to a decrease in the result, with consequences on the stock exchange rate and the competitiveness of competitive bidding). Impairment of goodwill on equity results in the decrease, and the result of future exercises is not influenced by amortization of goodwill.
Stocks	The 'stocks' field provides enough opportunities for subjectivism and creative accounting. A discrepancy found voluntarily in determining the stock size in the estate at the end of the exercise may lead to a "smoothing" of the outcome, meaning that the under-valuation or overestimation of the final stock has a bearing not only on the financial statements of the current exercise, but and those that belong to the next exercise. On the other hand, the inclusion of financial expenses in the cost of inventories has the effect of increasing the result in the year in which the expenditure is included. On the opposite side, if the enterprise's management has a pessimistic view of the outcome, it will apply the result method by treating interest as an expense item of the current exercise.
Provisions for risks and expenses	The practice of provisions (increasing and reducing them) is an effective tool for "smoothing" the outcome. The provisioning of provisions in those years in which the enterprise generates profit leads to a reduction in the result, while the resumption of earnings in provisions in the years when the enterprise records a deficit leads to an increase in the result.
Construction contracts	The choice between the two methods of accounting for construction contracts has the following impact on the profit and loss account: on the basis of the completed contract, the result will be recognized when the contract is finalized; based on the finalization percentage method, the result will be spread over time over the entire duration of the contract. Changing from one method to another also has a significant impact on the profit and loss account.

Source: The authors adaptation based on IFRS

or fraud. In order to ensure broader and more rigorous supervision, auditors should be willing to fight against their clients. This could lead to a radical reflection on the nature of the relationship between auditors and managers. It should not be neglected those concepts such as: integrity, objectivity, confidentiality, competence and, last but not least, credibility must be found in the conduct and documents of the work of any professional.

At the same time, the accounting result represents an important component of the value of a share (Andon, Baxter & Chua, 2007). There have been few cases when very Romanian profitable companies have gone into liquidation. That is why the stock market authority should sensitize investors about the indispensability of education and information, but this is a lengthy process.

Table 2. Accounting methods and manipulating estimates in accounting

Opportunities for creative accounting	Solutions that come to restrain creative accounting	Accounting traditions, where solutions are easy to apply
Choices regarding accounting methods	Reducing the number of allowed accounting methods	Western accounting model
Trends to estimate	Minimize opportunity for estimates	Western accounting model
Entering into an artificial transaction	'Substance over form'	Anglo-Saxon accounting model
Authentic transactions planning	Prescribing revaluations	Anglo-Saxon accounting model

Source: The authors adaptation based on IFRS

SOLUTIONS AND RECOMMENDATIONS

As stated above, creative accounting is seen as a particular feature of the Anglo-Saxon approach to accounting, characterized by flexibility and rationality, to the European continental model, characterized by detailed traditions and prescriptions. The continental accounting model, more prescriptive and inflexible, may be an opportunity to reduce abuses in choosing accounting methods and manipulating estimates in accounting (Table 2).

Financial scandals are based either on the discovery of falsehoods (willing submission of false statements or the dissemination of inaccurate information) or the discovery of the use of techniques to disguise the real situation, known as creative accounting. So, professional accountants long caricatured for their lack of imagination and rigid behavior have created the surprise of inventing creative or imaginative accounting.

FUTURE RESEARCH DIRECTIONS

The presented and analyzed issues are a synthesized part of the vast amount of information that has been developed by the authors to create the framework for understanding manipulating business performances by creative accounting. Therefore, there are new directions of future research such as:

- The choice of accounting methods should be diminished by reducing the number of permitted accounting methods or by specifying the situations in which each method should be used. The imposition of consistent methods is useful because a company who chose a method that gives a positive image in a year, will have to use the same method and during the years when the result will be less favorable.
- The abuse of reasoning can be nipped in two ways: by mapping rules to minimize the use of reasoning or by imposing consistency so that if a company chooses an accounting policy that favors one of the years, they will have to apply it during the coming years even if no longer favors them.
- For artificial transactions „the prevalence of substance over form” concept can be invoked, according to which the economic substance rather than the legal form is the one that determines the accounting substance.
- The time of the transaction is clearly a matter of leadership. However, the purpose of their use can be reduced by requiring the regular review of the elements so that gains or losses of values

change accounts are recognized in accounts for the years in which they appear (and not entirely in the year are transferred).

All these measures against „fraudulent” accounting practices must have the purpose to ensure a qualitative accounting information that faithfully represents reality and to allow decisions to ensure an optimal allocation between participants in value creation.

From the point of view of the accounting practice, the need for an ethical or behavioral code is an obvious matter (Chen, Qu & Sun, 2017). Professional accountants have a delicate position when it comes to the need to provide services that meet high quality standards and serve the public interest, and this is the premise of a need for principles of professional behavior. Thus, the International Federation of Accountants (IFAC) has formulated a set of ethics standards for the accounting profession, which form the Code of Ethics, and highlight the importance of this profession in influencing the organizational culture. In addition to the Code of Ethics, organizations need continuous management involvement as well as professional accountancy organizations working together to implement ethical principles and increase responsibility. Trust is an essential element in business survival, and major economic and financial scandals have demonstrated the fragility of the public or customer confidence.

CONCLUSION

The manipulation of accounting information can be done within the law and accounting rules or outside them (Li et al., 2017). In the latter case there are witnessing an illegal practice: accounting fraud. Although there is a clear difference between creative accounting and deliberate violation of the law (fraud), there is always a clear demarcation between the situation of creative accounting practices and accounting malpractice. Because the law is a two-tailed sword - a control tool, but also an argumentation base for deviating from the rule - the auditors should step up their efforts to identify possible manipulations of the information provided by the financial statements. In this respect, the audit function should include an assessment of the company's internal control system to prevent creative accounting or fraud. In order to ensure broader and more rigorous supervision, auditors should be willing to fight against their clients. This could lead to a radical reflection on the nature of the relationship between auditors and managers. It should not be neglected those concepts such as: integrity, objectivity, confidentiality, competence and, last but not least, credibility must be found in the conduct and documents of the work of any professional.

The fundamental problem of convergence of accounting is linked to the note of credibility given to accounting. The statement is based on the user confidence to the situation where the same public company, for the same period in different countries has different size images in equity and results, as a result of compliance with the rules in these countries.

Also consider that successful convergence IFRS - U.S. GAAP in practical terms depends on the coordination of activity of the IASB and FASB interpretation, because, even if the standards issued by the two bodies will be identical, the financial statements (prepared in accordance with IFRS or U.S. GAAP) will not be comparable (or will be only limited comparable), convergence efforts thus undermined, if the recommendations for the implementation of these standards will also be the same (or comparable).

Europeans are more skeptical of the utility of fair value for other categories of users of accounting information and there are many criticisms about the accounting model. Furthermore, the fair value is unlikely to apply within a Romanian accounting system, all the more so in the context of the loss of confidence in capital markets over the last few years, amplified by the global economic crisis. This is

because fair value is an emanation of the capital market (Ramanna, 2008). Even if the benefits of the fair value system, which are in balance with the disadvantages, are discussed, it cannot be said with certainty that it is superior to the historical cost system. The latter has an incontestable advantage - to be known and therefore mastered.

In conclusion, given the trends of globalization, accounting information users prefer to use an accounting system (concepts, principles, and accounting standards) uniform. As a condition of credibility, the information in financial statements must be complete, in terms of two general restrictions: the cost-benefit and materiality. Omissions can cause information to be false or misunderstood, resulting in a decrease in credibility and relevance.

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KEY TERMS AND DEFINITIONS

Accounting Engineering: The process whereby, given the existence of gaps in the rules to manipulate accounting numbers and taking advantage of flexibility, those practices are chosen for measurement and information that allow transforming synthesis documents from what they should be in what managers want.

Convergence of Accounting: The process by which accounting standards are developed in a manner that is able to lead to the same act or purpose, by showing the similarity of national, regional, international.

Creative Accounting: A tool to create a distortion of the quality of financial information, creating uncertainty about the consistency and comparability of information for users, in which case we are dealing with an accounting of intent.

Fair Value: The amount at which an asset is bought or sold in an arm's-length transaction, in which neither party is forced to act.

Financial Engineering: Represents an aggregate of procedures, which have as objective the modification of the level of the results while taking into account the optimization, minimization, or presentation of financial situations.

A Survey on Forensic Accounting

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INTRODUCTION

Globally, Forensic Accounting is coming to be one of the well-fortified expanded domain in the accounting career (Aribaba, 2013). In this chapter, the meaning of Forensic accounting will be examined. This will help create awareness of the significant use of a forensic accountant. Therefore, the objective of this chapter is to discuss the significance of forensic accounting in organizations and industries and the importance of forensic accountant in the detection and investigation of criminal activities such as fraud in an establishment. This chapter will be an eye-opener for the public on how forensic accounting can be used to curb fraud and criminal activities in our organization both locally and globally.

This study intends to evaluate the recognition and avoidance of fraudulent acts or fraud. The following are the objectives to achieve the aim of the study:

- 1) Examine the role of a forensic accountant in fraud recognition and avoidance
- 2) Examine and discuss the techniques that can be utilized in forensic accounting for detecting fraud or criminal activities.
- 3) Examine and discuss the concept of Fraud and forensic accounting
- 4) Discuss the relationship between forensic accounting

Research Questions

1. To what degree is the techniques of forensic accounting for revealing fraud or financial criminal activity reliable and effective.
2. To what degree do the existence of forensic accountant relevant in detecting and avoiding fraud or fraudulent activities.
3. To what degree do the existence of forensic accounting counteract criminal acts such as fraud

BACKGROUND

Meaning of Forensic Accounting

Forensic Accounting (FA) is defined as an ability, skill or knowledge acquired and applied to utilize accounting, auditing. It provides an accounting analysis suitable to be used in legal proceedings. Forensic accounting is frequently used in fraud and embezzlement cases to explain the nature of financial crime

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in court (Investopedia, 2019). Forensic Accounting necessitates the use of discovering sums of money, asset discovery and recuperation as well as due to meticulousness analyses. FA is also understood as an amalgamation of accounting and investigation practices to ascertain economic corruptions and one of its vital roles is to elucidate the kind of monetary misconduct to the magistrates.

History of Forensic Accounting

The significance of Forensic accounting set out following the year 2008, at that time when doubtful loaning exercises were in place then the massive Bernie Madoff Ponzi system make public extensive carelessness or misdeed and fraud in U. S. financial establishments (Morgan, 2017).

Overview of Fraud

Fraud is considered as an occurrence that is deliberately executed or discharged to obtain a benefit or generate a profit. It is also comparable to deceitfulness in business or the monetary market (My Accounting Degree, 2019). Fraud is considered as a broad legal word indicating a fraudulent deed that deliberately makes use of dishonesty to illegitimately deny another individual of cash, property or legal rights (ThoughtCo, 2019). Fraud depends on the use of deliberate falsification of information to achieve criminal acts (ThoughtCo, 2019).

The following are essential features of fraud (ThoughtCo, 2019)

- i. Falsification of a material fact: A deceitful proclamation encompassing material and pertinent fact need be prepared.
- ii. Realization of falsehood: The individual formulating the deceitful statement must comprehend that it is fallacious.
- iii. Determined to mislead: The deceitful proclamation need have been made deliberately with the focus of misleading and manipulating the target.
- iv. Realistic dependence by the victim: The rate in which the victim depends on the deceitful proclamation must be satisfactory in the sight of the law court
- v. Actual loss or injury suffered: As a consequence of victim dependency on deceitful proclamation, the victim experiences certain definite loss.

The Concept of Fraud

The Electoral and Financial Crime Commission (EFCC), 2004 and Okafor 2004, considered fraud to be a non-violent crime and illicit activity committed with the aim of getting illegal wealth either individually, as a group or an organized manner. Oxford English Dictionary, 2009 also referred to fraud as a wrongful or criminal deception intended to result in financial or personal gain.

Wang, Liao, Tsai & Hung, 2006 and Nwaze 2012 saw fraud as a planned tricky process or device usually undertaken by a person or group of persons with the full intention of cheating another person or organization to gain ill-gotten benefits.

Houck et al 2006 argues that forensic accountant requires unique skills and professional knowledge and training that is beyond academic degree. He also argues that for forensic accountants to be effective he must acquire relevant skills and knowledge. Forensic accounting came into existence due to failure of traditional auditor to detect and prevent fraud and other economic crimes.

According to Anastasia, 2018 forensic accounting is used to determine

- 1) **How:** How the nonconformity had taken place
- 2) **Where:** At what level of the bureaucratic chain had the nonconformity transpired
- 3) **What:** Is the nonconformity deliberate or not
- 4) **Why:** The purpose or aim for the deliberate discrepancy
- 5) **Who:** The individual that is at responsible for the act

Forensic accounting proficiencies facilitate an accountant to collect substantial proofs an occurrence of fraud besides other financial crimes and present it most often in a courtroom. It is, therefore, necessary for a forensic accountant to be well known both accounting and law to establish if financial misconduct had transpired or not. Top Accounting Degree discussed 5 important skills for a Forensic Accountant that will allow a forensic accountant to deliver effectively and efficiently. The skills are discussed below as follows:

- a) **Detail-Oriented Approach:** This involves the procedure of discovering financial indiscretions as well as observing any minimal inconsistencies that could signify a higher pattern of fraud that requires a careful focus and attention. Documentation of forensic accountant investigation should be structured.
- b) **Interviewing Skills:** Forensic accountant congregates facts as well as pursue improve understanding of a condition by cross-examining individuals. A Forensic accountant should be able to identify if an individual is being honest alongside with deciding when they require to drive for additional shred of evidence. A forensic accountant should also possess an attribute of good listening.
- c) **Analytical Skills:** These analytical skills acquired by a forensic accountant can be utilized to create a representation of what type of monetary misconduct may have transpired to make known that indications to others.
- d) **Communication Skills:** This skill is needed to be able to noticeably converse their deduction in both spoken and printed patterns. They must possess the skills of both strong writing and speaking.
- e) **Creative Thinking and Problem-Solving Skills:** They should be versatile and give solutions to difficulties effectually. They should possess the ability to envisage several sequences of events and potentials as well as take account of as to if they are unswerving with the evidence gathered or not

Some examples of Fraud by ThoughtCo, 2019 includes

- a. Mail fraud and wire fraud
- b. Tax fraud
- c. Stock and securities fraud
- d. Medicare and Medicaid Fraud

Some of the commonly committed crimes as stated by legaldictionary, 2019 are as follows

1. **Check Fraud:** This transpires once an individual pay for something with a check intending that there is not sufficient cash in the account to ensure for the cost.
2. **Internet sales:** This involves vending counterfeit stuff, taking payment with no intention of supplying the commodities or substances to customers.

3. **Website misdirection:** This implies imitating trustworthy establishments such as Amazon, eBay, etc.
4. **Charities fraud:** Illegitimate persons seek individuals to make assistances to countless foundations that do not exist.
5. **Work-from-home scams:** The usually called cybercrime such as yahoo yahoo
6. **Pyramid schemes:** It is like a multilevel business that is money is only made when we get a huge number of individuals to join beneath them.
7. **Identity theft:** They deprive preys of their fund, credit rating and private identity by acquiring their private information for their gain.
8. **Credit card fraud:** Individual's card information is obtained through various mediums; the criminal can speedily make a huge volume of purchases far before the consumer realizes what is happening.
9. **Debt elimination:** Many Americas in debt are easily being presented the prospect to clear their bills, the prey then fronts the expense with their credit card information and get nothing as profits.
10. **Insurance fraud:** This means false insurance that is referred to as claiming for automobile damages, medical bills, overheads, and proprietors are considered to be insurance fraud

Once it comes to revealing fraud, three forensic accounting methods can be utilized according to Anastasia 2018. They are

- 1) **Data mining with computers:** Data mining is concerned with considering inconsistencies, tendencies and forms in the datasets connecting to the business and its funds. Data collected during the investigation process is stored and processed with a remote server such as computers (Ogundokun, Afolayan, Adegun & Afolabi, 2019).
- 2) **Review of other documents using various methods:** Information is not continuously in digital form which means forensic accounting has to utilize documents reviewing tactics to spot fraud in an organization.
- 3) **Conducting interviews:** Forensic accounting doesn't only depend on datasets, conversation with personnel and other significant individuals is another fundamental approach to aid recognize data.

Functions of A Forensic Accountant

A forensic accountant is somewhat an accountant and at the same time partially an investigator. He or she is referred to as somebody who attends and manages broad investigates of financial statements and as well as analyses the trails of business dealings and also detects resources for repossession. They work for accounting organizations, risk management consulting companies, law firms, law enforcement agencies, insurance, companies, government agencies, and financial institutions. A forensic accountant has to be proficient and usually obtain qualifications as certified fraud examiner (CFE), certified public accountant (CPA), certified forensic accountant (CFA), chartered accountant (CA), certified management accountant (CMA), certified valuation analyst (CVA), certified fraud examiner (CFE), certified valuation analyst (CVA), certified in financial forensics (CFF), and investigative & forensic accountant (IFA) (Morgan, 2017). Forensic accountants are individuals that investigate, translate and encapsulate complicated monetary and corporate matters. They also accumulate fiscal proofs, establish computer applications to administer the information gathered and relate their discoveries in the format of records and performances (Investopedia, 2019).

The function of forensic accounting cannot be under projected in discovering fraud in the Nigerian's public subdivision (Amake & Ikhatua, 2016). Owojori & Asaolu 2009 specified that the function of a forensic accountant is distinctive from that of conventional auditor and it is appropriate to an establishment. They also identified that a forensic accountant makes use of secretarial, inspecting and scrutinizing skills while performing exploration and they are educated to look outside the range of dispute in numbers of ways.

Crumbley & Apostolou 2005, asserted that an expert in forensic accounting has a specific willing emphasis on exposure and avoidance of fraud. Forensic accounting frequently encompasses the precision of strives to infiltrate suppression strategies (Krell, 2002). Forensic accountant focuses on fraud discovery, documentation of precise proof necessitated for efficacious illegitimate examination, provide primary suggestion as an evaluation of the persuasion and indication accessible at the beginning of the procedures, evaluate and ascertain fundamental credentials which ought to be obtainable as proof, formulate a comprehensive steadiness on considerable proof which is fathomable, analyze professional accounting report and lawful guidance on financial and accounting concerns.

Forensic Accounting for Criminal Investigation

Forensic accounting is used to discover whether a crime occurred and assess the likelihood of criminal intent. Such crimes include employee theft, securities fraud, falsification of financial statement information, identity theft or insurance fraud.

Forensic Accounting Services

In 1995, KPMG discussed forensic accountant is often involved in the following activities;

1. Fraud Awareness Workshop
2. Investigation
3. Asset Tracing
4. Litigation Support
5. Business/Employee Fraud Investigations
6. Mediation and Arbitration

Methods to a Forensic Accounting Assignment

Each forensic accounting assignment is unique and generally much forensic accounting assignment would include the following steps below (Aribaba, 2013)

- i. Meeting with the client: Interacting with clients to apprehend the significance of the shreds of evidence and concerns within reach is extremely advantageous.
- ii. Performing a conflict check: Once the appropriate persons are recognized, a dispute validation would be accomplished.
- iii. Performing an initial investigation: Executing a preparatory analysis which is preceding to the progress of a comprehensive design of activities which permits following preparation to be centered on at that time.

- iv. Obtain the Relevant Evidence: These shreds of evidence could encompass discovering documents, financial restoration, assets, an individual, firm or enterprises and so on and this relies on the kind of the incident being investigated
- v. Develop an Action Plan: The information gotten by consulting with clients and accomplishing the primary inspections are brought and put into consideration. The goals of the investigation to be accomplished and the approach to make use to achieve the tactics are also being considered.
- vi. Perform the Analysis: The real investigation executed will be determinant upon the kind of the obligation.

Literature Reviews

Bhasin 2007 defined forensic accountants as trained personnel who look beyond the figures but deals with the business certainties of circumstances. In his article, he stated that forensic accounting includes inspecting, evaluation of financial facts, communication of these discoveries in form of details, presents and gather documents as well as also facilitates in legal happenings which comprise of attesting in court as a professional witness and organizing graphical aids to sustenance trial shreds of evidence. An investigation is referred to as the inspection of documents and accounts of an organization for a certain motive.

Zysma, 2004 examined forensic accounting as integration of bookkeeping, inspecting and analytical skills.

Olafinsola, 2007 considered forensic accounting as the presentation of illegitimate approaches besides the incorporation of accounting fact-finding activities and law practices associated with the detection and investigation of financial misdeeds and correlated monetary criminal acts.

Manning 2002 defined that forensic accounting is the utilization of financial accounting and analytical skills to a code of behavior satisfactory by the court to attend to concerns in a debate in the framework of civil and criminal legal proceeding. Forensic accounting was ascribed by Joshi (2003) to Kautilya who is the first economist to openly recognize forensic accounting and is an area of study that is fast advancing. It has significantly become a field of attention to auditors and accountants.

Fraud

Fraud is referred to as the unlawful act of being duplicitous to an individual(s) in order to obtain money or possessions illegitimately (Oxford Advanced Learner's Dictionary, 2010). Fraud was also considered as an act of making oneself richer by deliberately apprehending the worth or wealth of an asset in an undisclosed manner (Arzova, 2003). Okafor 2004 described fraud as a forensic term that encircles diverse (Jones, 2011) means which human's imagination can devise that can also be resorted to as one person is receiving advantage over another in deceptive representation. Fraud can also be described as treading outside the authoritarian structure intentionally to provide a deceitful representation of the accounts (Jones, 2011).

Adeniji 2004 along with others summaries the varieties of fraud on the foundation of the approaches of perpetration made by criminals. The fraud categories are as follows but not limited to the following

- a. Defalcation
- b. Suppression
- c. Outstripped
- d. Theft and Embezzlement

- e. Tampering with reserves
- f. Insider abuses and forgeries
- g. Fraudulent substitutions
- h. Unauthorized lending
- i. Lending to ghost borrowers
- j. Kite flying and cross-firing
- k. Fake payment
- l. Fraudulent use of a firm's documents
- m. Fictitious contracts

Fraud is a theme that matters a lot and has received a lot of attention both globally and locally (Oyejide 2008).

Bozkurt 2003 stated in his study that two kinds of fraud are perpetrated in business and they are personal use of business resources and secondly is drawing up of financial statement of business falsely. Studies have revealed that the total loss in public subdivision as an outcome of workers' deceitful deeds is extremely larger than that experienced as a consequence of populace carelessness (Amake & Ikhatua, 2016). Around 50% of workers are unwavering to perpetrate fraud whereas 80% of the workers could be liable to perpetrate fraud under an appropriate circumstance (Owolabi, 2007). It was also observed that most of the fraud perpetrated on the public subdivision were mostly perpetrated by married men than the unmarried with an outstanding level of education and extremely high IQ level and their ages are 28 years and above. They are in an appropriate working atmosphere, delegated with being in charge of accountability of taking care of fraud or their partners and they also established in money-spinning posts in an establishment. Forensic accounting had become a complex area of concern for the accounting profession (Okeye & Gbegi, 2003).

Emeh & Obi, 2013 conducted an empirical analysis of forensic accounting and financial fraud in Nigeria. They inspected the relationships of the presence of forensic accountant, the number of accountants with forensic accounting skills, the extent of forensic accounting practices, the extent of employee theft, the extent of financial fraud and extent of top management fraud. Their study gave a conclusion that there was any evidence of significant negative correlations between the presence of forensic accountants, the number of accountants with forensic accounting skills, and extent of forensic accounting practices with the extent of financial fraud.

Dada, Owolabi & Okwu, 2013 tried to take care of the importance of forensic accounting in a successful decrease in fraudulent performs in Nigeria. Their study resulted in disclosing that fraud decrement is important and connect or correlate with fraud investigation and exposure utilizing forensic accounting.

The Need for Forensic Accounting

The requirement of forensic accounting stimulated as a turn-out of no-success of audit method in businesses to discover fraud and other duplicitous happenings. Experts in this study area of accounting have perceived that concentrated economic difficulty has steered several people into fraudulent happenings in a great amount of business or enterprise. Forensic accounting program was devised to assist accountant advance with a fact-finding eye as regarding both the internal and external fraud and makes available crucial evidence to handle the issues when revealed (Amake & Ikhatua, 2016). Forensic accounting is a novel and speedy emerging area in the accounting field of study which is more or less like a conduit or channel linking accounting schemes to legal schemes (Mayungbe, 2012).

Skill of Forensic Accounting

Forensic accountant needs skillful and qualified expertise to be effectual in the enactment of obligations (Amake & Ikhatua, 2016). (Aderibigbe, 2000) recommended that a forensic accountant needs an extraordinary level of proficiency, uprightness, and trustworthiness to execute his job and be meticulously expert to demonstrate his proficiency by performing well in all appropriate investigation to become a representative of renowned accounting association. Forensic accounting field of study comprises of distinctive abilities that normally necessitates additional coaching outside an academic degree in accounting, Certified Public Account, Certified Fraud Examiners or any other certification. Forensic accountant ought to acquire understanding, proficiencies, and capabilities in the following areas listed below (Houck, Kranache, Moris & Robertson (2006):

1. Accounting and auditing skills
2. Criminology, lawful, authoritarian, certified setting and practical disputes
3. Fraud discovery, deterrence, investigation, and remediation in the following areas such as facilitate embezzlement, corruption and false representation of financial statement, fraud and forensic accounting established instruments and procedures for identifying and inspecting, automated incident supervision instruments and lastly other exclusive to computerized atmospheres
4. Loss deterrence
5. Forensic and lawsuit consultative assistances, incorporating research and investigation authentication of fatalities and impairments

FUTURE RESEARCH DIRECTIONS

This study can further be researched by implementing the techniques of forensic accounting reviewed in this study in a real life such as accounting organization worldwide. Forensic accounting can be adopted by many organization so as to make the business to continue to grow by making more profits. The following future research directions are listed below:

- a) More criminal and unlawful acts can be researched and reviewed on
- b) Implementing this study in real life both in accounting sector and legal court
- c) Adopting and using the techniques of forensic accounting in detecting fraud in organizations, banking sectors and so on and the criminal offences detected can be useful in legal court
- d) Government adopting the use of forensic accounting in the country economic

CONCLUSION

Fraud can occur in any company which can either be big, small, medium businesses. Revealing fraud can be challenging but forensic accounting delivers fairly a good number of clarifications to ascertaining whether a duplicitous activity has taken place or not. It, therefore, concluded that the study examined how forensic accounting can be used to detect fraudulent or criminal acts in a financial statement or organization. Also, the technique of forensic accounting that can be used in the detection of fraudulent acts committed was discussed.

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KEY TERMS AND DEFINITIONS

Court: This is referred to as a gathering to handle legal activities. It is also a territory in which a judges, lawyers, and people convene.

Criminal: This is an individual who responsible for a misconduct or an unlawful act and had been legitimately declared guilty of the offence.

Criminal Acts: This is referred to an illegal or unlawful attitude of an offender or criminal.

Criminal Investigation: This is referred to as the inspection or consideration of an offence or misconduct that is illegal or unlawful perpetrated by an individual.

Data Mining: Data mining refers to as data treatment by means of advanced data inspection competence and statistical procedures to ascertain patterns and associations in an already existing large database to uncover novel significance in data.

Financial Statement: This is a record presenting transaction's credits and debits.

Forensic: This is used in investigation and consideration of proofs or indication in a law court.

Forensic Accountant: This is an individual that uses secretarial abilities in scrutinising fraud or any form of criminal acts for use in legal court.

Forensic Accounting: This is defined as the practice involving secretarial abilities to scrutinise fraud or any form of criminal acts for use in legal court.

Fraud: The refers to something or an individual that consciously cheat, pretend, or trick with the aim of making profit as a benefit and this act can cause a harm to the victim.

The Necessity of Acting in the Public Interest: Corruption and Fraud in the Public Sector

1

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INTRODUCTION: THE CONCEPT OF PUBLIC INTEREST

The concept of public interest (Canning and O'Dwyer, 2001: 728), which is an issue where universal acceptance cannot be achieved as to what it is and how it can be measured, has an interdisciplinary importance and meaning today. Moreover, according to Sturm (1978 cited in Dellaportas and Davenport, 2007: 1084), it is at the centre of interpretations in political and social life.

Although the roots of the concept of public interest in the modern sense were first introduced by the French Revolution of 1789 (Saraç, 2002: 1), it can be said that the concept originated from the “common good” applied in England in the 17th century (Dellaportas and Davenport, 2007: 1084). Traditionally, common good is clearly a political idea and consists of some specific goals designed to promote the general well-being of all people, such as peace, order, prosperity and justice. Special goals, which were surrounded by common good until the mid-17th century, led to the collapse of medieval feudalism in England and the gradual disappearance of common good with the rise of national monarchies, and to clarify the distinction between common good and public good (Douglass, 1980, p. 107). In this context, the concept of public interest, which took its place as a separate concept in the literature, developed primarily with its managers or representatives interested in the material welfare of individuals rather than the welfare of the state. Then led to the attachment of individual welfare to the property rights and private interests of British property owners (Dellaportas and Davenport, 2007).

Although the public interest has developed its own identity, it remains a concept that cannot determine the content of the public or public interest. According to Gunn, the basis of this is that the term “interest has no definite meaning (Dellaportas and Davenport, 2007). The effects of uncertainty in the concept of interest can be found in P. Herring's study. According to the author, in fact the laws passing through the parliament are full of uncertainties and sometimes are ‘parliamentary’ activities that sometimes occur ‘so that they do not grow’, and the task of bureaucrats is to produce public policies which are operative from these unqualified obligations, and even this process can often be described as the public good itself (Shafritz et al. ., 2015). In addition to Herring expression, Flathman (cited in Dik, 2005: 3) points the process as a tool that the government considers while producing policies and provides legitimacy for the administration to carry out its activities easily.

Today, the concept of public interest, which forms the basis of the state and administration in the modern sense, tries to get rid of the uncertainty mentioned above and the law itself and everything that

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is legal, is defined as public interest (Saraç, 2002). In this study, first, explanations of corruption and fraud are brought to the necessity of the concept of public interest for both the private and public sectors. Then, in the context of the necessity of acting in the public interest for public institutions, explanations and evaluations regarding the phenomenon of corruption and fraud are given.

The Case of Corruption: The Necessity of Acting in Favour of Public Interest

In the literature, fraud and ignoring the principle of public interest lie at the root of corruption incidents. Corruption is a phenomenon dating back to ancient times (Tanzi, 1998: 559). With the definition adopted by the World Bank, corruption is expressed as the abuse of public power and resources of private interests (Tanzi, 1998: 564; Bardhan, 1997: 1321; Huntington, 2002: 254). The public administration glossary defines the phenomenon of corruption as fraudulent, improper, irregular work and behavior that occurs in violation of the rules, is not done properly. Again, in the literature, the concept of corruption in the legal and sociological sense is expressed as the fraudulent use of public duties, powers and resources contrary to the legal and social norms and standards that form the basis of social order (Uğur, 2012: 302-304). By linking the concept of corruption to fraudulent acts (Özbaran, 2003: 18), the Council of Europe Convention on Anti-Corruption Private Law defines bribery that directly or indirectly leads to deviations in the lawful performance of the duties or conduct of a person who obtains an illegal interest (cited in Yardimcioglu et al. 2014: 172).

In the accounting literature, the concept is explained on the basis of professional ethics and this requires a realistic presentation of the information provided by private or public enterprises. Although the concept of corruption refers to the use of personnel in public institutions in order to achieve specific results by violating the accepted norms, corruption is also observed in all societies but in every society in different ways than others. This situation arises when there is no effectiveness of political institution-alization. Especially in a society, as the differences between political development and modernization increase, it is possible to see various forms of corruption (Huntington, 2002: 254). However, although the explanations do not directly express corruption and similar activities in private sector enterprises, it is also known that regulations are made at the public level for events taking place in terms of private sector enterprises (Tanzi, 1998: 564).

In this context, it is possible to say that the necessity to act in the public interest constitutes the common point in the definition and the explanations about corruption. According to Shaub and Braun (2014: 5), the public interest approach is one of the most controversial parts of the accounting and auditing profession and the code of ethics. This controversial section may lead to the uncertainty of the concept in other areas of the literature. The International Federation of Accountants (IFAC - 2012) defines the public interest as follows:

“The net benefits derived for, and procedural rigor employed on behalf of, all society in relation to any action, decision or policy.”

As can be seen from this definition, the concept of public interest embodies a professional structure that produces good results for the general public in accounting. In particular, the four sources used by IFAC (2012) in developing the concept of public interest are important to explain the scope of this definition. The first source in the development of the concept is the meaning of the concept of public interest in the literature of politics, economy and psychology. The second source is the study of the studies emphasizing the relationship between public interest and accounting in the professional and academic literature,

and transforming the concept to include regulation, standard setting, market deficiencies, ethics, conflict of interest, corporate governance and accounting crises and scandals. The third source is the views of IFAC and other stakeholders regarding the concept, and the fourth is the examination of the concept in terms of IFAC's own regulations and objectives. The sources used in the definition of the concept are adopted in explaining the terms within the definition.

While the term of 'public' covers all internal and external users of the organization and the entire society; the term 'interest' includes the financial and non-financial information used in decision-making, all kinds of benefits that can increase the comparative presentation and efficiency. Again, IFAC sets two basic criteria for assessing public interest. The first is the evaluation of benefits and costs, the second is the evaluation of the process. The evaluation of the process is based on the criteria of transparency, accountability, independence, competence and professional care. IFAC's paper also describes the fact that the member of the profession stated in the announcement observes and applies the ethical rules while acting in the public interest (IESBA, Code of Ethics, 2018: Section 100.1). This leads us to another point that is as controversial as the understanding of the public interest, that is to serve the public interest. Proper action or service of the public interest is defined as an important means of combating corruption on the one hand, and on the other hand it requires consideration of the phenomenon of fraud, which represents an even higher concept for the public good.

The Case of Fraud: The Necessity to Act in Favor of Public Interest

Fraud refers to a crime on the basis of the phenomenon and means that one person makes a false statement to the other in order to gain a certain benefit (Singleton et al., 2006: 1) or that an intentional illegal action is taken in order to get more interest. In other words, fraud is defined as the intentional deception or misrepresentation of nonconformities and unlawful acts that a person knows is wrong or does not believe in the correctness (Emir, 2008: 112). Fraud is of great importance in terms of accounting system and financial reporting both in public and private sector organizations. This is because the existence of fraud reduces the possibility of a full assessment of the accounting system and leads to a direct misjudgement and even an ineffective use of resources to violate the concept of public interest. Whether the fraudulent application is large or small in amount does not change the damages or negative effects of the fraudulent case. Quantitative value does not reduce the negative effects of fraudulent transaction (Singleton et al., 2006: 3). What is important here is whether the process subject to fraud is done consciously. Therefore, the distinction of fraud from errors and inaccuracies must be made well and clearly for all organizations.

Fraudulent financial reporting, which is considered to be a direct relationship with fraud, refers to the preparation and presentation of financial statements in order to deceive all information users, particularly those of the society, the public, investors and fund institutions, by deliberately altering the information in the financial statements or eliminating actual evidence. At this point, fraudulent financial reporting occurs in cases where the top management of all organizations cannot bear the responsibility of providing accurate and reliable information during the preparation of financial statements, or prevents the financial reporting process from being honest and high quality, or the fraud cannot be detected or prevented during the audit process (Rezaee, 2002: 1-2).

In accordance with the explanations, fraudulent financial reporting can be said to be a criminal offense caused by the deliberate distortion of financial statements. Fraudulent financial reporting is the deliberate misrepresentation of users of financial statements by omitting or misrepresenting the amounts or disclosures required in the financial statements. Merchant (1987) also defines fraudulent financial

reporting as presenting by changing or altering financial documents, deleting records and eliminating information (Powell et al., 2005: 7).

In order for the fraudulent financial reporting process to be realized, the necessary elements must be defined. The theory developed by Donald R. Cressey in the late 1940s, the so-called “fraud triangle” reveals these elements in a well structured way. According to this theory; In order for fraudulent financial reporting to be potentially available, at least one of the three situations must exist. This approach, which constitutes the underlying theory of fraud risk factors, was dealt with according to Cressey’s theory in SAS No: 99, and the validity of all three situations in a fraud triangle was indicated in a trick. However, according to the approach in SAS No: 99, it is asserted that these three situations generally exist in fraud environments, but the presence of a single element in the fraud triangle is deemed sufficient for the fraud potential to occur (AICPA, SAS No: 99, Paragraph 7; Küçük, 2008 Skousen, 2004: 7; Wolfe and Hermanson, 2004: 38).

Fraud risk factors are classified according to the elements in the fraud triangle (Skousen, 2004: 6–12; 82). According to this approach (see Figure 1), the situations that exist in the environment where the fraud is committed are as follows (AICPA, SAS No: 99, paragraph 7, Küçük, 2008: 50-51):

- *Pressure (Incentives and Coercion): There are certain incentives and / or coercion elements such as profitability targeting, performance-based remuneration that motivate management or other employees to commit fraudulent behaviour.*
- *Opportunities: Some conditions, such as inadequate controls, inefficiency, or management’s ability to frustrate controls, provide some form of opportunity for fraud.*
- *Attitudes and Legitimation (Rationalization): Those who commit fraud can legitimize their fraudulent behaviour in accordance with their personal understanding of morality and try to excuse it. Some people’s moral understanding may allow them to behave intentionally and unintentionally. On the other hand, in situations where there is sufficient pressure, even those who do not expect such behaviour may be involved in fraudulent behaviour. The greater the incentive and pressure, the greater the chance that a person can legitimize the act of fraud.*

Figure 1. Fraud Triangle

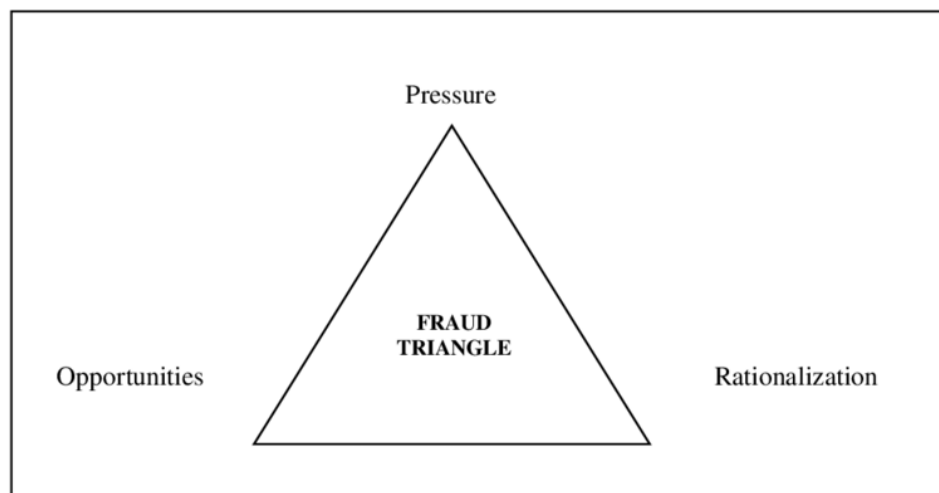
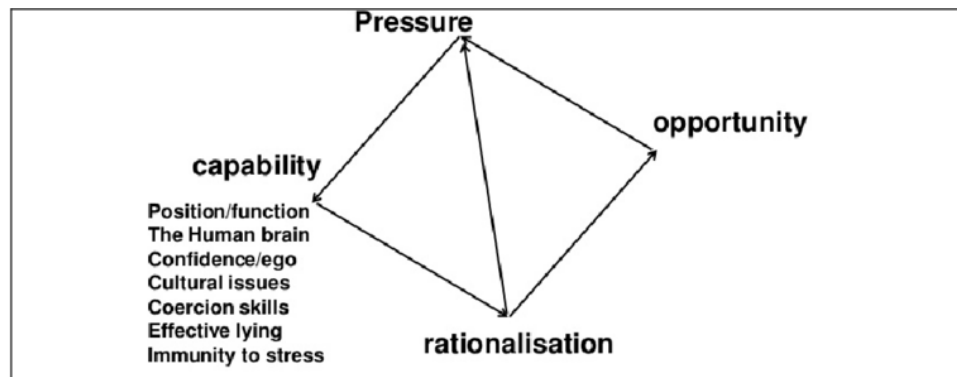


Figure 2. The Fraud Diamond



The fraud triangle and the fraudulent financial reporting environment have become more understandable for both the main actors such as businesses and auditors. However, in the following period, various contributions were made to this theory and a new theory was proposed under the name of cheating triangle. This theory is illustrated in Figure 2:

Wolfe and Hermanson (2004: 38-40) re-evaluated the elements related to fraud in their research. They found that besides the elements in the fraud triangle, the ability, capacity and capability of the individual played a major role in the detection of fraud. From this point, they have put forward the theory of *the fraud diamond*. Fraud diamond theory and elements of fraud; pressure, opportunities, rationalization and capability. Thus, it is seen that the ability or capacity of the individual is of great importance in detecting and preventing fraud.

In line with the explanations, it can be said that the incidence of fraud in both public and private sector organizations occurs with the presence of at least one of the dynamics mentioned above. In this context, the evaluation of the phenomenon of fraud for all institutions once again reveals the necessity of the concept of public interest. While the concept of public interest on the basis of the phenomenon of fraud includes all kinds of deliberate transactions that prevent the effective use or distribution of public resources for public institutions, the concept of public interest in private sector enterprises provides information misleading decision-making processes of all external information users and internal information users. it becomes a situation that needs to be evaluated in a wide range from unrealistic reporting. Thus, the oversight of the public interest for all stakeholders can be facilitated.

CONCLUSION AND DISCUSSION: CORRUPTION AND FRAUD IN THE PUBLIC SECTOR

The concepts of corruption and fraud, discussed in detail above, are difficult to define in the public sector but easy to recognize. Proof of these events is often not possible. It is generally seen that certain behaviors indicate corruption and fraud. However, the emergence of corruptions and their transfer to the judiciary generally necessitates the existence of a conflict of interest or the spread of unethical behaviors in the public sector. As can be seen here, corruption and fraud in the public sector; It is a phenomenon based on personal interest and dispersed by conflict of interest. According to many disciplines; corruption defined as attempting to maximize personal benefit; it is directly related to the lack of control of personal interests in the production process. (Turan, 2014). On the other hand, corruption can be described as a

kind of “public bad” that emits negative externality (Çelen, 2007). In a World Bank report, this conflict of interest, characterized by its negative externalities, described it as “abuse of public power for private interests (WB, 2014). The phenomenon of corruption involves the existence of the two sides and the exchange relationship between these two sides. In the face of an interest provided to the other party, those who hold the public power gain an interest. This interest can be on the one hand material values such as money or goods; and on the other hand, they may also be intangible values such as authority, position, prestige, and political interest.

As mentioned above, in cases of corruption and fraud in the public sector, a trade-off (or exchange) relationship between the two parties should be realized. In this exchange process one of the parties is authorized, which in most cases refers to the representative of the state authority, (usually the public official or the civil-servant). In this context, when we look at the definitions of non-compliance with the public interest or corruption and fraud in the literature, we see three common elements. These are (1) the existence of an authorized person or a public official, (2) the use of authority and behave against the rules and (3) the elements of gaining benefits. Some authors add the element of ‘secrecy or confidentiality’ to these elements (Özsemerci, 2002). However, the existence of these elements is constant in all cases of corruption. The first of these elements is authority. The concept of authority, without making any distinction between public and private sector, is expressed as the power of person or persons to use common authority or joint decision-making power (TEPAV, 2006). As it has already been mentioned the purpose of corruption is to gain interest and thus one of the parties to corruption will use these powers to gain benefits. In other words, the person or persons who are the side of corruption has the authority to serve their interests (Berkman, 1988: 10). Abuse of authority and acting out of authority is a combination of monopolistic power and discretion.

The second element of corruption and fraud in the public sector is the being against the rules. In a “rule of law” situation social life and the organization of the state are regulated by various rules. In the case of corruption, the public official’s misconduct these rules for material gain or special purposes arises. A part of these rules are the laws that are written and applied by the state. Corruption, regardless of which rules, whether written or unwritten, involves not following the order, deviating from the rules (Yavuziğit, 1996). In a such case irregularity or illegality brings corruption and corruption brings irregularity, which can be defined as a vicious circle. In other words, in the case of illegality corruption is not an exception. This does not undermine the irregularity principle of corruption. Because corruption is contrary to moral rules in all circumstances, even if it is done within the legal framework. For example; the behavior of a public official who ignores the shortcomings of an enterprise within the framework of the legal procedure, although not contrary to the law, is contrary to the code of ethics. Or, the application of the public officer who gives work- permission to an institution by falsifying documents is contrary to the written rules and illegal. This is subject to criminal sanction under the law. As can be seen, not only the dimension of non-compliance with the written rules (laws), but also the dimension of non-compliance with the unwritten rules (moral rules) is important in the non-compliance with the rules.

The abuse of authority in the process of corruption leads to a violation of the rules, ultimately gaining interest in these two elements, the third. An interest item with a material or moral value that will serve the interests of the public official and the decisions and procedures of the public official are required to be influenced. When corruption occurs, both parties gain in line with their own interests, and in some cases, the person making the corruption earns interest alone (Berkman, 1988). Whatever the kind, the aim is to gain interest. The interest can be material or spiritual.

In line with the explanations regarding the elements of corruption that has been illustrated above, the most reliable factor in determining the phenomenon of corruption is the “illegal use of authority”.

Since rules exist in social life and in the state organization, it should be considered as corruption that the state uses the authority of the public official in order to gain any benefit, which causes harm to the society or individuals. Accordingly, when the corruption cases investigated in Turkey, not in the form of applications to be against the law in cases of corruption; rather, mutual exchange of interests is observed through legal deviations. In other words, in cases of corruption, practices are often carried out in accordance with the law, but public authority is used in the hands of public officials/civil servants as a means to consciously benefit. This nature of corruption incidents makes it more difficult and complex to detect corruption and to find preventive remedies than unlawful actions and behavior. On the other hand, the efforts of the parties to increase their personal benefits are sometimes effective enough to make the appropriate legal arrangements, and sometimes the circulars and communiqués issued in areas where there are no legal regulations are deviated from their aims and they are tried to be ignored of the acts of corruption (Aktan 2001).

The literature draws attention to the existence of these three elements in almost all corruption and fraud procedures in the public sector. However, different reasons and sources of corruption can be put forward in the emergence of corruption in the public sector. For example, in addition to corruption caused by authority and persons in the public sector, corruption caused by the system also plays an important role. Corruption arising from the system can be explained under two aspects: direct and indirect. Direct factors are those that arise from the existence of the state. In this regard while public expenditures, investment decisions, taxation, procurement of goods and services and presentations directly affect the system; bureaucratic structure, wage levels, attitudes of managers and leaders, control and transparency can be shown as indirect factors (Kutlar, 2015).

In a general perspective, it is possible to classify the different causes of corruption under administrative, political, historical and social-economic sections (Ruslan, 2016). Historical and socio-economic reasons are directly related to the habits of a society both in determining how the concept of public interest will be shaped and in determining which kinds of habits are fraud and corruption. Administrative corruptions include matters related to the actions and procedures of the administration which cannot be defined as a tradition or habit. This kind of corruption occurs in the implementation of state policies and the execution of public services. Therefore, there is always a public official or a public body in administrative corruptions (Özsemerci, 2002: 15).

The main factors in the emergence of administrative corruption are the roles of states and their interventions in social and economic life. Although the functions of current states are regulated within the framework of certain rules, they are obliged to perform certain tasks and services. Activities in areas where the state is responsible are highly susceptible to corruption. For instance, government licenses, documents, permits and tenders for the provision of services are some of the most “attractive areas” for corruption. Another factor that causes administrative corruption is the fact that the authority is left to the civil servants in the use of estate and asset property that may have monetary value (TEPAV, 2006). Another important reason for the occurrence of administrative corruption is bureaucracy. The biggest factors in the formation of bureaucracy are people and the social environment/sphere. These factors play a role in shaping the bureaucratic structure while forming the administrative structure. The quality of the bureaucratic structure, the way it works, has its own characteristics in every country. The quality level of bureaucracy alleviates the effects of political instability, maintains the continuity of government, while complex bureaucracy slows down state levels and increase the possibility of fraud and corruption (Ruslan, 2016).

Another negative factor that triggers administrative corruption in parallel with the bureaucracy is centralization in which central governments have a strong control mechanism on the local governments.

Thus, in these structures, the central government has authority and this brings the monopoly of the center. Therefore in the strongly centralized and hierarchical countries like Turkey, the negativity of highly centralized government may cause disruption and distortion. It is inevitable that there are distortions in such administrative structures and in politics, which are the means of using the administrative power. Under the influence of bureaucracy and centralism, the lack of flexibility, complex and rigid structure of public administration allows corruption in the state levels (TEPAV, 2006).

The negativity in the political field does not only lead to deterioration of the citizen relations with the state, but also minimizes the trust in the state. Deficiencies in public services push those who want to access these services in unlawful ways, and there are cases of corruption where non-legal situations (such as favoritism, nepotism, cronyism, political favoritism, patronage) can be seen. In this case, the state and the citizen, which should form a whole, break with each other and the awareness of “public interest” is completely damaged. Consequently, the social, economic and democratic causes of corruption should not be ignored. Corruption tendencies are higher in less developed and developing countries where the culture of democracy is not fully established (Gray and Kaufman, 1998). Another problem of underdeveloped countries, unplanned population growth, disrupts the distribution of resources and increases the demand for the service sector. The unfair distribution of resources and the quality of monetary policy can also lead to increased corruption in the sharing of public services (Goel and Nelson, 2005). Inequalities and unrest arising from public policies begin to affect society negatively. The people who have lost ties with the state look for solutions in interest groups and illegal ways, which leads to the disappearance of public interest awareness and individual interests in society (Gray and Kaufman, 1998).

In short, the concept and awareness of public interest is an important fact that should be taken into consideration by almost every sector producing and receiving public services in society. The most important factor in the development of this phenomenon firstly in individuals and then in public institutions can be expressed by social, political and economic values. In Turkey, especially when viewed in the bureaucratic structure seen in almost every period in the public sector politicization, nepotism and cronyism processes are prepare for corruption and fraud transactions in public areas. On the one hand, patronage in the bureaucratic processes, authoritarian and over-centralized state structures, and the lack of sufficient public interest awareness in management levels, unemployment and low quality living conditions caused by rapid population growth and distorted urbanization created an environment suitable for the disappearance of public interest awareness and corruption. On the other hand, unqualified public policies and the sharing process of state-generated rent were another source of corruption and fraudulent transactions in the public sector (Özsemerci, 2002).

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Technical Efficiency Through Innovative Methods and Estimations in Financial Markets

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INTRODUCTION

In stochastic frontier model analysis, it is acknowledged that the estimation of production functions must respect the fact that actual production cannot exceed maximum possible production given input quantities. Consequently, one of the main questions is to investigate the relationship between inefficiency and a number of factors which are likely to be determinants and measure the extent to which they contribute to the presence of inefficiency. Overall, these determining factors characterize the process of technological change. Stochastic frontier models assume that producers operate under the same production technology and that the inefficiency distribution across individuals and time are homogeneous. Estimation of technical efficiency has been the subject of research in many empirical studies on industrial productivity, contributing to the theoretical development and empirical application of SFA at both the firm and industry levels, with the purpose of screening out the external effects and statistical noise from the producer's performance and achieving a more accurate efficiency measure (Wang, 2000). Following these fundamental approaches, there has been a rapid increase in the volume of research on analysis of efficiency in production, both in theoretical and empirical research. Most of the literature focused mainly on stochastic frontier model with distributional assumptions by which efficiency effects can be separated from stochastic element in the model and for this reason a distributional assumption has to be made. Unobservable individual effects also play an important role in the estimation of panel stochastic frontier models. In contrast to the conventional panel data literature, however, studies using stochastic frontier models often interpret individual effects as inefficiency (Schmidt and Sickles, 1984), such as technical inefficiency in a stochastic production frontier model.

This chapter focuses on reviewing the stochastic frontier analysis literature regarding estimating inefficiency in financial markets level, as well as explaining producer heterogeneity along with the relationships with productive efficiency level. The chapter begins with a general overview of the main research papers on estimating productive efficiency in financial markets, both in aggregate and disaggregate level, providing the main hypotheses and results of each case. Then, the chapter continues with explaining producer heterogeneity, as well as the main determining factors towards efficiency differentiations.

A question of interest is whether inefficiency occurs randomly across producers, or whether some producers have predictably higher levels of inefficiency than others. If the occurrence of inefficiency is not totally random, then it should be possible to identify factors that contribute to the existence of inefficiency (Reifschneider and Stevenson, 1991). The important task is to relate inefficiency to a number of factors that are likely to be determinants and measure the extent to which they contribute to the presence of inefficiency. Following these fundamental approaches, there has been a rapid increase in the volume

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of research on analysis of efficiency in production, both in theoretical and empirical research (Cowan and Salotti, 2015 and Iftekhar and Soula, 2017).

This chapter investigates technical efficiency estimation in financial markets, using both parametric and non-parametric techniques: parametric Stochastic Frontier Analysis (SFA) approach or non-parametric Data Envelopment Analysis (DEA). Contrary to the Stochastic Frontier Analysis approach (SFA), which requires a functional form to estimate the frontier production function and is based on the idea that the data is contaminated with measurement errors and noise (Bauer, 1990), Data Envelopment Analysis (DEA) approach uses linear programming techniques and cannot discriminate between inefficiency and noise. Thus, it tends to produce overestimated inefficiency measures, a fact which is the most important disadvantage of DEA in comparison to SFA (Bauer, 1990). This chapter proposes a slack-based DEA which allows a full evaluation of inefficiency in an industry's performance. The model estimated in this chapter is a DEA variant called slack-based measure, which is able to deal directly with the input excesses and the output shortfalls of the industry under evaluation (Tone, 2001). Estimated slacks are invariant to the units of measurement and are monotone decreasing with respect to each input and output slack. By using slack-based efficiency measure, we obtain different frontier levels and more appropriate performance benchmarks for inefficient industries. The production assumptions in DEA are that all actual observed inputs and outputs of any industries are feasible for all industries, as are linear combinations of observed inputs and outputs.

More specifically, this chapter focuses on reviewing the stochastic frontier analysis literature regarding estimating inefficiency at industrial level, as well as explaining producer heterogeneity along with the relationships with productive efficiency level. The chapter begins with a general overview of the main research papers on estimating productive efficiency in different industries, providing the main hypotheses and results of each case. Then, the chapter continues with explaining producer heterogeneity, as well as the main deterring factors.

This approach suggests the great importance of the interaction between the different determining factors and estimate any implication for efficiency. Over all, the major contribution of this approach is that it provides a better understanding of the contribution of technical efficiency taking into account major interrelationships and complementarities. The purpose is to study financial industries experience in an effort to determine the potential efficiency determining factors and to investigate various aspects of the relationship between efficiency and determining factors in an attempt to reach a better understanding of the contribution of alternative factors to efficiency growth.

This is of value for practitioners, policy makers and the academic community:

1. For industries, in order to make recommendations to firms on identifying, developing and deploying their resources that may influence their technical efficiency, competitiveness and consequently their performance.
2. For policy makers, the value stems for a better identification and understanding of the key resources. This will allow government entities to formulate and implement programs, which will leverage areas of industries, which require further development.
3. Last but not least, the value for the academic community mainly lies on an increased knowledge about the impacts of different determining factors on efficiency estimation.

BACKGROUND

1

One of the most important hypotheses in modern economic theory is based on the assumption of optimizing behavior, both from a technical and economic perspective.

However, not all behaviors succeed in solving optimization problems under all circumstances. In real economic life, it is unlikely that all (or possibly any) behaviors operate at the full efficiency frontier, with failure to attain the efficiency frontier implying the existence of technical inefficiency.

More specifically, a measure of evaluating the performance at producer level is technical efficiency through production frontier, a concept which compares the transformation process of converting input into output. If the occurrence of inefficiency is not totally random, then it should be possible to identify factors that contribute to its existence. In this case, estimating these efficiency measures involves estimating the unknown production frontier: the current state of technology in the industry, representing the maximum output attainable from each input level is called the efficiency frontier.

For these reasons, it is important to analyze the degree to which producers fail to optimize and the extent of any resulting distances from the frontier of full technical efficiency, mainly due to the following reasons:

1. First, only by measuring efficiency, and by separating the associated effects from those of the operating environment, it is possible to explore hypotheses concerning the sources of efficiency, essential to improve performance.
2. Second, efficiency measures are success indicators by which producers are evaluated and the ability to quantify efficiency provides a control mechanism with which to monitor the performance of a production unit.
3. In addition, if policy and planning is to concern itself with the performance of a particular economic unit, it is important to know to what level a given producer may be expected to increase output by simply increasing efficiency, without absorbing any further resources.

Better understanding of the process of generating efficiency requires studying the deeper determinants and factors which explain the differences in efficiency growth.

In response to this most important research issue, and with the increase in data availability, economic literature has shown a resurgence of interest in testing and quantifying various theories of explaining efficiency growth and examining the corresponding relationships has attracted a lot of interest with the main research questions arising could be summarized into:

1. What are the reasons for diverging efficiency?
2. Which factors contribute to efficiency differences?
3. How the efficiency evolves over time, with respect to technical progress and other related determining factors?

This chapter focuses on financial markets, the role of which to the economy is even more important, taking into consideration the slowdown in the world economy, and the effects on the business environment created by the financial crisis. Thus, medium and high technology financial markets have a very important role in creating opportunities making an important contribution to economic growth and development. Nonetheless, financial markets have shortages of different types of resources necessary to develop and implement their strategies. These shortages may include financial, marketing, technological

and managerial resources, or skilled personnel. Overcoming those shortages and increasing technical efficiency has become critical for their long term survival and profitability.

However, due to their nature, these markets are characterized by being very heterogeneous since they differ in their endowments of resources as well as on the risks involved in their productive activities. For this reason, it is of great importance, on the one hand to analyze their efficiency level and potential, and on the other hand, to analyze the factors which determine their efficiency potential. This analysis is the main aim of this chapter, which focuses on the most current innovative methods on estimation of technical efficiency. Thus, this chapter is expected to provide meaningful insights into the level of industry-specific technical efficiency along with factors determining and affecting efficiency. The core aim of this chapter is to understand and evaluate the impact of technical efficiency on productivity and growth and combine the theory (theoretical background) and the empirical applications.

The scope of the suggested chapter is to analyze the process of technical efficiency, plotting both the related present and future trends and developments. Most importantly, this chapter aims to fill the gap in literature regarding the subjects of technical efficiency with respect to the impact of stochastic frontier analysis and data envelopment analysis, two of the most modern and challenging theoretical and empirical approaches. Furthermore, the chapter intends to provide a broad understanding of the current issues and problems of technical efficiency, investigating a great span of aspects and consequences of technical efficiency that are obscure or as yet unexplored. In particular, with its wide range of topics, methodologies and perspectives, the chapter offers stimulating and wide-ranging analyses that will be of interest to students, economic theorists, empirical social scientists, policy makers, as well as the informed general reader.

FOCUS OF THE ARTICLE

In the modern knowledge economy, growth depends extensively on the presence or the formation of a network and environment favorable to innovation, which is based on the endogenous development capabilities. Even though the producer-specific factors are important determinants of innovation activity, technological opportunities and favorable entrepreneurial environment have a positive effect on innovation activity, as well. Technological change, innovation and technology creation and diffusion are an important factor to economic progress.

Combining the production functions in order to create and disseminate innovations leads to improvements in productivity and efficiency. However, at a given moment of time, when technology and production environment are essentially the same, producers may exhibit different productivity levels due to differences in their production efficiency. Within growth process, therefore, efficiency of production resources becomes a critical element in growth, through utilizing the available, yet scarce, resources more productively. Within this framework, productivity represents the estimation of how well a producer uses the available resources to produce outputs from inputs. However, the productivity theory literature has emphasized factors such as productive efficiency, mainly through technological spillovers, increasing returns, learning by doing, and unobserved inputs (e.g. human capital quality), whereas the empirical industrial organization literature has emphasized the degree of openness of countries to imports and industry structure (Koop, 2001).

There is a huge literature on factors influencing productive efficiency and productivity growth. In this literature, it is widely accepted that decision making units are not homogeneous producing units and, therefore, not all units are operating at the same level of efficiency (Caves, 1989).

Bos et al. (2010) investigate the sources of output growth for a panel of manufacturing industries. They propose a flexible model beyond the division of output growth applied in the conventional growth accounting and cross-country growth regression literature, as well as the strong assumptions they typically rely upon (efficient use of resources, constant returns to scale). Bos et al. (2010) focus on the use of technology, the sources of output growth, technology spillovers and catch-up, as well as policy implications. To decrease the aggregation bias that may occur when these issues are considered at the country-level (Bernard and Jones, 1996 a,b), Bos et al. (2010) focus on manufacturing industries. Traditionally, the growth accounting literature has referred to the unexplained part of output growth as the 'productivity residual' or 'technical change'. This interpretation, however, depends, among other things, on the strong assumption that economic units (countries or industries) are always efficient. In reality, however, economic units may well use the best-practice (frontier) technology with varying degrees of efficiency. If this is the case, part of what is measured as technical change is in fact an improved use of the best-practice technology. Put differently, inefficient industries increase output by becoming more efficient in the use of the best-practice technology, whereas efficient industries increase output through technical change. In addition, not controlling for possible inefficient use of inputs may also result in underestimating the productivity of outputs for the best-practice technology. Bos et al. (2010) account for inefficiency and estimate a stochastic production frontier, which is the empirical analog of the theoretical production possibility frontier. This modelling strategy adds structure to the unexplained residual. Under reasonable assumptions, it disentangles the residual into inefficiency and measurement error. Technical change is modelled as a shift of the stochastic frontier, whereas efficiency change is a movement towards or away from the frontier. This framework decomposes output changes into three types of change: technical, efficiency and input change. Empirical literature carries out efficiency analyses along lines similar to Bos et al. (2010), although using different modelling approaches, considering that output change is also decomposed into technical, efficiency, and input change. Even though the attention has largely been at decomposing aggregate (country-level) output, a number of studies have investigated the role of efficiency in explaining growth differentials for a panel of manufacturing industries in the OECD countries (Bos et al., 2010).

As a management tool, stochastic frontier analysis focuses on the variables which are under the decision-makers' control. However, efficiency may be influenced by factors beyond the control of the managers. In stochastic frontier model analysis it is acknowledged that the estimation of production functions must respect the fact that actual production cannot exceed maximum possible production given input quantities.

In stochastic frontier models, output is assumed to be bounded from above by a stochastic production function. In this case, each producer faces a production frontier which is randomly due to stochastic shocks outside the producer's control. Moreover, this method enables to distinguish between shifts in determining factors from movements towards the best-practice frontier. On the other hand, frontier approaches provide a technology frontier constructed by the best-performing producers of the industry. The performance of all producers is then compared against that frontier, which enables the analyst to evaluate each producer's behavior. A frontier function represents a best-practice technology, against which the efficiency of the producers within the industry can be measured (Coelli, 1995). If a producer belongs to the frontier, it is efficient. If a producer is beneath the efficiency frontier, then it is inefficient and further analysis identifies the sources and extent of the inefficiency. There are different alternative methods, in order to estimate this frontier function, as well as to estimate any deviations from it. Literature distinguishes between parametric and nonparametric efficiency measurement and considers the characteristics of each method. Parametric estimation concepts involve strong assumptions about the

functional forms describing the production process or the distribution functions of the stochastic part in the model. Nonparametric approaches assume no parametric restrictions for any features of the probability model and the frontier is not described by a specific analytical function (Acharya and Naqvi, 2012).

Consequently, one of the main questions is to investigate the relationship between inefficiency and a number of factors which are likely to be determinants, and measure the extent to which they contribute to the presence of inefficiency. These factors are neither inputs to the production process nor outputs of it but nonetheless exert an influence on producer performance. Such factors are widely referred to as efficiency explanatory variables.

In this context, the term 'efficiency explanatory variables' is used to describe factors that could influence the efficiency of a producer, where such factors are not traditional inputs and are not under the control of the producer (Fried et al., 1999). However, they may influence productive efficiency. In particular, in order to investigate the determinants of the productive efficiency we distinguish between producers or industry -specific and efficiency explanatory factors (Caves and Barton, 1990).

Efficiency explanatory factors are not under direct control of the producer, at least in the short-run, and they may be industry-affiliated, such as producer location characteristics, managerial restrictions, slow adoption to changes of the market environment and/or to technological developments, or asymmetric information in the labour market, social aspects, geographical or climatic conditions, as well as regulatory and institutional constraints, ownership differences (public/private), and government regulations (Coelli et al, 1998, Stephan et al. 2008). Producer-specific factors, on the other hand, refer to characteristics that can be influenced by the producer in the short-run, as producer size, R&D intensity and degree of outsourcing.

This section connects the discussion of theory in the thesis to the empirics. The empirical analysis focuses on productive efficiency of industries and national economies. In line with the empirical framework based on stochastic frontier analyses (SFA) and data envelopment analyses (DEA), productivity is decomposed into the production possibility frontier and technical (in) efficiency. For this reason, the discussion on theory clearly indicates what should determine the frontier and what affects efficiency.

The empirical methods of frontier and non-frontier production functions were primarily developed to be used for analyses of efficiency mainly across different producers, and not across industries and countries using aggregate data. Such an aggregation across industries and countries may create significant problems because of heterogeneity within the industry or the country. For example, while the production technology can perhaps be assumed to be similar within a given industry, this is not the case when data for different regions, and particularly industries, are pooled. What it is important is to acknowledge the potential problems which it generates and attempt to address these through the empirical methods and framework. Recent contributions include Eberhardt and Teal (2011) and Oh (2012), who demonstrate the serious implications of such aggregation for estimation both of the frontier and efficiency. Empirical estimation should take into consideration that there is likely to be some form of aggregation bias. As also becomes apparent from the analysis by Oh (2012), if SFA approach is used for the same industries and countries, but in one case aggregate industry-level data is used, and in another firm-level data is used, the results will be different. This is meant to show the impacts of aggregation bias, on the basis, that firm-level data adds up to the industry-level but smooths out firm-level heterogeneity (Ferreira and Souza, 2015 and Rahim, et al, 2013).

Stochastic frontier studies often employ aggregate data to analyse the productivity and technical efficiency of regions. According to Oh (2012), a stochastic frontier model is run on plant-level data and region-level aggregate data. Comparisons of estimated coefficients and characteristics of regional produc-

tion based on estimation outcomes suggest that an empirical model employing regional-level data can provide misleading results concerning the production function faced by a representative plant in a region.

Measurements of inefficiency in financial markets were first constructed by estimating deterministic frontiers and subsequently by using stochastic frontiers. Aigner and Chu (1968) were the first researchers to estimate a deterministic frontier using Cobb-Douglas production function through linear and quadratic programming techniques. They argued that for a given industry producers might differ from each other in their production processes (Covitz et al, 2013 and (Dharmendra and Fida, 2015).

The distinguishing features among producers could be represented by:

1. attained values for certain technical parameters in an industry production function,
2. differences in scales of operation, and
3. various structures in their organization

As far as the research implementing technical efficiency analysis is concerned, there is a great number of papers examining technical efficiency through stochastic Frontier Approach or Data Envelopment Analysis. Camanho and Dyson (2005) enhanced cost efficiency measurement methods to account for different scenarios relating to input price information in banking industry. These consist of situations where prices are known exactly at each decision making unit (DMU) and situations with incomplete price information. The assessments under price uncertainty are based on extensions to the Data Envelopment Analysis (DEA) model that incorporate weight restrictions of the form of input cone assurance regions. Huang and Wang (2002) estimated economic efficiency and economies of scale, using panel data of 22 Taiwanese commercial banks over the period 1982-97, employing a wide range of parametric and non-parametric cost frontiers' efficiency estimation methods to estimate economic efficiency and economies of scale, using the same panel data of 22 Taiwanese commercial banks over the period 1982-97. According to their empirical implementation, the two methodologies yield similar average efficiency estimates, yet they come to very dissimilar results pertaining to the efficiency rankings, the stability of measured efficiency over time, the consistency between frontier efficiency and conventional performance measures, and the estimates of scale economies. Thus, the choice of an estimation approach can result in very different conclusions and policy implications regarding cost efficiencies and cost economies. These findings suggest that making policy decisions and evaluations relies on multiple techniques and specifications (Apergis, 2014 and Berger and Bouwman, 2016).

Silva Portela and Thanassoulis (2005) using parametric and non-parametric methods, have been focusing mainly on profit efficiency and to identify the sources of any shortfall in profitability (technical and/or allocative inefficiency). The method is applied to a set of Portuguese bank branches first assuming long run and then a short run profit maximisation objective. In the long run most of the scope for profit improvement of bank branches is by becoming more allocatively efficient. In the short run most of profit gain can be realized through higher technical efficiency. Wheelock and Wilson (2000) use alternative measures of productive efficiency to proxy management quality in individual U.S. banks, and find that inefficiency increases the risk of failure while reducing the probability of a bank's being acquired. Becchetti and Sierra (2003) investigated the determinants of bankruptcy in three representative unbalanced samples of Italian firms for the periods 1989-91, 1992-94 and 1995-97. Two important results are that: (i) the degree of relative firm inefficiency measured as the distance from the efficient frontier has significant explanatory power in predicting bankruptcy (ii) qualitative regressors such as customers' concentration and strength and proximity of competitors have significant predictive power.

In order to promote innovation activities and technological opportunities entrepreneurship enhancement seems to have a significant importance not only to business success, but also to the long run performance of the economy as a whole. Under this perspective, growth policies should focus on creating favorable environment for the co-operation between banks and institutions that support the development and exploitation of knowledge and innovation.

Furthermore, policies should promote the entrepreneurial relations between firms and institutions, fostering the development and dissemination of the expertise, the mobility of human and physical capital and the enhancement of the relationships between business and research entities. Specifically, they should encourage actions such as, promoting innovation, technology transfer and interactions between firms and higher education and research institutes, networking and industrial co-operation and support for research and technology supply infrastructure.

As it has already been mentioned, innovation and technology is an important source of regional competitiveness through facilitating cooperation between the various parties involved in both the public and private sectors. In particular, they can improve collective processes of learning and the creation, transfer and diffusion of knowledge and transfer, which are critical for innovation. Such cooperation and the networks that are formed help to translate knowledge into economic opportunity, while at the same time building the relationships between people and organizations which can act as a catalyst for innovation. Such actions should extend to all the policy areas relevant for economic, scientific and social development and should ideally establish a long-term policy horizon. This, however, needs to happen not just in central parts where productivity and employment are highest and innovative capacity most developed but throughout the Union. Countries and regions need assistance in overcoming their structural deficiencies and in developing their comparative advantages. This means, among others, that encouraging the development of knowledge-based economic activities and innovation and that particular attention needs to be given to:

1. developing new innovation promotion policies which focus much more on the provision of collective business and technology services to groups of firms which can affect their innovative behaviour, rather than direct grants to individual firms which tend only to reduce costs temporarily.
2. developing new policies to strengthen the capacity of SMEs to innovate through business networks and clusters and improving their links with the knowledge base, including with universities and research centres.
3. encouraging the development of the indigenous R&D potential of weaker regions and their capacity to adapt technological advances made elsewhere to local circumstances and needs.
4. facilitating access of researchers, businesses and others in less favoured regions to international networks of excellence, sources of new technology and potential R&D partners.

These conditions are largely related to economic competitiveness and include, among others, the capacity of a regional economy to generate, diffuse and utilize knowledge and so maintain an effective regional innovation system. Furthermore, policies should promote the entrepreneurial relations between firms and institutions, fostering the development and dissemination of the expertise, the mobility of human and physical capital and the enhancement of the relationships between business and research entities. Specifically, they should encourage actions such as, promoting innovation, technology transfer and interactions between firms and higher education and research institutes, networking and industrial co-operation and support for research and technology supply infrastructure. Such cooperation and the networks that are formed help to translate knowledge into economic opportunity, while at the same time

building the relationships between people and organizations which can act as a catalyst for innovation. Such actions should extend to all the policy areas relevant for economic, scientific and social development and should ideally establish a long-term policy horizon.

Under this perspective, growth policies should focus on creating favorable environment for the co-operation between firms and institutions that support the development and exploitation of knowledge and innovation. Furthermore, policies should promote the entrepreneurial relations between firms and institutions, fostering the development and dissemination of the expertise, the mobility of human and physical capital and the enhancement of the relationships between business and research entities. Specifically, they should encourage actions such as, promoting innovation, technology transfer and interactions between firms and higher education and research institutes, networking and industrial co-operation and support for research and technology supply infrastructure. These conditions are largely related to economic competitiveness and include, among others, the capacity of a regional economy to generate, diffuse and utilize knowledge and so maintain an effective regional innovation system, contributing into a sustainable economic growth path.

However, the main concern of an industry or country in its innovation policy should be to have the optimal combination of business activities in various stages of the innovation cycle. Countries, industries, or firms concerned primarily with activities of the innovation takeoff stage may find themselves lacking sufficient economic resources to exploit these activities through improvement-related innovations. Countries, industries, or firms dominated by activities of the maturation stage, such as limitation and improvement of given technologies, incremental innovation, diversification of products, exploitation of scale economy, extension of vertical integration, and automation of production processes, will lose their advantage with respect to dynamic efficiency and experience stagnation (Haustein, et al., 1981). Without knowing the needs of and possibilities offered by the economic environment, one cannot understand the mechanism of technological change towards productivity enhancement. A crucial task to improve innovation policy at the national and industrial levels is to provide information about fields of innovation, which are dependent on factors which fall into three categories:

1. Urgency of demand for the innovation
2. Existence of scientific and technological advancements
3. Existence of a socio-economic environment which allows productive efficiency enhancement through scientific and technological feasibilities

Successful producers will probably be those able to respond effectively in these fields. Once the right direction is chosen, success depends on managing the factors that influence innovative activities towards efficiency enhancement.

SOLUTIONS AND RECOMMENDATIONS

Nowadays, the role of manufacturing industries to the economy is even more important taking into consideration the slowdown in the world economy, and the effects on the business environment created by the financial crisis. Thus, manufacturing industries have a very important role in creating opportunities making an important contribution to economic growth and development. However, due to their nature, manufacturing industries are characterized by being very heterogeneous since they differ in their endowments of resources as well as on the risks involved in their productive activities. For this reason, it is

of great importance, on the one hand to analyze their efficiency level and potential, and in addition, to analyze the factors which determine their efficiency potential. Thus, this thesis provided insights into the level of industry-specific technical efficiency along with factors affecting inefficiency, focusing on manufacturing industries and seeks to obtain the empirical results by specifying the translog functional form and the model for the technical inefficiency effects in the stochastic frontiers.

The key factors influencing the competitiveness of the EU manufacturing industry are access to innovation, R&D and international trade. The main recommendations revolve around three key areas innovation and research and strengthening networks and clusters; responsible use of natural resources; and the need for open world markets with fair competition. Clustering, collaboration and the formation of strategic alliances are becoming increasingly important. Continuous R&D and innovation efforts are essential elements into guaranteeing the long-term competitiveness of Europe's manufacturing industries. European research, technical development and innovation policies should focus on developing the framework conditions that stimulate innovation, entrepreneurship and, thus, growth and employment. Innovation for sustainable manufacturing requires paying attention to the interfaces between R&D policies with other critical policy fields. Strong emphasis needs to be placed upon the management of the interfaces between R&D policy and other policy realms competition policy, intellectual property rights, standardization, education and training, environmental policy, labour market, employment and social policy, to facilitate the creation of a sustainable European manufacturing industry environment, along with fiscal instruments and incentives. Understanding future challenges and issues is important on future developments in manufacturing. Industrial change driven by new technological opportunities will impact on the manufacturing structures in European Union. contribute to sustainable growth and improve technical efficiency.

Finally, technical progress is another major determinant as new technologies allow the automation of production processes that have led to many new and improved products. allow for better and closer links between firms. and can help improve information flows and organization of production. At the same time, technical progress can be embodied in new equipment and trained workers can only be fully productive if they have the appropriate equipment with which to work. Increases in physical capital are clearly necessary as there are spillovers from capital investment to productivity growth. Thus it is not appropriate to consider physical capital, human capital and technology as separate factors since their contributions are closely linked. It is the combination of these three factors and the way in which they are organized and managed within the industry that will determine the extent of productivity growth. For sustained output growth, it is also important that a balance between the three main factors be maintained.

The potential for technical efficiency enhancement is considered to a large extent to depend on the EU's capability to transform the economy towards one that makes more productive use of its resources. Much will depend on the capacity of markets to facilitate the reallocation of resources to industries that show rapid productivity growth. However, it is difficult to predict which industries will be the most productive in the future, as technology and innovation trends are inherently difficult to forecast. For now, a productive use of a larger input from skilled employment and the exploitation of ICT investments in manufacturing industries appear the most successful policy avenues for a European productivity revival.

Promoting technical and productive efficiency into the European Union has resulted in a growing challenge for policymakers. Productive and regional disparities and inequalities are an increasing issue for the European Union to consolidate, as a result policy makers have to adapt the policy agenda considering industrial and innovation policy in order to enhance technical and productive efficiency capabilities.

Moreover, efficiency and policy planning is a major matter which due to the wide interpretations and implications should have a clear mix of principles and priorities, mainly focusing on the effectiveness

of the related EU policies. EU industrial and innovation policy should aim to bridging the technical efficiency gaps, both in industrial and country level, benefiting for economic cohesion, allowing members states with a backwards economy or backwards industries to modernise and thus compete in European and international markets, promoting convergence, competitiveness and cooperation. Infrastructure, innovation and investments should be among the main goals.

FUTURE RESEARCH DIRECTIONS

As it has been asserted above, globalization and worldwide competition has shifted the comparative advantage of corporations and economies towards the factor of knowledge and innovation, where entrepreneurship based on the technical efficiency enhancement plays a rather important role, as far as the growth, productivity and competitiveness enhancement are concerned. In order to promote innovation activities and technological opportunities entrepreneurship enhancement seems to have a significant importance not only to business success, but also to the long run performance of the economy as a whole. Under this perspective, growth policies should focus on creating favorable environment for the co-operation between firms and institutions that support the development and exploitation of knowledge and innovation and technical efficiency. Furthermore, policies should promote the entrepreneurial relations between firms and institutions, fostering the development and dissemination of the expertise, the mobility of human and physical capital and the enhancement of the relationships between business and research entities. Specifically, they should encourage actions such as, promoting innovation, technology transfer and interactions between firms and higher education and research institutes, networking and industrial co-operation and support for research and technology supply infrastructure.

Regarding further research, special focus should be put on the appreciation of the ways in which organizations, industries and industries change and adapt in the presence of new opportunities and constraints. Accordingly, future research could study how changing configurations of the knowledge based economy combined with the emergence and adaptation of institutional structures in an technology-intensive industry like manufacturing industries, especially these of high technology and high value added. In particular, a dual evolutionary research could be undertaken regarding the growth in ICT investment in the industry and the emergence of knowledge communication across countries. In doing so, it highlights the coordinating role of ICT technologies and economy openness in enabling the innovative potential opened up by new technologies and innovation activities.

CONCLUSION

After the US subprime crisis, the first signs of a sovereign debt crisis spread among European financial players. The regulation of the markets by European Commission and European Central Bank created limitation to obtained great amount of liquidity in commercial banking sector. In this context, the successful survival of some European banks became in a dangerous situation.

For this reason, financial researchers had dedicated a large effort to discover the factors that explain differences in the enterprises' financial performance during several years. Around the world stock markets have fallen, large financial institutions have collapsed or been bought out, and governments in even the wealthiest nations have had to come up with rescue packages to bail out their financial systems. In this context, all agents focus their attention on productivity and efficiency gains since both are central to the

growth of firms in any industry. For this matter, inefficiency can be due to structural problems or market imperfections or even other factors, resulting in firms producing below their maximum attainable output.

Efforts to measure how efficiently a firm (a Decision Maker Unit, known as DMU in literature) produces outputs with its inputs have led to the development of a number of efficiency concepts, including scale efficiency, scope efficiency, economic efficiency, and technical efficiency (Ferreira and Souza, 2015)

This chapter aims to investigate the degree of technical efficiencies in financial sector, by using the data envelopment analysis (DEA) and stochastic frontier approach (SFA). The results related to returns-to-scale emphasize that decreasing returns-to-scale is the major form of scale inefficiency. The estimated efficiency scores could be further regressed (e.g. using Tobit model) on a set of explanatory variables, i.e. size, profitability, capital adequacy and liquidity.

Financial sector plays an important role in the growth and stability of an economy. It helps in channelizing the household savings to corporate and industries where it is optimally used for the development of the country. Therefore, financial institutions work as an intermediary and if this financial intermediation is efficient it is going to add value to economy as a whole. Thus, the performance of the financial system is important and is a point of concern for all the stakeholders. The performance measurement is of prime importance for all the economies. Performance of financial sector can be measured either by using financial ratios or by measuring its efficiency. Efficiency is defined as ratio of output and input of the firm. Proper and efficient utilization of resources or inputs to get desired quantity and quality of output is always expected by the management.

As compared to past, today financial industry is facing a tough competition and the probability of bankruptcy is also high as the financial markets across the world are integrated. Because of integration, risk in one part of the world is easily transmitted to rest of the countries. In this uncertain scenario, it is essential to measure the technical efficiency of the sector. The present study is an attempt to quantify the degree of overall technical efficiency and detect the source of inefficiencies either in management or in handling resources used to run an organization. The measure of scale efficiency provides the ability of the management to choose the optimum size of bank or, to choose the scale of production (Dharmendra and Bashir, 2015).

As it has already been mentioned, innovation and technology is an important source of regional competitiveness through facilitating cooperation between the various parties involved in both the public and private sectors. In particular, they can improve collective processes of learning and the creation, transfer and diffusion of knowledge and transfer, which are critical for innovation. Such cooperation and the networks that are formed help to translate knowledge into efficiency opportunities. Such actions should extend to all the policy areas relevant for economic, scientific and social development and should ideally establish a long-term policy horizon. This, however, needs to happen not just in central parts where productivity and employment are highest and innovative capacity most developed but throughout the Union. Countries and regions need assistance in overcoming their structural deficiencies and in developing their comparative advantages. This means, among others, that encouraging the development of knowledge-based economic activities and innovation and that particular attention needs to be given to:

- developing new innovation promotion policies which focus much more on the provision of collective business and technology services to groups of firms which can affect their innovative behaviour, rather than direct grants to individual firms which tend only to reduce costs temporarily.
- developing new policies to strengthen the capacity of SMEs to innovate through business networks and clusters and improving their links with the knowledge base, including with universities and research centres.

- encouraging the development of the indigenous R&D potential of weaker regions and industries and their capacity to adapt technological advances made elsewhere to local circumstances and needs.
- facilitating access of researchers, businesses and others in less favoured regions to international networks of excellence, sources of new technology and potential R&D partners.

These conditions are largely related to productive and technical efficiency and include, among others, the capacity of a regional economy to generate, diffuse and utilize knowledge and so maintain an effective production system.

Towards this direction, our expected contribution is considered providing a better understanding of the contribution of technical change; ICT investment, innovation activities and economy openness to technical efficiency taking into account the interrelationships and the complementarities between innovation and efficiency. This chapter investigated various aspects of the relationship between productive efficiency and determining factors in an attempt to reach a better understanding of the contribution of alternative factors to technical efficiency growth. Industries should investigate and act towards identifying, developing and deploying their resources that may influence their technical efficiency, competitiveness and consequently their productivity performance, with better identification and understanding of the key resources, mainly increased knowledge about the impacts of different determining factors on technical efficiency.

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KEY TERMS AND DEFINITIONS

Decision-Making Units: The decision-making unit (DMU) is a collection or team of individuals who participate in a buyer *decision* process.

Determining Factors: A factor is one of the things that affects an event, decision, or situation.

Efficiency: Efficiency is a measurable concept, quantitatively determined by the ratio of useful output to total input.

Financial Markets: A financial market is a broad term describing any marketplace where trading of securities including equities, bonds, currencies, and derivatives occur. Some financial markets are small with little activity, while some financial markets like the New York Stock Exchange (NYSE) trade trillions of dollars of securities daily.

Productive Efficiency: Productive efficiency is concerned with producing goods and services with the optimal combination of inputs to produce maximum output for the minimum cost. To be productively efficient means the economy must be producing on its production possibility frontier.

Technical Efficiency: Technical efficiency is the effectiveness with which a given set of inputs is used to produce an output. A firm is said to be technically efficient if a firm is producing the maximum output from the minimum quantity of inputs, such as labour, capital, and technology.

Financing Digital Innovation for Sustainable Development

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INTRODUCTION

The United Nations' Sustainable Development Goals (SDG) 17 (SDG 17), supports “access to science, technology and innovation and enhance knowledge sharing ... through improved coordination among existing mechanisms, at the United Nations level” ([United Nations, ECOSOC, Metadata Statistics website](#)). SDG 17 pursues capacity building through improved access to data (i.e. solid statistics), information and knowledge to support decision-making and oversight. SDG17 is also closely linked to Objective 6, which covers the provision of technical knowledge, quality and services. Such guidelines embrace the economic viability, replicability and sustainability attributes that innovation must have to be called such, in the field of promoting digital innovation. Those guidelines provide a clear path to streamline efforts in this area by directing support to three crucial areas: (i) developing a market for digital innovation products and services; (ii) supporting initiatives to bring about new and more efficient business models and processes; and (iii) providing focused support to the generation of innovative products and services. To achieve these ends, it is proposed to establish adequate mechanisms to provide technical and financial support in each one of those areas, utilizing partners and collaboration mechanisms.

In this context, the authors propose two different Digital Innovation Trust Funds financing innovation for sustainable development, reviewing other funds and funding sources with similar or complementary purposes that operate at international development agencies.

The specific nature and workings of the financial instruments is discussed in detail and defined further, presenting two proposed scenarios for the Inter-American Development Bank (IADB) and the Food and Agriculture Organization of the United Nations (FAO), two of the largest international organizations working for the development of emerging economies in general, and the achievement of the SDGs in particular.

BACKGROUND

Main observations from success and failure stories from other donors as well as lessons learned in the implementation of innovation funding in developing countries include (Piaggese, 2017):

- a. International development agencies are all consistently pursuing the overall goal of reducing poverty and promoting socio-economic growth, under the guidance of the UN's Sustainable Development

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- Goals. For that overarching goal, digital innovation, ICT for development and technology innovation are means to achieve those goals faster, more efficiently and more widely; while they do not appear as a sector or priority activity, they are present in practically each sectoral effort and project. It is possible to say that today, digital innovation has been mainstreamed into development financing.
- b. Innovation funding tends to be directed towards financing: (i) applications of ICT to make more efficient and reach wider audiences for sector projects, with emphasis on education, health, transportation, environment, among others; (ii) applications of ICT to increase the amount, relevance and quality of information available to beneficiaries, in order to improve decision making; (iii) e-government and government capacity building; (iv) government digital strategy development; (v) knowledge acquisition, development, and management.
 - c. Financing for basic or applied research is less common; responsibility for this type of investment is left to government intervention, if any. In practice, research and development rest with large private corporations mostly in developed countries.
 - d. Financing in support of private sector investment is rare; some investment is present for private sector (mostly small & medium enterprises) capacity building, but risk capital or equity investment is extremely rare. Identified sources of development (concessionary) financing in development countries are limited to multi-lateral banks and a couple of bi-lateral financial institutions. Financing for initial stages of product or service development (start-ups) is even less frequent, with only a handful of sources available.

THE INTER-AMERICAN DEVELOPMENT BANK (IADB)

The Knowledge Economy (KE) is an interconnected, globalized economy where knowledge resources such as know-how, expertise and intellectual property are as critical as other economic resources such as land, natural resources, or even manpower (Piaggese, 2009). Under this concept, Knowledge is recognized as a source of competitiveness, where value lies in innovative ideas, services and networks, using technology as an instrument, not as an end. The KE is not a subject per se, but rather a new development paradigm where education, information and communication technologies and infrastructure, innovation, social inclusion and intellectual property rights protection converge into a “virtuous” circle to transform the intangible nature of Knowledge into an asset with market value able to contribute substantially to economic growth.

While Asia has excelled in developing knowledge-based industries (OECD, 2000) and knowledge-rich products, Latin America and the Caribbean (LAC), in general, lag well behind other developing countries. The experience of Asia shows that the successful transition to a KE typically involves long-term investment in education, development of indigenous innovation capabilities, modernization of information sharing infrastructure, and creation of a market environment that is conducive to knowledge-based-transactions. It is estimated that the LAC region’s performance for the education and ICT related indicators is somewhat below the average for all developing countries (Trucano, 2005); while indicators for institutional quality and innovation indicators are generally weaker.

International development organizations are striving to introduce Knowledge as an investment category to help countries find a suitable and viable niche in the international and national markets where Knowledge is a tradable asset. By establishing two closely related funding mechanisms to support this purpose, the Inter-American Development Bank (IADB), the largest development bank in the LAC region, would provide technical assistance for beneficiary countries to find such niche and then develop

the instruments to derive income generation opportunities from it. Both Knowledge Economy Funds will provide non-reimbursable resources to trigger the adoption of KE principles and practices among its borrowing member countries.

Individually or collectively, LAC countries would greatly benefit from the regional production and use of Knowledge and its world-wide exchange as a tangible asset and commodity. The IADB would make a substantial contribution by assisting its borrowing member countries in finding niches that respond to their comparative advantages and in setting up the structures and infrastructure needed to participate effectively in this competitive market.

The knowledge-driven economy has highlighted the growing importance of knowledge for industrial structure, for national economic performance, and for sources of competitive advantage for both firms and nations. A challenge has emerged for governments to build national capabilities, facilitate collaboration within and between businesses, and encourage competition. In this new economy, sustained use and creation of Knowledge are at the center of the economic development process. Knowledge and education can be treated as a business product, as educational and innovative intellectual products and services can be exported for high value return as productive assets. In a KE, Knowledge is used to produce economic benefits, therefore making it an engine of economic growth. KE, thus, is defined as the added non-monetary value that society accrues from increased access to data, information, and knowledge in the new, globally connected world (Piaggese, 2009).

Today an un-quantified amount of Knowledge is lost because development agents are not actively seeking to capture and retain it (The Competency Group, 2018). People's knowledge is lost when employees move on; indigenous knowledge is often disregarded when modern technology is introduced; institutional knowledge is drained when changes overrun existing operating systems; cultural knowledge is wasted when development goals are narrowly defined as economic gain. In most of the world, Knowledge is not yet considered a commodity to be exchanged and thus its impact on today's "knowledge society" is grossly underestimated.

A significant gap exists today between developed and developing countries in terms of access to the potential benefits of the KE (United Nations, 2000). Least developed countries are at a great disadvantage because international trade and direct external investment flows do not favor them. Furthermore, trademark and intellectual property right systems are not well developed and do not adequately protect the smaller economies.

In their efforts to tap the benefits of the KE, developing countries would need to consider action in two fronts. On the one hand, investment is needed to capture, retain and manage knowledge that already exists (so called "knowledge spillover") and put it to work as a factor in production, a tradable good or a negotiation chip. Here the LAC region can be expected to have significant advantages, since LAC countries are particularly well endowed in terms of vernacular, traditional and original knowledge. On the other hand, developing countries must at the same time invest in the generation of new knowledge through investments in education, innovation, adequate regulatory framework and viable institutions. It is possible that some countries would choose one path or the other, or that some may choose to undertake these paths sequentially.

In either case, the transition towards a KE requires that the rules and practices that determine success in the industrial economy be rewritten. Economic valuation and accounting rules need to be redefined so that governments, industries and organizations incorporate the value of knowledge and the added value that its innovative use would create. Accordingly, public policies must be redesigned to provide the conditions necessary to make knowledge a monetary asset. Public policies designed and implemented to support the knowledge economy must focus on how to generate public value out of knowledge exist-

ing or produced in the country, and how to make locally available knowledge produced in the global economy. Public policies must therefore provide conditions to exploit the positive externalities of the global knowledge economy.

The concept of KE does not necessarily revolve around high technology or ICT (information and communication technologies). Its instruments do not need to be technological. Sometimes, utilization of traditional means to collect, transmit and apply knowledge may be more effective than highly sophisticated systems. The experience of Asia, which precedes the rest of the world in this path, shows that the successful transition to a KE typically involves long-term investment in education, development of indigenous innovation capabilities, modernization of information sharing infrastructure, and creation of a market environment that is conducive to knowledge-based-transactions.

The World Bank and other international financial institutions that are active in this field recognize the following elements as pillars and framework of the KE (Chen, Derek & Carl J. Dahlman, 2006):

- a. Economic incentives and institutional regime —i.e. economic policies and institutions that permit efficient mobilization and allocation of resources stimulate creativity and the dissemination and use of existing knowledge;
- b. Educated and skilled workers —i.e. a labor force that continuously upgrades and adapts its skills to efficiently create and use knowledge;
- c. An innovative institutional and entrepreneurial system —i.e. private firms, research centers, universities, consultants and other organizations actively involved in keeping up with the knowledge revolution tap into the growing stock of global knowledge, assimilating and adapting it to local needs;
- d. A modern and adequate information infrastructure —i.e. means to effectively acquire, process, communicate and disseminate information and knowledge.

Investments in activities that bring about these conditions are necessary to sustain the creation and adoption of knowledge as a factor in domestic economic production. Sustained use of knowledge leads to higher value-added goods and services. This in turn results in greater probability of economic success, and hence, greater and sustainable economic development. Knowledge can make an enormous difference in a country's position within today's highly competitive and globalized world economy.

National and international development organizations are striving to make their operational development methodologies with beneficiary countries more effective. An important part of this effort will depend on how well the role of knowledge is understood and integrated into the development process.

The conditions required to develop a KE are numerous and complex. Multi-lateral Development Banks (MDBs)' clients expect excellence in the provision of services and the use of state-of-the-art methods and technology to improve the impact of their development investment. There is an un-met demand for knowledge products among the MDBs' borrowing member countries. In several cases, access to knowledge-rich products is more important to a country than investment capital.

Most of international financing institutions are striving to help developing countries enter the KE "market", acknowledging the promise the KE holds for those which find a competitive niche in it. We see mechanisms to provide rapid and effective response to the demand for knowledge products; notwithstanding, the MDBs would need to make a concerted effort to develop and apply the requisite instruments needed to optimize KE benefits for its clients, through an activity completely and exclusively focused on this purpose.

Among the MDBs, the Inter-American Development Bank (IADB) is the oldest and leading development bank in the LAC region. For this reason, two funding instruments are proposed for the IADB to engage the KE sector. The first would involve ordinary capital non-reimbursable funding (IADB KE-Fund) which would support all actions needed to place the Bank as a proactive, agile and innovative strategic partner for the Bank's borrowing member countries in their search for a viable niche in the international KE markets. The IADB KE-Fund would finance high-level government advice and technical assistance, country-specific analysis, financial surveys, market studies and other non-financial products, as well as pilot projects required to support beneficiary countries. The IADB-KE Fund would also act as leverage to induce other donors to channel funds towards the LAC region in support of KE projects, by acting as a matching-fund source to its sister fund, the Multi-Donor KE Fund. The second instrument is a Multi-Donor KE Fund, which would focus on technical cooperation and pre-investment for KE project financing, including providing funds for pilot or demonstrative projects.

Through these two funds the IADB would provide borrowing member countries with incentives and tools to use their knowledge capital and generation capabilities as well as to get access to knowledge created in most advanced economies and put it to work towards their development. The IADB's value added would be to facilitate each country in finding its own niche and identifying investments that would facilitate the development of their Knowledge sector and exploit the relevant knowledge related sources publicly available in the global knowledge economy. The implementation of these funds would also affect positively existing IADB units directly, to the extent that it would introduce KE related investments in their portfolios.

A PROPOSED IADB FUND FINANCING DIGITAL INNOVATION FOR SUSTAINABLE DEVELOPMENT

The authors present a scenario for the establishment of an IADB-KE fund. The objectives of the proposed IADB-KE Fund are: (i) provide timely knowledge-rich technical assistance demanded by beneficiary countries in the various sectors that make up the Bank's portfolio; (ii) support the development of KE policies and strategies in beneficiary countries; (iii) develop a new generation of KE technical assistance and investment portfolio for the Bank, jointly with the Multi-Donor KE Fund; and (iv) establish the IADB at the forefront of international development organizations in this field.

All borrowing member countries of the Bank are potential beneficiaries of the IADB KE Fund. However, the Fund would start with a few participating selected countries based on interest expressed by their authorities. In each of those countries, local authorities need expressing their official support for the Fund proposal and have advanced letters of interest to become part of the first group and gain access to technical cooperation to prepare their respective project proposals. Other countries would be added to the list as the Fund initiates operations and has access to resources that would allow the development of additional project proposals.

Eligible beneficiaries would include: (i) public sector agencies; (ii) universities and all higher-level learning agencies, whether public, semi-public or private; (iii) research and development agencies and centers of excellence, public, semi-public or private; (iv) private sector organizations; and (v) non-governmental, non-for-profit organizations, devoted to social purposes.

The IADB KE-Fund would fund, on a non-reimbursable basis, the following expenditures: (i) consulting services to advise governments on strategic thinking and planning to harness the benefits of the KE within their individual circumstances and priorities; (ii) consulting services required by sector Divisions

and beneficiary countries to improve sector knowledge in any sector attended by the Bank; (iii) technical cooperation to define KE development strategies, policies, and plans; (iv) knowledge sharing and cross-fertilization events to facilitate intra-region discussion of opportunities, restrictions and common ground; (v); studies to analyze market developments, trends, lessons learned, conceptual developments and other subjects that would advance the Bank's positions and capabilities in this field; (vi) evaluation of progress and impact of the Fund and dissemination of results; and (vii) match the funding provided by the Multi-Donor KE Fund for KE demonstration and start-up or pilot projects identified by either Fund.

Indeed, to the extent that it is aimed at contributing to making the Bank a knowledge creation and capacity building institution, the Fund activities are consistent with this purpose. The Fund would include costs associated to the delivery of the Fund activities, including Fund staff salaries, benefits and overhead costs, as well as Fund staff participation in inter-agency coordination meetings where the Bank can learn from other agencies' work or share results from its own experience as well as Project related and promotional travel.

Application of KE opportunities directed towards making more profitable and equitable utilization of existing or new knowledge would hold exciting potential to improve the conditions of lower-income groups. Through carefully crafted KE investments, the poor can earn more out of their knowledge capital than they would out of their labor alone. Socio-economic benefits of KE projects could include, for example: employment derived from new knowledge-based industries; higher education institutions aligned with KE objectives and niches; preservation and valorization of traditional knowledge; or income generation opportunities associated to new cultural industries. Thus, a line of funding devoted to providing the poor with the option and means to participate in the KE would contribute enormously to the growth in value and worth of low-income groups and society in general.

On the other hand, multiplier effects can be achieved from industry's incursion in the KE field, through new knowledge development or better management of existing knowledge. Local industries able to locate a niche where they can compete favorably in international markets through development of new knowledge-based applications would also benefit from direct project investment, as well as from improved national policies designed to provide incentives and facilitate their insertion in such competitive markets that the Fund would promote.

Direct beneficiaries of KE investment would include: (i) public sector institutions from any sector where gains can be attained by the application of KE instruments; (ii) academic and training institutions that can establish centers of excellence for the diffusion of KE in the LAC region; (iii) private sector companies and foundations who are willing to invest their own resources matching those of the Bank for the pursuit of joint objectives; and (iv) communities where KE projects are directed to raise employment or training opportunities.

THE FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS (FAO)

FAO's Reviewed Strategic Framework and Outline of the Medium Term-Plan 2018-21 of December 2016 (FAO, 2016) embraced the United Nations' Sustainable Development Goals (SDGs) as guiding objectives for its own results framework and work program, with emphasis on the fulfillment of SDG2 "End hunger, achieve food security and improve nutrition and promote sustainable agriculture". SDG 17 supports "access to science, technology and innovation and enhance knowledge sharing ... through improved coordination among existing mechanisms, at the United Nations level" (United Nations, idem).

In the Reviewed Strategic Framework, SDG 17 was mentioned in support of all FAO's Five Strategic Objectives as it pursues capacity building through improved access to data (i.e. solid statistics), information and knowledge to support decision-making and oversight. SDG17 is also closely linked to Objective 6, which covers the provision of technical knowledge, quality and services in support of all crosscutting themes that underlay all Five Strategic Objectives.

To contribute to the fulfillment of FAO's Strategic Framework, the institution spearheaded the development of a Digital Strategy (FAO, 2017), which aims at taking advantage of new digital technologies to support FAO's mission. Such new digital technologies have the potential to accelerate FAO's meeting its strategic objectives, making use of its knowledge capital, becoming more competitive in the process. Derived from the Digital Strategy's Action Plan, FAO is to develop a systematic approach to innovation, defining innovation as "The process of translating an idea or invention into a good or service that creates value or for which customers will pay. To be called an innovation, an idea must be replicable at an economic cost and must satisfy a specific need." To implement this, the Digital Strategy consists of the following priorities: implement specific projects where IT solutions is the prime driver; use partnerships to deliver measurable results; and establish an innovation fund to encourage a culture of innovation, all the time providing for adequate oversight and evaluation.

Guiding the implementation of the Digital Strategy, tactical guidelines were issued, in the document "Implementing digital innovation at FAO" (Varas, 2017). Such guidelines embrace the economic viability, replicability and sustainability attributes that innovation must have to be called such at FAO particularly in the field of promoting Digital Innovation. Those guidelines provide a clear path to streamline FAO's efforts in this area by directing its support to three crucial areas: (i) developing a market for digital innovation products and services; (ii) supporting initiatives to bring about new and more efficient business models and processes; and (iii) providing focused support to the generation of innovative products and services. To achieve these ends, the authors propose to establish adequate mechanisms to provide technical and financial support in each one of those areas, utilizing partners and collaboration mechanisms.

In designing this proposal for an Innovation Trust Fund, the authors have investigated other Funds and funding sources with similar or complementary purposes that operate at other international agencies. Main observations derived from this exercise include (Piaggese, 2017. Idem):

- a. International development agencies are all consistently pursuing the overall goal of reducing poverty and promoting socio-economic growth, under the guidance of the UN's Sustainable Development Goals, just as FAO does. For that overarching goal, digital innovation, ICT for development and technology innovation are means to achieve those goals faster, more efficiently and more widely; while they do not appear as a sector or priority activity, they are present in practically each sectoral effort and project. It is possible to say that today, digital innovation has been mainstreamed into development financing.
- b. Innovation funding tends to be directed towards financing: (i) applications of ICT to make more efficient and reach wider audiences for sector projects, with emphasis on education, health, transportation, environment, among others; (ii) applications of ICT to increase the amount, relevance and quality of information available to beneficiaries, in order to improve decision making; (iii) e-government and government capacity building; (iv) government digital strategy development; (v) knowledge acquisition, development, and management.
- c. Financing for basic or applied research is less common; responsibility for this type of investment is left to government intervention, if any. In practice, research and development rest with large private corporations mostly in developed countries.

- d. Financing in support of private sector investment is rare; some investment is present for private sector (mostly small & medium enterprises) capacity building, but risk capital or equity investment is extremely rare. Identified sources of development (concessionary) financing in development countries are limited to multi-Lateral banks and a couple of bi-lateral financial institutions. Financing for initial stages of product or service development (start-ups) is even less frequent, with only a handful of sources available.

There are several Funds devoted to the area of digital innovation, ICT for development and technology innovation. However, most of them tend to support the creation of ICT infrastructure or the establishment of conditions that would facilitate access to ICT, rather than the development of ICT applications for a specific development sector—for example, agriculture. In general, Funds are vague as to the nature of the “innovation” activities they would support, which leaves the proponent to decide whether their proposal would fall or not within the realm of interest of each Fund. Size of the grants tend to be small (less than US\$50,000 each); project duration tends to be short—12 months seems to be the most common duration—which may limit the long-term sustainability of the efforts they support. While there is some coalition among funding sources at the regional level (Latin America and Caribbean, Africa and Asia), funding seems to be too dispersed to be able to have significant impact to solve the problems of poverty and hunger in those regions. Finally, there are several Funds devoted to supporting ICT and Digital Innovation in their own countries, including some in the developing world; multi-country Funds are less common.

Principal lessons learned from experience by other donors in the field of financing innovation sources—specifically ICT for Development funding—point at: (i) the importance of local ownership for sustainability and, concomitantly, the need to invest in capacity-building; (ii) the relevance of government (local, national and international) participation to provide conditions that make innovation viable—clear regulations, competitive environment, protection of intellectual property, among others; (iii) the role of private sector involvement, particularly for scaling up and devising commercial applications; and (iv) the need to invest in social inclusion for the projects to achieve tangible social impact.

Observations from success and failure stories from other donors as well as lessons learned in the implementation of innovation funding in developing countries have both been used to shape the current proposal. The specific nature and workings of the proposed financial instruments will need to be discussed in detail and defined further.

A PROPOSED FAO DIGITAL STRATEGY AND INNOVATION FUND FOR AGRICULTURE DEVELOPMENT

The authors present a scenario for the establishment of a funding mechanism to support the implementation of a Digital Innovation Program under FAO’s Digital Strategy, by way of a Multi-Donor Digital Innovation Trust Fund (MDIF) whose objective would be to promote flagship digital innovation solutions to improve decision-making and/or enhance productivity of end-users (farmers, fishers, forest dwellers among others) in the field, at the same time generating society-relevant public goods. The Trust Fund would prioritize those project proposals that show economic viability, a vital attribute to ensure replicability and sustainability of digital innovation products and services that would be generated by those projects once funded.

Projects supported by the Trust Fund would contribute directly to the attainment of FAO's strategic objectives. The alignment of the Trust Fund's objectives and goals to those of FAO would be described in the Trust Fund's Results Framework.

Specifically, the MDIF would finance:

- a. Development of new digital-innovation-based business models and processes
- b. Development of digital innovation ecosystems in agriculture
- c. Start-up projects to help beneficiaries test their strategic choices and/or lay the ground for further work and investment in the future; and
- d. Training and knowledge transfer among beneficiaries and between beneficiaries and knowledge providers worldwide.

The risk of funding initiatives that may not live up to their potential in terms of scalability or sustainability would be mitigated through the accumulated experience of the Trust Fund's future partners, who would have developed significant knowledge on existing markets and opportunities to help the Trust Fund choose those projects that have the greatest potential of success. Partnering with other sources of funding would also be crucial in securing resources additional to those contributed by the Trust Fund, to support projects beyond the start-up phase.

Beneficiaries would be able to apply to any one of these lines of financing and could re-apply to a different line of financing if the results of the first financing are promising. For example, a beneficiary could be awarded funding to improve its business model, and after concluding adaptations, apply to be financed as a start-up. To support beneficiaries in all these areas, the Trust Fund would provide GRANTS to cover the following three kinds of activities: (i) technical cooperation, to provide specialized consulting services to help beneficiaries in developing new business models and processes, buttress their implementation and train their staff in specific areas related to the project; (ii) pre-investment, to allow beneficiaries to apply or contract proper feasibility analysis, conduct market research and build solid business plans for their project concepts; and (iii) investment, to provide seed funding to start-up project proposals that have proven they can be beneficial and sustainable.

The proposed MDIF would involve the private sector, other UN agencies and multinational and multi and bi lateral development agencies in this effort to multiply the impact of this initiative, take full advantage of creativity developed elsewhere, and reduce the potential of duplication among development agencies active in this field.

The Trust Fund would receive applications from FAO beneficiary member countries' end-user associations (such as farmer cooperatives or unions); incubators, innovation accelerators, impact hubs; non-for-profit non-governmental organizations that support those sectors; and small and medium sized local enterprises involved in those sectors. Local government agencies responsible for the same areas could participate in the projects providing partial financing or in-kind contributions.

In replicating and disseminating MDIF best practices among FAO's 2,000+ currently active projects in FAO's five regions (Africa; Asia and the Pacific; Europe and Central Asia; Latin America and the Caribbean; and Near East and North Africa), indirect beneficiaries of the MDIF could potentially be the entire population served by FAO.

The Trust Fund would accept proposals that present innovative, scalable and sustainable solutions in the following areas:

- a. Develop local, regional or international markets for digital innovation-based innovations, to match supply and demand for digital innovation products and services –a gap between supply and demand is a widespread problem that affects potential beneficiaries in most developing countries. Examples of this type of projects could be:
 - Proposals to develop supply-and-demand networks for innovation products and services, matching an existing or newly developed product or service (the supply) with a user who could benefit from acquiring them (the demand).
 - Project-specific market research for digital innovation products and services (ICT, digital innovation products and services generated through R&D) to identify opportunities for their sale and distribution, using readily available research on regional and global markets.
 - Support to establish user organizations (cooperatives, etc.) allowing them to reach critical mass to become attractive to markets while at the same time allowing potential providers to achieve economies of scale and therefore reduce price of digital innovation products and services offered.
- b. Improve beneficiary organization's business models and internal processes through the introduction of digital innovation products and services to increase efficiency and improve production. Examples of these types of projects could be:
 - Conduct analyses to identify existing deficiencies or inefficiencies in beneficiaries' business models or processes and identify digital innovation-based solutions to overcome them
 - Identify new opportunities to increase their participation in the value chain of their products using digital innovation in any phase of product/service development
- c. Generate new digital innovation products and services with a clear promise to have social and economic viability to solve clearly defined problems along the whole value chain of target agricultural, livestock, forestry or fishery products. Examples of this type of projects could be:
 - Design new digital innovation-based products and services that could be marketable including adequate pre-investment resources
 - Develop prototypes of new digital innovation products with specific applications to solve also specific problems identified
 - Develop detailed proposals for the provision of digital innovation-based services that would solve a specific problem or add to the socio-economic viability of a given product
- d. Develop or improve digital ecosystem structures and support their operation; for example, establishment of innovation labs, with associated incubators, accelerators and hubs, and their respective connections to the local, regional or international Trust Fund structure

The Trust Fund would receive both, earmarked and general contributions. When individual donors or associations of donors require earmarking of their contributions, the Trust Fund would open a separate "account" to accommodate donor priorities --specific regions and/or purposes. This option would give the Trust Fund versatility and increase its appeal to different donors by offering diversity of opportunities.

General contributions would be un-tied funds provided by donors for the specific purpose of financing project proposals presented to the MDIF, trusted to FAO in management. Such general contributions would be subject to matching by Ordinary Capital (OC) contributions by FAO and thus reported to donors along with the appropriate financial information.

FAO will collect and disseminate best-practices generated by field projects supported by MDIF to multiply the reach of its accomplishments within FAO's and UN's online platforms to support Sustainable Development Goals progress. FAO will also include information on innovative products, services,

models and processes offered by other sources, further contributing to project beneficiaries' decision-making in the structuring and running of their respective projects.

Potential partners —particularly private companies— may be unwilling to transfer funds for FAO to manage. To facilitate such partnerships, and under FAO's new delivery arrangements which allow FAO to delegate project delivery to an implementing agency, one such third party would be hired—a non-for-profit non-governmental agency—to coordinate implementation. This arrangement would streamline management and facilitate oversight.

To prepare the initial steps in the implementation of the Trust Fund, as well as to allow for fine-tuning of its internal regulations, a first-year batch of projects would be developed in coordination with identified partners. Such first group would be presented as a sample and processed as a single operation under FAO's project cycle. This preparatory phase would further allow to work closely with FAO's business units engaged in implementing other project funding instruments to maximize synergies and minimize duplication or overlap.

Socio-economic benefits from each funded project can be expected to derive from: (i) enhanced economic viability and sustainability of each beneficiary enterprise and endeavor resulting from the insertion of more advanced and appropriate technology innovation solutions; (ii) greater reach—in terms of number of beneficiaries and geographic scope of such benefits—derived from the utilization of digital innovation solutions that typically multiply access to the same products and services offered through traditional means; (iii) enhanced opportunities afforded to specific groups such as women, youth, persons with disabilities, for whom digital innovation products and services have been proved to facilitate access provided adequate and specific support is present; (iv) greater awareness of the potential benefits that can be accrued by digital innovation-based investment among local societies and governments, with the potential of a multiplying and replicating effect.

FUTURE RESEARCH DIRECTION

Further analysis is needed to identify those which could hold the greatest potential to become valuable partners to the proposed Trust Funds. Exploratory interviews with each should follow, prioritizing those which already have some sort of agreement established with the IADB and the FAO. After canvassing the field, we should be working on a gap analysis to identify possible niches that could be occupied by the IADB and the FAO, as well as to better define the nature and scope of the Funds. The latter activity would involve marketing work through the development of the Fund's unique "value proposition" (a "resonating focus" approach). Once the outlines of the proposed Funds have been decided, partner-specific proposals of collaboration would need to be produced and discussed.

CONCLUSION

There are several Funds devoted to the area of digital innovation, ICT for development and technology innovation. However, most of them tend to support the creation of ICT infrastructure or the establishment of conditions that would facilitate access to ICT, rather than the development of ICT applications for a specific development sector—for example, agriculture. In general, funds are vague as to the nature of the "innovation" activities they would support, which leaves the proponent to decide whether their proposal would fall or not within the realm of interest of each fund. Size of the grants tend to be small

(less than US\$50,000 each); project duration tends to be short—12 months seems to be the most common duration—which may limit the long-term sustainability of the efforts they support. While there is some coalition among funding sources at the regional level (Latin America and Caribbean, Africa and Asia), funding seems to be too dispersed to be able to have significant impact to solve the problems of poverty and hunger in those regions. Finally, there are several Funds devoted to supporting ICT and Digital Innovation in their own countries, including some in the developing world; multi-country Funds are less common. Principal lessons learned from experience by other donors in the field of financing innovation sources—specifically ICT for Development funding—point at: (i) the importance of local ownership for sustainability and, concomitantly, the need to invest in capacity-building; (ii) the relevance of government (local, national and international) participation to provide conditions that make innovation viable—clear regulations, competitive environment, protection of intellectual property, among others; (iii) the role of private sector involvement, particularly for scaling up and devising commercial applications; and (iv) the need to invest in social inclusion for the projects to achieve tangible social impact.

The two scenarios presented for the Inter-American Development Bank (IADB) and the Food and Agriculture Organization of the United Nations (FAO), would comply with the above conditions.

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KEY TERMS AND DEFINITIONS

Digital Innovation (DI): The DI is the application of new technologies to existing problems or practices. The process is ongoing, but it can be better understood as taking place in waves, with each way propelled by advancements in technology.

Knowledge Economy (KE): The KE is an interconnected, globalized economy where knowledge resources such as know-how, expertise and intellectual property are as critical as other economic resources such as land, natural resources, or even manpower. Under this concept, Knowledge is recognized as a source of competitiveness, where value lies in innovative ideas, services, and networks, using technology as an instrument, not as an end.

Sustainable Development Goals (SDGs): The SDGs are the blueprint to achieve a better and more sustainable future for all. They address the global challenges we face, including those related to poverty, inequality, climate, environmental degradation, prosperity, peace, and justice. The SDGs are interconnected, and the challenge is to achieve them by 2030. Technology plays an important role in achieving the SDGs.

Auction-Based Pricing in Cloud Environment

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INTRODUCTION

The rapid development of technologies triggered the emergence of cloud computing. Cloud computing enables network access to a scalable and elastic pool of shareable physical or virtual resources. Resources in the cloud environment are generally provisioned as cloud instances, i.e. Virtual Machines (VMs) with the required CPU, memory and I/O resources. The main advantages of cloud computing are scalability, low costs, dependability, service-driven, self-healing and multi-faceted. However, there are also numerous challenges including a vulnerability, bandwidth costs, transparency access, trust, reliability, security, availability, resource management, task scheduling, and performance (Gullhav & Nygreen, 2016; Sebastio, Gnecco & Bemporad, 2017). The dominant factor in supporting customers to use virtual resources and move towards cloud computing is pricing. Cloud customers pay for required cloud resources depending on instance type and pricing mechanism applied. In addition, different levels of guarantees in terms of availability and termination are possible. Pricing mechanisms in the cloud environment can be generally classified into static and dynamic. The static pricing mechanisms are the dominant scheme in the cloud environment and involve the charging the fixed price per hour and per instance. The dynamic pricing mechanisms include charging the usage of cloud resources as long as the cloud customers' bids are equal or exceed the price per instance and per time interval, determined by the cloud provider (Alzhouri & Agarwal, 2015). For example, Amazon Elastic Compute Cloud (EC2) uses three different pricing options for cloud resources: Reserved instances, On-demand instances, and Spot instances. Reserved instances are provided with long-term availability guarantees, On-demand instances are provided for specific time periods and are guaranteed to be available once assigned, and Spot instances are provided through an auction-like mechanism, but their availability depends on the time-varying Spot price. Reservation and On-demand pricing mechanisms are considered as static since prices for cloud resources are invariant for both under-utilization and over-utilization of the resources. Idle cloud resources can be offered as Spot instances. This purchasing option offers no guarantees on minimum sustained availability. Submitting a bid for the access to Spot instances, cloud customers specify the maximum price they are willing to pay. The actual price they pay is not the value of the bid, but the value of the Spot price. Cloud provider set Spot price depending on the availability of the idle resources and current demand. When the Spot price exceeds the value of the bid, the Spot instance is terminated. Cloud provider can also revoke Spot Instances when the supply of available Spot Instances decreases. Recently, a new variety of Spot instances, Spot Block instances, are introduced. These instances run continuously for a finite duration, up to 6 hours. When cloud customer submits a bid, two parameters need to be specified: the value of the bid (the maximum price willing to pay per hour) and the Block

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duration parameter (the number of hours that Spot Block instance will run). The Spot Block instance is terminated only at the end of the Spot Block duration.

As a dynamic form of pricing, auction mechanisms can be an effective and promising solution for profit maximization of cloud providers. These mechanisms provide price variation depending on the changes in supply and demand by creating competition among cloud customers. Therefore, auctions can balance supply and demand for cloud resources. They support cloud customers for truthful bidding and allocate the resources to the customers that value them the most. Various auction-based allocation and pricing mechanisms can be used for cloud resources: Uniform price auctions, Second-price auctions, Combinatorial auctions, Double auctions etc. In this chapter, the analysis of different auction-based mechanisms for pricing and allocation of cloud resources is provided.

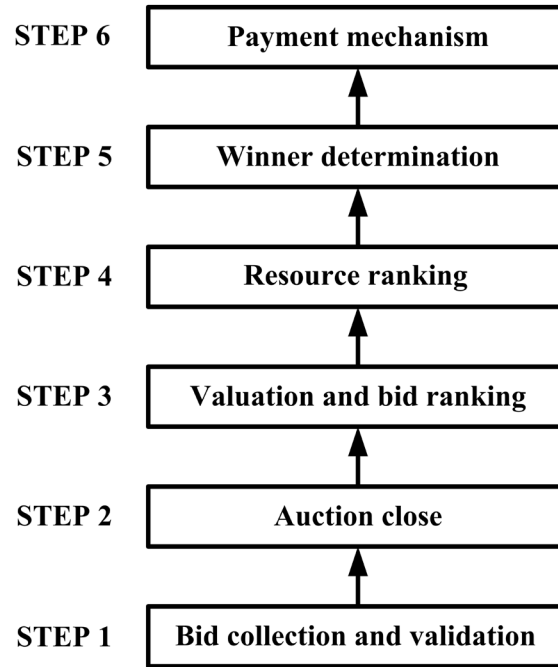
BACKGROUND

Auction mechanism is also referred as market-clearing mechanism that equates demand and supply. It is a widely adopted mechanism for resource allocation in telecommunications. For instance, auctions are used for efficient and effective spectrum allocation in mobile communication, and to trade-off electricity using spot marketing. There are three entities in an auction: seller, buyer and auctioneer (Baranwal, Kumar, Raza & Vidyarthi, 2018). Seller owns the commodities, offers them to the buyers and earns profit. In terms of cloud computing, cloud providers are sellers, while commodities are cloud resources (for instance, various types of VMs). Buyers are cloud customers who purchase the commodities, i.e. cloud resources from the cloud providers. Auctioneer is the entity that performs an auction. It is an intermediate agent that acts as the market maker. Since the auctioneer stores the repository of the historical transactions, it provides support for cloud providers to identify the new trends in cloud resource allocation. Auctions consist of two sub-processes: winner determination and payment mechanism. These processes are performed in six steps, as shown in Figure 1.

The auction starts with the collection of bids from various bidders by the auctioneer. Set of rules and constraints in an auction need to be specified clearly. Constraints might be bid expiry, resource availability, bidder's budget, time period for resource provisioning, etc. Bids that do not satisfy the given set of constraints are canceled in validation phase by the auctioneer. Step 2 refers to the auction closing. Auctioneer can close the auction and finish accepting the bids upon certain conditions (sufficient number of bids received, time limit specified for bidding, availability of resources, etc.). Once the auction is closed, any change in a bid or accepting new bids is not allowed. The value of each bid is computed after closing the auction (Step 3). Bids are then sorted, depending on their values. In Step 4, resources are ranked according to their intrinsic value. Depending on the predefined rules, some bidders are selected as winners in resource allocation (Step 5). Computational complexity of the winner determination increases with the increase in the number of the participants in the market. In Step 6, cloud customer pays according to the defined pricing mechanism. If the pricing mechanism is properly implemented, the auction is truthful, i.e. incentive compatible.

Various auction-based pricing and allocation mechanisms in the cloud environment are proposed (Kumar, Baranwal, Raza & Vidyarthi, 2017; Kumar, Baranwal, Raza & Vidyarthi, 2018; Lu, Yu, Zhu, Li, 2018). The current research on auction-based pricing mechanisms in the cloud environment is primarily focused on a static, single type resource with a single requirement. The issue closely related to pricing is cloud resources allocation. A comprehensive literature review of auction mechanisms for cloud resource allocation is provided by Sheikholeslami and Navimipour (2018). There are many possible classifications

Figure 1.



of the auction mechanisms in cloud environment (Baranwal, Kumar, Raza & Vidyarthi, 2018). In this chapter, the research focus is on the one-sided, double-sided, and combinatorial auction mechanisms.

In one-sided auctions, bidders submit their bids without awareness of other bids. The highest bidder wins an auction. A well-known auction mechanism is Vickrey auction, also referred as Second-price auction. The resources are allocated to the second highest bidder. A widespread used auction-based method in the cloud environment is Uniform price auction (Zhang, Gurses & Boutaba, 2011). In such an auction mechanism, the provider allocates resources to bidders in decreasing order of their bids, while the selling price equals the lowest winning bid. The concept of the marginal bid, i.e. the highest unsuccessful bid for pricing and allocation of cloud resources under Second-price auction is proposed by Lin, Lin & Wei (2010). The proposed concept achieves high revenue for the cloud provider, with low response time. However, it provides low revenues for the customers.

In double-sided auctions, both the cloud providers and cloud customers place their bids. If cloud providers' offers and cloud customers' bids can be placed at any time, the auction is referred to as Continuous Double Auction. A detailed study of double auction-based mechanisms application in a cloud environment along with a framework for a future cloud market using double auction is provided by Kumar, Baranwal, Raza & Vidyarthi (2017). In the two-sided market, a cloud customer can purchase cloud resources from multiple providers, while a cloud provider can rent its resources to multiple customers. Different cloud providers offer different pricing mechanisms. Hence, it is often very difficult for cloud customers to make an optimum request. However, the double auction can be an effective pricing and allocation mechanism for two-sided markets.

Combinatorial auctions are often used for pricing and allocation of cloud resources. In the combinatorial auction, a cloud provider offers a group of resources, in form of bundles, while cloud customers

submit their bids. Therefore, there are more than two resource types in the auction. Combinatorial auctions are considered as a convenient and efficient mechanism for both cloud providers and customers. The problem of allocation VM instances of several types to several customers requesting a set of VM instances of different types is analyzed by Zaman & Grosu (2013). They proposed two combinatorial auction-based allocation mechanisms. The first mechanism considers the situation with few types of items and many instances of each type. The other mechanism determines allocation based on the customers' bids and the total number of items they demand, with consideration of the relative sizes of VM instances. These two mechanisms are further compared with the fixed-price based allocation mechanisms. It is shown that combinatorial auction-based mechanisms outperform the fixed-priced mechanisms in terms of resource utilization, revenues and allocation efficiency (Zaman & Grosu, 2013). These mechanisms provide high revenues for cloud providers, high resource utilization with low costs. However, cloud customers' benefits are not considered.

BENEFITS OF AUCTION-BASED PRICING MECHANISMS

Despite their simplicity, static pricing mechanisms do not support revenue maximization since idle resources earn no revenue and even introduce additional costs due to depreciation. In addition, demand for cloud resources varies over time. Therefore, the use of dynamic forms of pricing mechanisms is appropriate to optimize the cloud provider's revenue. Price adjustment based on actual or forecasted dependences between supply and demand can enable demand shifting from the periods of high traffic load to the periods of low traffic load. The aim of dynamic pricing mechanisms is to charge the idle resources at a low price to improve resource utilization and raise the price if the demand for cloud resources increases (Wan, Zhang, Gui & Xu, 2016). Cloud providers offer a variety of computing and storage resources to different types of customers by different pricing mechanisms. Therefore, a convenient pricing mechanism from cloud customers' perspective enables efficient service provisioning at least price. On the other hand, an effective pricing mechanism from the cloud providers' perspective provides profit maximization with increased resource utilization. Different auction mechanisms are convenient to use as a form of dynamic pricing in a cloud environment due to several advantages (Toosi, Vanmechelen, Khodadadi & Buyya, 2016). Auctions encourage cloud customers to reveal the true values they are willing to pay for required resources, ensure that resources are allocated to customers that value them the most (Zaman & Grosu, 2013), and the prices are corrected depending on demand and supply conditions by creating competition among customers. The efficiency of cloud resource usage is improved under auction-based pricing and allocation mechanisms (Taifi, Shi & Khreishah, 2011). Thus, such pricing mechanism can effectively determine the market value of cloud resources, especially when allocating relatively limited resources to a potentially large number of cloud customers (Chichin, Vo & Kowalczyk, 2014).

From cloud customers' perspective, auction-based pricing mechanisms set, on average, lower prices than fixed pricing mechanisms (Jung, Chin, Chung, Yu & Gil, 2011; Kaminski & Szufel, 2015). Amazon EC2 Spot pricing, as a typical example of auction-based pricing, enables significant savings if On-demand instances are being replaced by Spot instances (Javadi, Thulasiram & Buyya, 2013). Some empirical studies show that with the proper bids, savings over On-demand instances can be up to 36% (Leslie, Lee, Lu & Zomaya, 2013). In addition, Spot pricing improves customers' satisfaction (Xu & Li, 2013). In situations when the demand for On-demand and Reservation instances is high, customers can shorten waiting time by using the alternative instances, Spot instances or their variety - Spot Blocks. Additionally, combinatorial auctions enable more convenient trading of different types of cloud resources for the

customers with high requirements. With the appropriate market structure, it is possible to achieve fair interactions between cloud providers and cloud customers through an auction pricing mechanisms. Thus, higher social welfare is enabled for the entire cloud environment (Shi, Zhang, Wu, Li, & Lau, 2016).

The recently introduced form of cloud idle resources, Spot Block instances, provide several advantages over Spot instances. Cloud customers can choose Spot Block duration without termination (1-6 hours) in an auction-based allocation scheme. Therefore, the utilization of a cloud provider's resources is improved since cloud customers can use cloud idle resources for the less flexible tasks. Once determined, the Spot Block price is fixed for a predefined time period, which also improves cloud customers' satisfaction in cloud service provisioning. If an auction mechanism is appropriately set, Spot Block instances are a cost-efficient solution for workloads that require uninterrupted provisioning in duration up to 6 hours. The generalized Second-price auction can be convenient for Spot Blocks allocation from the cloud provider's perspective since it assures greater revenues. However, Uniform price auction provides greater savings for cloud customers (Mikavica & Kostic-Ljubisavljevic, 2018).

BIDDING STRATEGIES IN AUCTION BASED PRICING MECHANISMS

In auction-based mechanisms for pricing and allocation of cloud resources, selection of appropriate bidding strategy is crucial from cloud customers' perspective. The cloud provider allocates its idle resources to the cloud customers based on all received bids and on the available resources through an auction-based mechanism. Once bids are submitted, the cloud provider aggregates bids and demands and reconcile them with the supply. The usage of idle resources provides significant cost advantages for both providers and customers. However, customers need to make the decision regarding the bidding strategy. In general, the chosen bidding strategy impacts the following performance metrics: costs, wait time and interruption rate (Karunakaran & Sundarraj 2014). Lower bids can assure lower costs. However, the other performance metrics such as task completion time and interruptions are deteriorated. Therefore, cloud providers often recommend bidding high in order to increase the possibility of uninterrupted cloud instance running. Price-sensitive cloud customers usually submit low bids. This means that they are willing to pay only a low price for cloud VMs. However, VMs with a low bid might have a low availability and high possibility of being revoked if the market price increases more than the bid price. Frequent revocations can lead to application downtimes, prolonged deadlines and decreased performances. Therefore, bidding presents cloud customers' tradeoffs between costs and availability/revocation-rate. Appropriate bidding strategy should minimize costs with different constraints including deadlines, for a wide range of applications. The complexity of bidding is the reason why, despite lower prices, auction-based renting of cloud resources has a low usage (Sharma, Irwin & Shenov, 2017).

Several bidding strategies are analyzed by (Sharma, Irwin & Shenov, 2017): bidding close to the reserved instance price, bidding above the average Spot price, bidding close to the On-demand price and bidding above the On-demand price. Their study shows that bidders who choose the strategy of bidding close to the reserved instance price reduce costs on the expense of greater waiting times and higher interruption rate. Furthermore, bidders adopting bidding above the On-demand price achieve the lowest waiting times and interruption rates but higher costs, in comparison with the other bidding strategies. In addition, it appears that marginal increase in cost is much higher than the marginal decrease in waiting times and interruption rates. However, 35% of bidders chose to bid above the On-demand price. Bidding above the average Spot price and bidding close to the On-demand price ensure a satisfying tradeoff between costs, waiting times and interruptions, while bidding close to the On-demand price

provide the maximum marginal difference. Therefore, the strategy to bid close to the reserved instance price is convenient for price-sensitive cloud customers with flexible tasks' deadlines. The strategies for bidding above the average Spot price and bidding close to the On-demand price are acceptable for cloud customers with equal requirements in terms of costs, waiting times and interruption rates.

Pricing and different bidding strategies (bidding close to the Spot Block price for one hour in previous time interval, bidding close to the Spot Block price for six hours in previous time interval, and bidding close to the On-demand price) for Spot Block instances along with the cloud provider's revenue analysis are proposed by Mikavica & Kostic-Ljubisavljevic (2018). Bidding and allocation of Spot Block instances are more complex as compared to regular Spot instances. Additional complexity is introduced by allowing that Spot Block instance runs without termination even if the market price exceeds the Spot Block price. Since Spot Block prices per hour are different for different Spot Block Duration, bids cannot be sorted only based on their value. A model for the translation of bids into unit bids in order to enable their easy comparison in an auction mechanism is proposed by (Mikavica & Kostic-Ljubisavljevic, 2018).

The optimization of cost-availability tradeoff can be achieved through different bidding strategies. When a cloud customer increases their bid, their availability also increases at the expense of more pay per hour. Furthermore, the availability of idle resources is not sensitive to bidding for a large range of bid prices. Similarly applies to the costs, since there is no penalty for bidding high due to the auction's properties. Another important metric is the frequency of revocations. Regardless of the bid price, revocations are inevitable when using cloud idle resources. In accordance with, some studies show that cloud customers need not employ some complex bidding strategies (Sharma, Irwin & Shenov, 2017). Instead, customers should choose appropriate instance type in order to reduce the revocation risk and bid price equal to the On-demand price. However, the recommendation is to select different instance types and to apply migration to other instance types if necessary. This can significantly reduce the impact of revocations and concurrently to decrease costs. The effectiveness of cloud resources can also be improved. Therefore, the combination of proper selection of instance types and fault tolerance policies are key factors that determine performance and costs.

SOLUTIONS AND RECOMMENDATIONS

The optimization problem of the cloud provider's revenue maximization or resource allocation is NP-hard or NP-complete (Song, Yao & Golubchik, 2013; Wang, Ren & Meng, 2012). The implementation of such pricing and allocation mechanism requires a lot of effort and managerial overheads (Xu & Li, 2013). In addition, untruthful bidding and mutual cooperation between cloud customers can cause that auction-based pricing mechanism to become unprofitable for cloud providers (Karunakaran & Sundarraj, 2013). Cloud customers should recognize and control potential anchors that can influence their bid decision making. These anchors can be provider's recommendations, customers' guidelines, spot-price history, peer bids etc. In order to achieve an effective auction mechanism, customers should ensure that their bid decisions closely reflect their costs, waiting time and interruption rate tradeoffs. Some studies show that bidding above On-demand price is not efficient (Karunakaran & Sundarraj 2014). Therefore, cloud customers should choose appropriate bidding strategy with great caution.

One of the most important requests that auction should satisfy is truthfulness. An auction is truthful if participants in the auction cannot increase their revenues through untruthful behavior. Such truthful auction-based pricing and resource allocation mechanism is possible only if perfect knowledge about bidders' valuations is available (Wang, Li & Liang, 2012). Designing a mechanism that benefits both

cloud customers and cloud providers is of high importance. Cloud resource pricing and allocation with multiple customers' requests can be performed by a truthful auction-based mechanism, such that both cloud providers and cloud customers can benefit (Xie, Zhang & Zhang, 2017). In practice, cloud customers rarely know the exact capacity needed for completion of their tasks. Therefore, customer's task requirements are often inconsistent with providers' resource (Lu, Yu, Zhu & Li, 2018). A truthful double auction mechanism can be efficient in solving that issue.

Cloud customers are also exposed to some limitations in the auction-based provisioning of idle resources. The main limitation relates to the availability/reliability of cloud instances. Cloud provider controls termination of idle resources depending on the demand-supply relations and applies price adjustment. Thus, cloud instances can be terminated at any time. Performances are uncertain, which negatively impacts on the economic advantages of using cloud idle resources. Moreover, the potential frequent instance termination could eventually be inefficient compared to static pricing mechanisms (Shi, Zhang, Wu, Li & Lau, 2016). Therefore, dynamic pricing mechanisms are considered unsuitable for workloads with little flexibility and long-running tasks (Xu & Li, 2013). Another important issue in terms of auction-based pricing mechanisms is appropriate bidding. Bidding low prices can result in extremely low execution time without significant cost savings while bidding high prices can lead to large cost increase without reduction computation time (Kaminski & Szufel, 2015).

Most of the proposed pricing and allocation auction-based pricing mechanisms consider uni-attribute where cloud customers bid on price only. Parameters, such as reputation, customers' experience, etc. should also be taken into consideration (Baranwal & Vidyarthi, 2015). Therefore, a multi-attribute auction is a convenient solution that allows cloud customers to bid on various attributes of resources along with the price. The cloud provider chooses a winner based on the defined multi-attributes. In addition, cloud providers offer a collection of resources in form of bundles. Bundling based on the cloud customers' interests with maximization of cloud providers' profits is a huge research challenge. Combinatorial auctions seem like a promising solution since customers can bid for a bundle of dependent and complementary resources. Moreover, when there are multiple cloud providers and multiple cloud customers, it is preferable to apply double auctions, due to their greater efficiency compared to several single sided auctions. Cloud resources pricing and allocation occur either when the customers' request appears, or cloud resources become available. Each cloud customer has a practical budget limitation for a certain time period. Therefore, online auction mechanisms are appropriate due to time dimension consideration.

FUTURE RESEARCH DIRECTIONS

The coordination between cloud providers in an auction-based resource provisioning in the cloud market is an important issue. Hence, it would be beneficial to introduce the game theory into the auction mechanism, and potentially, to adopt auction-based resource allocation mechanisms between different cloud providers. Most of the game-theoretic studies on pricing and allocation of cloud resources consider only the competition between cloud customers competing for the resources of a single cloud provider (Valerio, Cardellini & Presti, 2013; Ma & Huang, 2012; Sowmya & Sundarraj, 2012). Truthfulness in an auction for cloud resources pricing and allocation is very complex and requires further analysis. Moreover, the tradeoff between efficiency and truthfulness should be also considered. Achieving a fair, truthful, efficient and revenue-maximizing auction mechanism is a highly challenging issue and requires a comprehensive analysis in the future.

Cloud resources' allocation and pricing should be considered from both the economic and computational points of view. From economic point of view, individual rationality should be further analyzed. The computational perspective focuses on the complexity of given auction mechanism. The development of a simple auction mechanism that can be executed in a reasonable amount of time is complex. In addition, all participants in an auction should communicate with each other with the least complexity. Furthermore, resource allocation and pricing in specific cloud service models should be analyzed. These challenging issues are potential topics for future research.

Double-sided auctions are computationally and economically efficient when there are very large number of participants in the market. Although practical implementation of double-sided auctions in cloud environment is not performed yet, there is great potential of its implementation. Since cloud resources are provided to the customers by the multiple providers, to design a standard for the resource offering is a complex task. The development of such design could be one of the future research directions. Additionally, the effects of migration of cloud customers from one to another cloud provider and associated costs should also be considered.

Further research direction could be to design game-theoretic strategies with multiple providers competing with each other. Cloud customers choose different strategies to increase their workflow completion time while cloud providers adjust their prices based on the market price in competition with each other. Therefore, the analysis of the market behavior of participants in the auction is another issue that should be improved. Optimizing costs, power consumption, the under-utilization of resources, requests' loss and balance load are challenging issues. Introduction of Service Level Agreement (SLA) management based resource allocation can improve the overall performance and hence, it should be the segment of future research. Cloud customers' bidding strategy depends on numerous factors including characteristics of their workload, deadline constraints, number of the cloud providers, alternative SLAs, etc. There are several issues related to bidding that might be improved, including bidding strategies in the presence of the irrational bidders and relations between price predictions and chosen bidding strategies.

CONCLUSION

Auction-based pricing and allocation of cloud resources receive a great attention among the researchers. Dynamic pricing has numerous advantages that influenced leading cloud providers to start offering their resources through different dynamic pricing and allocation mechanisms. Auctions are a very convenient solution for cloud providers' revenue maximization. Along with, they can provide incentives for cloud customers for truthful bidding. Pricing, bidding, and allocation of cloud resources require a comprehensive, multidisciplinary approach. These issues can be analyzed from different perspectives including price modeling, price prediction, bidding strategies, methods to improve the availability of resources, variants of fault tolerance etc. In this chapter, the major benefits of auction-based pricing and allocation mechanisms for cloud resources are emphasized. The importance of the selection an appropriate bidding strategy is also analyzed. Despite their advantages, auction-based mechanisms raise some research challenges. This chapter provides an insight into open issues and suggests possible solutions.

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KEY TERMS AND DEFINITIONS

Auction Mechanism: Often used pricing mechanism for cloud provider's idle resources. If properly set, an auction mechanism should support customers to bid truthfully for cloud resources and allocate resources to customers that value them the most.

Cloud Customer: Content/service provider or end user that rents cloud resources for execution specific tasks depending on their requirements.

Cloud Provider: Undertaking that provides storage and computational resources to cloud customers depending on appropriate pricing and allocation mechanism and resources' availability.

Cloud Resources: Virtual machines (VM) with specific computational and storage capacities provided to the cloud customers in the form of cloud instances. Cloud customers can rent those instances depending on their availability and applied pricing mechanism.

Pricing and Allocation Mechanism: Mechanism that determines which cloud resources will be allocated to which cloud customers at a specific price and specific duration.

Spot Block Instances: Subset of cloud provider's Spot instances. Cloud customers submit bids, determining the maximum price they are willing to pay for specific cloud instance per hour and the Spot Block duration up to six hours. The Spot Block runs uninterrupted up to Spot Block durations expires, regardless on the Spot Block prices.

Spot Instances: Cloud provider's idle resources provided through an auction-like mechanism, where cloud customers submit bids, i.e. maximum price they are willing to pay for specific cloud instance of one-hour duration. The spot instance can be terminated whenever the submitted bid exceeds the Spot price determined by the cloud provider.

Taking a Peek Behind the Corporate Finance in China

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INTRODUCTION

One of the most widely used concepts in corporate finance is the financial structure (Ayturk, 2017; Kowalewski, Stetsyuk & Talavera, 2007). Certain authors (Chi & Young, 2007; Taylor, 2013; Shi & Zhang, 2018), in their specialized publications, consider the terms financial structure, capital structure and capitals' structure to be synonymous. The financial structure takes into account the component of all company capitals and it may be rendered as ratio of own capitals to company debts, as ratio of company's internal to external financing sources, or as ratio of short-term financing to long-term financing (Elston, Chen & Weidinger, 2016).

Howsoever, an enterprise has the possibility to choose from several alternative financial structures (Wan & Yuce, 2007). In addition to the general term of capital structure, there is the term of optimum capital structure represented by the ratio of own capital to borrowed capital which leads to maximizing the shares' market price and which determines a minimization of average weighted cost of the enterprise's capitals.

In this context, a rather controversial issue in corporate finance related to capital structure was presented by Modigliani and Miller in a remarkable specialized work published in 1958. Subsequently, other theories were developed, which had as starting point the theoretical framework set by the two authors. Modigliani and Miller (1958) in their studies related to the manner of selecting enterprise financing, reach a paradoxical conclusion in the sense that various types of financing may be equivalent and then there cannot be an optimum financial structure in order to be able to optimize the capital cost. They explain that the capital cost remains relatively constant in situations in which the company adopts an indebtedness policy benefitting from a low interest because, in such situation, the cost of own capitals may increase due to the existence of risks, associated with the new loans (the shareholders' claims increase). Overall, the average weighted cost will be approximately the same. Moreover, the cost of capitals in the form of dividends cannot be compared to the cost of the other sources of financing.

In the classic western corporate finance theory, investors hold the right to vote in the market. When the incumbent management of the company is inefficient in operation, the original shareholders or the new shareholders acquiring company will acquire sufficient shares to obtain the control of the company and create a new receiver. Although U.S. laws have more legal restrictions on the takeover of compa-

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nies in recent years, the takeover market of the company remains largely effective in terms of external regulatory functions.

Although considering the information asymmetry and incomplete contract factors in the western classic corporate finance theory, it is considered that given the information premise, investors are completely rational and the market is effective (Koksal & Orman, 2015).

In China, due to the short development time of capital market, the phenomenon of speculation and stock price manipulation are more and the protection to investors is also weaker. Therefore, investors cannot correctly identify the signal of enterprise quality according to the relevant financial information (Wintoki, Linck & Netter, 2012).

Most of the listed companies, because of the phenomenon of “single domination”, when the incumbent management of the company is not efficient, unless the major shareholder is willing to negotiate the transfer of non-negotiable shares through the OTC, the outsiders are difficult to buy enough outstanding shares to achieve the purpose of taking over the company, that is, the imperfection of the company’s control market is difficult to play the role of external governance (Liu, 2017).

At the same time, Corporate Social Responsibility (CSR) is a useful instrument centered around two main directions: (1) increasing the competitiveness of Romanian companies based on China or foreign capital on the market; and (2) improving the responsibility of local communities, multinational companies, large companies, and SMEs regardless of their capital, whether public or private. The results of empirical studies on CSR communication have indicated that corporations in China are moving more easily from “visible” involvement to “real” involvement, proving a certain degree of progress and maturity when compared to the situation encountered before the economic and financial crisis in 2007. However, there is still a set of challenges such as the difficulty of quantifying the precise budgets allocated to CSR initiatives thus far by companies belonging to international or multinational groups and the inadequate frequency of communication channels selected by companies in transmitting their CSR messages (Morck & Yeung, 2014; Shi & Zhang, 2018; Chen, Li & Xin, 2017).

Later on, Ross, Westerfield & Jaffe (1993) emphasized that the model elaborated by Modigliani and Miller in 1958 is a theoretical version which has no solid empirical basis. Subsequently, Modigliani & Miller, in a specialized paper published in 1963, handled the issue of capital structure in the taxation hypothesis, emphasizing the effect it has on debts and own capitals in an indebted enterprise and in a debt-free enterprise. As well, in case of applying taxation, the enterprise’s financial structure cannot be neutral anymore, because the debt, which is deductible when calculating the taxable profit, the average weighted capital cost in an indebted enterprise is decreased as a result of fiscal savings, and in this case the financial structure indeed influences the company’s value

There are many research achievements in corporate finance field, mainly including: capital cost analysis, financing preference analysis, capital structure decision, the relationship between capital structure and company performance. In the research of capital cost analysis, the capital cost of listed companies in China is mainly calculated by capital asset pricing method in classic corporate finance theory and Modigliani and Miller average cost pricing method. In the research of financing order and capital structure, most of them are empirical studies, and most of them discuss the possible economic influence variables according to the western classic corporate financial model, and then establish the model to conduct the measurement test. In the analysis of the empirical results, the key point is also to judge whether the financial decision-making behaviors of listed companies in China conform to the conclusion of classic corporate finance theory.

This chapter studies the difference between the theoretical premise of western corporate finance and the corporate finance theory in China. The authors construct an econometric model for corporate gov-

ernance mechanisms adopted by 150 firms on the newly established Growth Enterprise Market (GEM) in China. The main conclusions of this study are as follows: the cost of capital of listed companies in our country is declining, listed companies have a strong preference for equity financing, on the capital structure of the factors, in addition to capital costs, industry factors, but also includes the size of the enterprise, profitability, business growth and other factors. However, in the above studies, institutional constraints on the nature of the economy and the external economic environment are often overlooked, and the impact of external factors is not controlled.

This chapter is structured in the following way: in the first section, the authors will introduce a brief outline of the main dimensions of the evolution regarding the corporate finance theory; in the second section, research methodology will be discussed; in the third section, the results of the study will be discussed; finally, the authors will argue the conclusions and will presented this paper's limitation.

BACKGROUND

In time, several researchers (Stiglitz, 1969; Jensen & Meckling, 1976; Jensen, 1986; Myers & Majluf, 1984; Baker & Wurgler, 2002) also emphasized other aspects of the theories related to capital structure, with reference to costs due to lack of liquidities, bankruptcy costs, agency costs, asymmetry of information, etc. The capital structure can decrease the agency costs, but achieving such an optimum capital structure which decreases the agency costs and also ensures the financing resources is a rather ideal aspect.

Regarding the grouping of factors which determine the capital structure, several specialized works among which there is the work of Hermanns (2006), two categories of factors are emphasized: external factors and enterprise specific (internal) factors. The external ones take into account economic growth, the size of inflation and the average interest rate. Also, in the specialized studies of many authors, internal factors are emphasized in terms of the achieved profitability (Wu, Gao & Peng, 2003), enterprise size (Rajan & Zingales, 1995), assets' tangibility (Titman & Wessels, 1988; Rajan & Zingales, 1995; Fama & French, 2002; Nivorozhkin, 2004; Daskalakis & Psillaki, 2008), occurrence of enterprise bankruptcy (Su, D. (2005).

In the statistical models elaborated by Booth et al. (2001) and Rajan & Zingales, (1995) certain differences were emphasized between the financing behavior of enterprises in developed countries and the behavior of enterprises in emerging countries, which were explained in terms of the nature of correlations among specific enterprise factors and their level of indebtedness (Booth et al., 2001; Chen, 2004).

A series of studies indicates as well that corporate governance may become an important factor to the dividends policy, indicating a positive correlation between the allocation of dividends and the good practices of corporate governance of the respective company (Kowalewski, Stetsyuk, Talavera, 2007; Wang & Guo, 2011).

In one of his studies (Mitton, 2004), the author emphasizes that companies with solid corporate governance standards can pay higher dividends. These companies are more profitable, and higher profitability explains the high levels of dividends. Likewise, the "positive relationship between corporate governance and dividend payment is found firstly in countries with a strong protection of investors, emphasizing the fact that corporate governance at company level and the protection of investors at country level are complementary rather than substitutes."

In the studies performed by some authors a series of factors are emphasized which can lead to adopting corporate governance codes in countries with emerging economies, such as: "the increase in the amount and the nature of financing structures which companies have access to, the decrease in capital

cost and the increase in company value, the increase in operational efficiency due to efficient allocation and management of resources, the more effective operation of financial markets” (Claessens & Yurtoglu, 2013; Cuomo et al., 2016).

In the opinion of authors Agrawal, Catalini and Goldfarb (2015) a corporate governance mechanism, if applied correctly, leads to “limiting the managers’ various discretionary actions taken in order to increase or decrease the share prices, and also to correct financial reporting, which brings along credibility to investors”. Moreover, the corporate governance mechanism would also lead to “motivating” managers into increasing the enterprises’ long-term value (Eisenhardt, 1989).

In the past decade, the number of studies on corporate governance has increased at global level, including Asia. Some of these studies are based on ideas inspired from the principal–agency theory. Authors (Shleifer & Vishny, 1997) emphasize the fact that managers, although they are “agents” of the shareholders, can also have interests which are incompatible with the principle of maximizing the overall value of the company, as principle of healthy financial management.

Authors (Chen, Cheong & Rasiah, 2016; Morek & Yeung, 2014), in a recent study, research the influence of corporate governance during the state enterprises’ reform period in China. An issue which is increasingly debated regarding the internationalization of enterprises in China is the fact that a large number of these enterprises are state enterprises, and the principles of corporate governance are difficult to implement. Furthermore, the listed company’s debt constraint is a kind of soft constraint. There are many non-economic factors in the company’s bankruptcy mechanism, and the administrative interference of the government has a great influence on the bankruptcy mechanism (Guney, Li & Fairchild, 2011). Also, the lender as the creditor is often excluded from the bankruptcy liquidation. In addition, there is no vote on the liquidation of an enterprise’s property (Ding, Nowak & Zhang, 2010). Due to the government financial guarantee (avoid bad debt), so the creditor banks have neither the ability nor the motivation to carry out the control of financial distress companies.

The maximum statutory tax rate of corporate income tax in China is 33%, but the percentage of the statutory tax rate of 33% of listed companies implementing the whole is very small (Yuan, Xiao, Milonas, & Zou, 2009). Generally, the preferential tax rate and many non-tax concessions are available. The statutory tax rates of listed companies in different industries, regions and scales are distinct. In this case, it is difficult to judge the tax.

On the other hand, other authors (Huang & Wright, 2015; Kling & Weitzel, 2011) identified a series of elements (company characteristics, the effects of industry and corporate governance mechanisms) which favor the internationalization of these companies, reaching the conclusion that cross border mergers and acquisitions lead to increasing share value, but enterprises which are the property of the Chinese state achieve too few cross border mergers.

In one of his papers, author (Li, 2007) emphasizes the recent changes which have occurred in China such as those related to property structure and the corporate governance practices, arguing that enterprise performance and also efficiency can be influenced significantly by the various market conditions. Also, a successive transformation of property and the introduction of corporate governance practices are almost impossible to achieve without there being mutations once the markets are re-launched in order to operate sustainably.

Despite all progress made by China in terms of re-balancing the economy mostly, we must still take into account the lack of transparency, the industrial policies, the still dominant position of state enterprises and a series of non-tariff measures which discriminate against foreign companies (Qiao, 2013).

Yet, the introduction of the new foreign exchange mechanism in 2015, and the less tight regulations regarding the purchase of shares with level effect could lead to an increased volatility of share markets

in China (Wei, 2017). Thus, the consolidation of the rather frail corporate environment in the past years could have new meaning in the process of reforming and liberalizing this country's economy.

RESEARCH METHODOLOGY

The empirical research builds on sample of 150 listed firms, using data from the Chinese Stock Market and Accounting Research (CSMAR) database for the financial years 2012- 2016. This analysis is based on the information discovered following the documentation process, by means of comparative research methods and critical analysis, supported by professional reasoning. We calculated both the market value-based financial leverage ratio and the book value-based debt-to-assets ratio as proxies for capital structure. We also analyzed, during the conceptual and empirical incursions, along with the financial risk, technical elements related to the corporate governance structure. The information's were processed using the Scientific Package for Social Sciences (SPSS) 17.0 and the making of the database structure was achieved by defining variables in Variable View.

In order to test the predictive quality of the corporate finance to forecast future operating cash-flows, the model formulated in this way is the following:

$$CF_{i,t} = \beta_0 \beta_0 + \beta_1 \beta_1 CFO_{i,t-1} + \beta_2 \beta_2 MVBF_{i,t-1} + \beta_3 \beta_3 ETS_{i,t-1} + \varepsilon_{i,t} \quad (1)$$

CFO: Operating cash-flows

MVBF: Market value-based financial leverage ratio

ETS: Executives' total shareholding

All the coefficients are β_1 , β_2 and β_3 are significantly positive at the level of 1%. In order to concretize the adoption impact of the corporate governance mechanisms on the predictive ability of the operating cash-flows and essentially on the predicative quality of corporate finance, we were based on the same steps to measure the market value for Chinese listed SMEs. The application of Hausman's specification test served to decide about the use of model fix effect or aleatory model. This test proves that the fix effect model is better adapted for the date in this context for the period before adoption of corporate governance mechanisms. The synthesis results in the Table 1exposes that the market value-based financial leverage ratio impact on the prediction of future cash-flow of exploitation is positive. As far as the executives' total shareholding, the estimations prove the positive significant impact. The same remark is indeed for the cash-flow of exploitation. In addition, the Fisher's test linked to the global validity of the model announces that it is significant.

The results show that the proportion of tradeable shares improves access to external debt and reduced the information asymmetry between borrowers and lenders, thereby facilitating better leverage decisions by the lenders. These findings highlight the need to improve the corporate governance of Chinese listed SMEs in order to facilitate their ability to access external debt from increasingly risk-averse lenders. The positive relationship found between executives' total shareholding and leverage suggest that policy makers should provide additional support and training for investors, to ensure that they play more of an active role in monitoring management.

Table 1. Synthesis of statistics related to regression of future operating cash flows

Variable	Coef	P-value
Constant	5,792	(0,000)***
CFO _{t-1}	0,2539	(0,016)**
MVBF _{t-1}	1,241	(0,000)***
ETS _{t-1}	0,155	(0,000)***
Model validity tests		
Hausman test Chi2 Prob>ch2	149,47 (0,0000)***	
test Breusch-Pagen Chi2 Prob>ch2	9,26 (0,0022)***	
Fisher test F Prob > F	8,72 (0,0000)***	
<i>N observations</i>	150	
<i>R²overall</i>	64,53%	
*** significant at the level of 1%, ** significant at the level of 5%, * significant at the level of 10%		

In spite of this study bringing, it seems that our results should be interpret with caution. Indeed, to study the predictive power of the operating cash-flows on a sample of heterogeneous enterprises may be a source of bias.

SOLUTIONS AND RECOMMENDATIONS

In interpreting the financial behavior of listed companies, it is necessary to determine who the decision-maker of a particular financial behavior based on the corporate governance structure and what is the objective function in reality and what are the constraints. It cannot be like Western classic corporate finance theory, thinking that the company is in an ideal state of corporate governance, and that financial policy-makers are the objective function of maximizing the company's shareholder value. For example, in China, judging from the corporate governance structure of a listed company, it is the core shareholder who owns the company's control right. The objective function in reality is to obtain the maximization of "control rent" (in different specific area of financial decision-making, "control of rent maximization" can be transformed into different specific goals). Constraints are the actual conditions of other interest balances and capital markets in the corporate governance structure. The correlation between CSR and profit, and how companies behave while they are experiencing losses but still carry out CSR activities have been analyzed in China. Finally, the actual financial decisions can be explained behavior. The process of developing CSR policies and the benefits from the involvement of all key actors including legislators, academia, business, and stakeholders are also important. Despite their general involvement, there is a general lack of coordination between these efforts. If we take into account the dividend rate estimate, then there is the issue of implementing concrete methods to determine the shareholders' expected profitability (Du, Jian & Lai, 2017). Thereby, majority shareholders are interested in long-term investments which do not take into account an immediate profitability per share, being willing to wait for

an increase in the shares' value in the future and for subsequent dividends. On the other hand, a minority shareholder more often than not aims at short-term profitability with immediate dividend.

In support of the major impact that regulations had in the stage of the corporate finance evolution, we propose the following solutions: solutions:

- A better delimitation of financial factors that determine the optimality of separation;
- The risk neutral valuation must require as many contingent claims be traded as possible jump levels ;
- Investors can base their decisions on information provided by the investment behavior of other crowd investors.

FUTURE RESEARCH DIRECTIONS

Through the goals set, this chapter has touched its target. The presented and analyzed issues are a synthesized part of the vast amount of information that has been developed by the authors to create the framework for underlining the importance of the theory of corporate finance in China.

Therefore, new directions of future research have been created, such as:

- Analyzing the impact of managerial decisions resulting from the adaptation of the principles of corporate governance;
- The assessment of the financial risk within a company can be made by assessing the reiterative frequencies of such events attesting the risk presence (for example, rectifying statements and reports);
- Analyzing the possibility of creating new tools for monitoring and measuring financial performance/performance based on the enterprise's financial structure.

Future research may investigate whether the corporate governance mechanisms improve firms' access to debt in other emerging economies and whether the access to different sources of debt has a resultant influence on the performance of SMEs.

CONCLUSION

Often under the umbrella of the speculation label or hidden legality operations, which aimed to attract investors to investments that are too risky and ultimately proved to be damaging to them (Huang, Boateng & Newman, 2016). Developed markets have issued, based on the rich experience accumulated in the field, a set of rules for the leadership of listed issuers that provide robust hedge against speculative operations to mislead investors by protecting their funds and hence retaining the positive nature of speculative operations.

In the study of the optimal financial decision-making of listed companies, we first need to determine what the objective function of financial decision-making is, and then different corporate governance concepts. However, with the development of modern companies in China, the company's goal is not to maximize the stock market value or maximize shareholders' interests, but to consider the interests of

stakeholders, that is, the “stakeholder theory.” Corporate governance is described as the behavior and outcome of all stakeholders and there is no internationally accepted model of corporate governance.

The results show that China is in the process of transition to a market economy, and the direction of corporate governance structure development in the future and what kind of concept to take in corporate governance are still inconclusive. Western corporate finance research is to maximize the value of the company as the goal, and its essence is still based on the investor, but also because the shareholders of the stock is fully tradable shares. Bonds of creditors can also be traded, so maximizing the value of company is the same as maximizing the company’s stock and bond market prices.

On the other hand, China has totally different situation. First, most of the corporate debt is bank loans, transactions cannot be traded, and creditors pursue the security of corporate finance and principal repayments. Second, most of the shareholders in the stock market are non-tradable shares. They can transfer a limited agreement. The transfer price is equal to net assets, so that this part of the non-tradable shareholders to maximize its value must maximize the amount of its own net assets. Thereby, tradable shares of shareholders in the market circulation of the transfer maximizing stock prices. It can be assumed that under the current control of non-tradable shareholders, financial decision-making reflects the controlling shareholder’s intention of “maximizing business control.”

In the future, with the gradual full circulation of state-owned shares, different corporate governance models will lead to different corporate financial targets. Therefore, in the corporate finance research, behavioral interpretation or the optimal design cannot leave this country’s special institutional background.

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KEY TERMS AND DEFINITIONS

Capital Markets: Those financial markets, including institutions and individuals that exchange securities, especially long-term debt instruments.

Capital Structure: Is made up of the liabilities and equity of a company.

Cash Flow Financing: Short-term loan providing additional cash to cover cash shortfalls in anticipation of revenue, such as the payment(s) of receivables.

Corporate Finance Theory: Is a science that studies the flow and operation of company funds.

Decision: A person or group of persons’ social and deliberate act defining the purpose and the objectives of a certain action, the directions and the ways to achieve that action, all of them determined, according to a certain need, by a process of obtaining information, deliberation, and assessment of the means and consequences of carrying out that action.

Economic Management: The achievement of the budget objectives with minimum costs so that when the activity is completed the revenue exceeds the costs, namely there is a profit that ensures a level of profitability as high as possible both at general level and by product, department, or service performed.

Financial Instruments: Tools for managing the risk of business problems related to economic changes such as higher interest rates, higher oil prices, higher inflation, or fluctuating foreign exchange rates.

Funding Capital Assets: Assets used in a governmental unit that are part of a proprietary or fiduciary fund.

Market Value-Based Debt Ratio: Represent the book value of debt/ (market capitalization + book value of debt).

Performance Measurement: Determining how well a company or one of its subdivisions has done during the period.

Financial Education

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INTRODUCTION

As defined by the OECD (2005b), financial education refers to the “process by which financial consumers improve their understanding of financial products, concepts and risks and, through information, instruction and/or objective advice, develop the skills and confidence to become more aware of financial risks and opportunities, to make informed choices, to know where to go for help, and to take other effective actions to improve their financial well-being”.

Financial education is therefore defined as a process oriented towards helping the financial products consumer develop a series of skills that enable him/her to make better financial decisions based on greater financial knowledge and better decision-making techniques (Lusardi & Mitchell, 2014). The possession of such skills has, in turn, been termed “financial literacy”.

The PISA report also pointed to the need for a homogeneous unit of measurement to assess the outcome of the educational process in terms of “literacy”. The term literacy has been defined as “the capacity of students to apply knowledge and skills in key subject areas and to analyse, reason and communicate effectively as they pose, solve and interpret problems in a variety of situations” (OECD, 2012:12). This definition clearly reflects what the focus of financial education should be: not the degree of mastery of the academic curriculum content, but the ability of young people to make informed, responsible and therefore effective financial decisions, by applying the lessons learned on personal finances (OECD, 2012).

Therefore, financial literacy implies having the appropriate knowledge, skills, behaviours and attitudes (Atkinson & Messy, 2012, ACCA, 2014:4), since all of them are necessary to make suitable financial choices and thus improve individual well-being (OECD INFE, 2015b: 5). That is, financial skills include not only the possession of financial knowledge, but also more broad-spectrum cognitive processes such as searching, comparing, contrasting, extrapolating, evaluating and applying information within a financial decision-making context.

The objective of financial education is therefore well defined: to improve personal financial well-being, with a particular focus on personal finances, but also aimed at fostering an ability to understand and manage broader and more complex aspects of the economic system. These range from the simple and most common, to more complex and unusual financial contexts, which have lasting consequences.

This article defines the concept of financial education as well as the results achieved at an international level. The article also analyses the potential consequences of higher-level financial education for citizens and financial consumers. Finally, the article summarizes the main positions for and against financial education and draws conclusions in the form of recommendations for designing and implementing financial education programmes. The article carries this out through a thorough review of the existing to date literature, as well as through a novel review of the different financial education programs carried out internationally and their obtained results.

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BACKGROUND

1

Despite the vital importance of financial education and literacy, the reality is that the level of financial knowledge varies substantially worldwide.

The Global Financial Literacy Test carried out by Standard and Poor's with the collaboration of the World Bank in 2014 has revealed a worrying situation: only one-third of the surveyed adults were labelled as financially literate, in that they demonstrated an understanding of basic financial concepts such as risk management via diversification, simple and compound interest calculations, inflation and purchasing power. However, there are highly significant differences between countries in the level of financial literacy.

In a global financial environment with an ever-increasing number and complexity of financial products, an uneducated citizen is inevitably at a disadvantage when it comes to making informed financial decisions. Users who fail to understand basic financial issues often overestimate their ability to manage their personal finances; being overly self-confident makes them believe that they have a significantly better understanding of financial issues than they actually do (Arellano, Cámara & Roasta, 2014; Hospido & Villanueva, 2016; Lusardi & Mitchell, 2014).

The problem is thus twofold: the adult population shows a deficient knowledge of basic financial concepts, but also has an unrealistic perception of their level of understanding. This explains why, for example, 60% of American adults admit to not having a budget, less than half have savings for emergencies and the average family debt on the credit card is 3,000 dollars (McCormick, 2016). Or why an investigation by the Financial Services Authority (2006) concluded that 70% of UK citizens did not have provisions to cover an unexpected drop in income.

The insufficient financial capability of the adult population is also an incremental problem, which grows over time, as shown by the Financial Industry Regulation Authority with data from the National Financial Capability Study. Among the Silent Generation (those over 66 years of age), 65% saved for emergencies, only 8% used non-bank loans, and 14% spent more than they received. Millennials, meanwhile, show a radically different distribution: the percentage of individuals who save for emergencies has more than halved (32%), while over-consumption via non-bank loans has increased to 43%, and 23% of this age group spends beyond their means, spending more than what they receive as an income. This attitudinal change comes together with a collapse in the high levels of financial education, which has fallen from 55% in the Silent Generation, to 24% in Millennials.

The first international institution to promote financial literacy was the OECD, launching its Financial Education Project in 2003 in response to the growing interest of Member States in improving the financial culture of their citizens. This project culminated in 2005 with the publication of the book, *Improving Financial Literacy: Analysis of Issues and Policies*, which recommended promoting the financial education of citizens at all stages of life, in order to improve both personal and collective well-being. This publication served as a basis for managers to implement effective financial education programmes inspired by best practices and experiences at the international level. The OECD has continued to produce studies promoting the need to improve the public financial culture (OECD, 2008, 2014A, 2016).

However, it was with the outbreak of the international financial crisis in 2007 that a huge rise was seen in both financial education programmes and institutional initiatives, in response to the widely-supported thesis that financial illiteracy bore a good deal of the responsibility for triggering, or at least exacerbating, the crisis (OECD, 2009:9). In 2008, the European Parliament advocated for the establishment of a financial education network with the participation of public and private actors. U.S. President Barack Obama proclaimed April 2010 as the National Financial Literacy Month. Likewise, in 2012, the G20

showed its support for the principles of national financial education developed by the OECD International Network on Financial Education (INFE) (2012A). The suffering of the people caught up in the problems stemming from the financial crisis explains why the European Commission (2009:2) referred to the recent recession as a pedagogically usable moment because it helped direct adult consumers' attention towards financial education, in search of explanations and solutions to the problems they were facing.

The largest-scale initiative undertaken by the OECD in this field was to establish a framework for the design and implementation of financial education programmes and the general principles that should inspire them (OECD INFE, 2012A; OECD, 2013a, B, 2015b), as well as the introduction in 2008 of the International Gateway for Financial Education. The best evidence of the hugely positive response to these initiatives after the crisis has been the growth of INFE launched in 2012 by the OECD, which has attracted massive support from APEC (Asia-Pacific Economic Cooperation) and the G20 (San Petersburg Summit, 2013), among other institutions. Another broad alliance committed to funding programme evaluation is the Russia/WB/OECD Trust for Financial Literacy and Education. Concern about assessment has also led to the inclusion of a specific block on financial education in the PISA reports from 2015, following a pilot test in 2012.

The financial education programmes developed by different countries have not only proliferated in quantity but also in variety, including a diverse set of initiatives such as publications, internet portals, publicity campaigns, dissemination events and advisory services. Despite the difficulty of carrying out a complete inventory of these initiatives, as the OECD itself acknowledges (2016:34), this organization has persevered in this endeavour by promoting the International Gateway for Financial Education (www.financial-education.org) as an international reference database on the subject.

Financial education has also prompted projects on the G20 agenda, which in 2011 adopted the principles for the protection of financial consumers as a method of restoring confidence in the sector and strengthening financial stability. In January 2017, its programme of action addressed digitalization, inclusion and financial education, under the rationale that digital technologies may be a key tool for delivering financial education and ensuring financial inclusion.

FOCUS OF THE ARTICLE

The Debate Around Financial Education

The expansion of financial education initiatives and citizens' growing awareness of this subject has led to a situation where a large majority wants to learn about financial issues, even if they do not have a strong financial background.

But despite this broad social support, there is no shortage of dissenting voices regarding the introduction of financial education in schools. This has led to a lively debate on the advantages and disadvantages of such teaching, which has raised doubts even among columnists such as Tim Harford (2014) writing in the *Financial Times*, a publication that a priori might be assumed to be a defender of financial culture.

Defending the Value of Financial Education

Viewed as a form of human capital that has a cost (in the case of free programmes, it is not a monetary cost but learning does entail a cost in terms of time and effort), the optimum level of financial education will depend on each individual. Each person will invest in improving their financial capacities to the

point where the marginal costs of time and effort equal the marginal benefits. If these marginal benefits diminish because one person can benefit from another's financial advice, which compensates for their financial ignorance, the incentive to increase financial knowledge decreases. However, financial education is one of the few subjects that addresses issues that will be play a part in the lives of all people, whether as workers, savers, investors or consumers.

The specific personal benefits expected from financial education include the following:

- It has a positive impact on young people's financial knowledge. (Danes, Huddleston-Casas & Boyce, 1999; Bernheim, Garrett & Maki, 2001; Swinton, DeBerry, Scafidi & Woodard, 2007; Waldstad, Rebeck & MacDonald, 2010; Lührmann, Serra-García & Winter, 2015).
- It helps young people to understand the value of money and savings, to develop budgets that enable them to manage their income and distribute it between consumption and savings, and to keep their expenses under control (Bernheim, Garrett & Maki, 2001; Lusardi & Mitchell, 2009).
- It is a preparation for independent living because, for example, it teaches young people to manage loans to fund studies.
- It helps to plan ahead for the savings needed to meet future needs (e.g. retirement derivatives) or unforeseen situations (Lusardi & Mitchell, 2009).
- Greater financial knowledge is associated with prudent behaviours such as the diversification of investment portfolios or the prevention of over-indebtedness (Christelis, Jappelli & Padula, 2010, Van Rooij, Lusardi & Alessie, 2011, Lusardi & Tufano, 2015).
- It helps people contract products such as mortgages and loans with lower costs in terms of interest and commissions (Lusardi & Tufano, 2015).
- It offers knowledge that can prevent people from becoming victims of errors and fraud. However, more knowledge in this area may encourage greater frequency of use of financial instruments that expose people to greater risk (Otto, 2013).

The benefits derived from an effective financial education are not limited to the private sphere; some extend more broadly to the social sphere. Examples of such benefits include:

- Facilitating the development of a well-prepared citizenry, able to understand problems and their financial solutions, and who hold values related to saving, austerity, foresight and productive investment.
- Achieving social inclusion and a more participative society.

The third block of advantages refers to general economic benefits, which can be divided into four classic aspects of economic analysis; namely, resource allocation, economic stability, economic development and distribution (Domínguez, 2017):

- Benefits relating to resource allocation, as a competitive, efficient and stable financial system can play a Schumpeterian role stimulating an efficient allocation of capital between projects, helping to correct the bias that results from overvaluing present rewards compared to future ones, and establishing a more balanced economy.
- Benefits relating to economic stability, which mainly result from positive externalities due to their nature as public good. Financial education brings greater levels of transparency and security to the relationships between financial services users and financial institutions, and creates better-

prepared investors and more transparent markets. In turn, this can boost the efficiency of the financial system, preventing credit bubbles and ensuring greater protection of the users of financial services.

- Benefits from economic development, including developing capital markets resulting in greater entrepreneurship, enhancing innovation and higher economic growth (OECDINFE, 2015a).
- Benefits relating to distribution, as financial education helps to eliminate or mitigate another market failure, namely the problems of financial exclusion (Villasenor, West & Lewis, 2016:18). Ignorance of basic financial issues considerably reduces the likelihood of people's participation in the financial markets (Van Rooij, Lusardi & Akessie, 2011). The extent of financial exclusion has been estimated by Atkinson & Messy (2013) at 2.3 billion adults who work but who do not have an open account in any formal financial institution. Therefore, financial education can help to improve the economic position of the more disadvantaged social groups that often lack the resources required to access the financial system.

Despite the breadth and importance of the aforementioned benefits, which in the first cycle of research received practically unanimous support from the academic community, there have been some adverse reactions to the programmes that have called into question the effectiveness of the deployed initiatives.

Against the Effectiveness of Financial Education

A first group of critical voices has focused on the debatable effectiveness of financial education in terms of increasing knowledge in this field and shaping behaviour. On the basis of theoretical reasoning, some critics have questioned the universal ability of such programmes to solve financial problems. Willis (2011 a, b), in two highly critical articles, argues that financial education can have a null and even negative effect for two reasons: its inability to adapt to the speed of change and the complexity of financial products and markets, which non-specialists cannot fully understand; and its inability to counteract the greater marketing power of financial institutions.

On the other hand, there are still relatively few methodologically rigorous studies confirming the relationship between financial education and personal behaviour involving a greater propensity for saving and making long-term investments, as Atkinson, Messy, Radonivich & Yoong (2015) conclude in their review of the literature. Even the meta-analysis carried out by Fernandes, Lynch & Netemeyer (2014) concludes that the initiatives designed to improve financial knowledge only explain a very small part (0.1%) of the variance in the subsequent financial behaviour of the recipients of this training, and the partial effects of financial literacy decrease when using an instrument to control for omitted variables.

This criticism is timely because it has highlighted the need for rigorous evaluations of the effects of financial education programmes on the knowledge and financial behaviours of recipients, as well as on society and the economy as a whole (Domínguez, 2017). Despite this need, the number of evaluation studies in this area is fairly small. For example, in the PISA 2012 report only 18 of the 65 countries participating in the evaluation (mathematics and language) opted to assess financial literacy. Haslem (2014:50) indicates that few evaluations follow the standard requirements for experimental studies, including the use of a control group (individuals who have not participated in the initiatives), which can blur the significance of estimated impacts. Another methodological error that occurs rather frequently when appropriate econometric methods are not used is the problem of endogeneity (Lyons, Palmer, Jayaratne & SCHERPF, 2006). This can arise through errors of measurement of the dependent variable, the existence of simultaneity between the dependent and independent variables or the omission of a variable

correlated with an independent variable included in the model. The meta-analysis of Fernandes et al. (2014) confirms this risk by finding that studies analysing the relationship between financial education and financial literacy through simple correlations report much higher positive results than those that have employed techniques that prevent endogeneity problems. For all these reasons, Lusardi & Mitchell (2014) claim that few empirical studies can be considered as serious assessments of the effectiveness of financial education programmes.

The assessment of the positive impact of financial education initiatives is also extremely complicated because the variables that can be used to measure their effects (such as the delinquency rate or the volume of funding available) are influenced by a combination of forces that are hard to separate. The analysis of the effectiveness of financial education has helped to highlight the factors associated with the acquisition of financial knowledge; together with the educational system, these include other determinants related to the family environment and the personal profile of the students, which can explain 80% of the total variance of the results (Moreno, Campillo & Salas-Velasco, 2015).

Within students' personal profile, gender stands out as a discriminating variable, with both adult men (Lusardi & Mitchell, 2008) and young male students (Lusardi & Mitchell, 2009) getting better results. The student's age and whether they are native or immigrant have not resulted in significant differences in the causal models constructed with the PISA 2012 data (Cordero & Pedraja, 2016A).

The family's economic context plays an important role in explaining young people's financial knowledge, according to international evidence (Lusardi & Mitchell, 2009; Lusardi & Mitchell, 2014; Van Rooij et al., 2011, 2012). Entrepreneurs tend to impart a higher level of financial education than employees, who in turn provide more education than unemployed people (Lusardi, 2015; Trombetta, 2016).

The results of the evaluation can be significantly skewed by factors such as whether the teaching centres are participating voluntarily in the programme, the design of the course (in terms of technical adequacy of the content, structure and teaching methodology) (Waldstad, 2013), the degree of training and technical specialization of the teachers, and the characteristics of the formative action in terms of the time that should be dedicated to it and operational aspects. Some research, such as the study by Vrenning (2014:42), concludes that even a single three-hour class might be enough to boost people's financial self-confidence and help them improve their finance decisions. However, Harford (2014) questions whether such depths of financial ignorance can be fixed with a few night classes. Therefore, as Ambuehl, Berheim & Lusardi (2016:34) recognize, it is necessary to discern whether brief financial education actions can be effective. In short, as indicated by Haslem (2014:50), the quality of the financial education must be determined before its effects on students' knowledge of the subject can be inferred. Hastings, Madrian & Skimmyhorn (2012:16, 31-32), after expressing scepticism about the certainty of the positive relationship between education and financial knowledge, subsequently add that well-designed and well-implemented financial education programmes seem to have a positive impact.

The students' environment in terms of friendships, both in and outside the school, has also been analysed because it gives rise to valuable social and cultural capital. The peer effect has been shown to have strong explanatory power for student's financial knowledge (Cordero & Pedraja, 2016a), and the effect is stronger still when the school registers below-average performance (Albert, Neira and García-Aracil, 2014).

Finally, the level of financial literacy is influenced by the socioeconomic characteristics of the population, including the level of GDP per capita (Klapper, Lusardi & Oudheusden, 2015). There is a positive relationship between per capita income and financial education, but only for the top 50% of economies in terms of living standards. In these economies, 38% of the variation in the financial literacy rate is explained by per capita income.

The debate on the correlation between the degree of financial knowledge and certain practices in the management of personal finances even extends to the problems of establishing the direction of causation (Lusardi, 2011:45) and the meaning of causality. Hastings, Madrian & Skimmyhorn (2012:15) raise the question of whether it is financial education that leads to behaviours that generate better economic performance or, conversely, whether engaging in certain financial behaviours leads to better education in this field, in a manifestation of the well-known learning-by-doing effect. However, Lusardi & Mitchell (2014:34) reaffirm the thesis that causality flows from financial education to financial behaviour, citing as evidence experimental studies based on instrumental variables.

Another criticism of the early introduction of financial education in the school curriculum alludes to its limited usefulness, because of the time that elapses between receiving the financial education and having the chance to apply it: much of the knowledge acquired will have been lost by the time its use is required (McDermott, 2014; Eley, 2014).

The effectiveness of financial education is also conditioned by the student's attitude towards the subject. Both students' self-confidence (Arellano et al., 2014) and effort (proxied by indicators of perseverance) (Fernandez de Guevara, Serrano & Soler, 2014) have been identified as moderating variables of the effect of education on financial knowledge). On the other hand, financial experience (whether in managing bank accounts or credit cards) does not contribute significantly to influencing students' financial competence (Fernandez de Guevara, Serrano & Soler, 2014).

Cordero & Pedraja (2016a, B), based on the results of PISA 2012 at the international level, find a positive impact on financial knowledge only if the financial education is incorporated within other subjects rather than delivered separately. This is, of course, a surprising result, since it implies that teachers who are not specialized in the field get better results than those specifically trained in it. The potential for boosting students' academic performance with improved teacher training is very high (Waldstad, Rebeck & MacDonald, 2010). A report from Smart Tennessee (2010) estimated that the percentage of students with a grade of 70% or higher grew from 10.2% to 42.7% in elementary school, and from 2.6% to 39.5% in middle school, when comparing the situation before and after teacher retraining schemes and the integration of the educational centre in Financial Fitness for Life, a programme promoted by the Council for Economic Education.

SOLUTIONS AND RECOMMENDATIONS

The variation found when analysing the effects of financial education on acquiring financial knowledge and adopting good financial practices certainly makes it difficult to develop appropriate training programmes that meet recipients' needs and are adapted to the social, economic and regulatory changes that have occurred within the financial sector.

It is therefore necessary to establish certain principles of financial education. A good guide was the one developed by the OECD in 2005 in its Recommendation on Principles and Good Practices for Financial Education and Awareness. In that document, the OECD (2005b) has developed a list of good practices that is structured into four blocks: public action, the role of financial institutions, financial education for retirement savings and financial education programmes.

In terms of public action for financial education, good practices emphasize the need to educate students as soon as possible and to start financial training programmes at school, developing free information services and programmes that are as user-friendly as possible.

On the other hand, good practices in regard to the role of financial institutions in financial education call for financial institutions to act ethically and responsibly by informing, educating, and advising both their clients and their employees in a clear, transparent and understandable way.

With respect to good practice in financial education programmes, the OECD establishes how such programmes should help financial consumers find the relevant data and understand the pros and cons, as well as the different types of risks associated with the different financial products and services. Moreover, these programmes must be measurable, evaluable and, above all, adapted to the individual circumstances of each population segment.

Despite the difficulty in determining the skills to be developed by financial education, the 2012 PISA Financial Literacy report, which draws on the work of the OECD (2012, 2013c, 2015a), details the financial competences that 15-year-old students should have before entering the labour market or going on to further studies. These skills have been divided into four areas, which have been defined as central in most financial education programmes: money and transactions, planning and managing finances, risk and reward, and the financial landscape.

FUTURE RESEARCH DIRECTIONS

This article shows how some empirical studies have reported limited effectiveness in developing financial literacy (Peng, Bartholomae, Fox & Cravener, 2007; Mandell & Klein, 2009) as well as a lack of evidence of people developing behaviour involving a greater propensity for saving and making long-term investments (Atkinson, Messy, Radonivich & Yoong, 2015). It may thus be necessary to recognize that there is still scarce empirical evidence on the positive effects of financial education programmes on a personal level (Hastins, Madrian & Skimmyhorn, 2013).

To clarify the matter, it is necessary to separate two different, but frequently intermingled, issues. The first refers to the causal effect of financial literacy on related behaviour. The second is whether teaching people about personal finances results in greater financial literacy, which in turn facilitates more prudent and informed behaviours. In their meta-analysis, Fernandes, Lynch & Netemeyer (2014) use the term “measured financial literacy” to refer to the outcome of longitudinal studies that examine the causal relationships between the levels of financial literacy and subsequent financial decisions, controlling for theoretically relevant variables. On the other hand, they use the term “manipulated financial literacy” to refer to an experimental intervention to improve financial knowledge with the intention of generating more informed and responsible behaviours.

This meta-analysis of the empirical literature indicates that increased financial knowledge in terms of measured financial literacy has a significantly greater effect on financial behaviour than when we refer to manipulated financial literacy, explaining 1.8% of the variance compared to 0.1%, respectively. The effect of interventions to increase financial literacy on subsequent financial behaviour decreases even more when controlling for the omitted psychological profile, and in low-income individuals. It also decreases over time. The key problem seems to be that the courses do not achieve a significant improvement in students’ financial literacy, and the effect of such interventions is much smaller than that achieved with other educational actions in other domains. Moreover, the effect decays over time, disappearing after a few months.

If the conclusions of the meta-analytic study by Fernandes, Lynch & Netemeyer (2014) are confirmed, it would provide good cause to criticize the financial education initiatives developed, as they could be

considered an expensive waste of resources and because they entail opportunity costs when replacing other subjects that have proven positive results.

One of the possible explanations for the poor results reported to date by financial education initiatives could be found on its isolated implementation. By its very nature, any financial education policy should be framed within more ambitious activities that promote economic education from a global perspective. This integrating approach should be carried out through the development of basic modules of economic analysis, covering in the first place the demand and supply functions. Secondly, it should address the general functioning of the financial system, its agents and the products that in it are negotiated. Finally, the market regulation should complement the training of its agents, encompassing both state regulation and self-regulation by the so-called “invisible hand”; as well as the functional distribution of income and its effects on the personal distribution of income.

CONCLUSION

Although the empirical evidence presents certain gaps, this article shows that the most obvious conclusion to be drawn is that financial education is an essential element for the development of a financially-educated and responsible society.

Even so, the design of curricular content and training programmes must take into account the particular features addressed above, as well as the elements of a personal, family, economic or social nature that have a significant impact on the viability and effectiveness of financial education.

Financial education, however, is only one of the foundations on which to build a stable financial system and a consumer base capable of financial decision-making.

The design of financial education programmes must take a broad view, which includes defending citizens’ rights and needs. Excessive interest rates, abusive lending practices, and over-indebtedness among poor borrowers have generated great concern about the concept of responsible financing and consumer protection measures.

Ethical and responsible finances are therefore an essential ingredient in the fight against poverty and in generating sustainable management strategies aimed at developing lasting and prosperous businesses that benefit society. The fullest possible application of ethics in financial and banking management is thus justified to address the problems and solutions arising from the current financial model. An adequate level of financial literacy helps citizens to understand and participate in this debate and to manage their own financial future.

Given the serious gaps and important contrasts shown at an international level in terms of financial education, the implementation of effective measures to develop knowledge and financial capabilities in the population is a crucial objective. The formation and the consequent understanding of the basic functioning of the financial system will create more responsible consumers, that will make better decisions, involving both their own individual level benefit, as well as that of the society as a whole.

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KEY TERMS AND DEFINITIONS

Behavioural Finance: Born from the union of psychology, traditional economy and neuroeconomy, behavioural finance study investors' psychology while making financial and investment decisions.

Ethical Finance: A financial system that seeks, not only purely financial returns, but also qualitative outcomes, reflection ideas from faith, social, environmental and governance theories.

Financial Competences: Knowledge and understanding of financial concepts, as well as skills, motivation and confidence to apply and understand that knowledge, in order to make effective decisions in a variety of financial contexts.

Financial Consumer: Any client, user or potential customer of the products or services offered by financial entities.

Financial Literacy: The capacity of students to apply knowledge and skills in key subject areas and to analyse, reason, and communicate effectively as they pose, solve, and interpret problems in a variety of situation.

Personal Finance: The management of money and financial decisions for a person or family including budgeting, investments, retirement planning and investments.

An Overview of Diversities in the Use of the Profit and Loss Statement

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INTRODUCTION

The main objective of any economic activity is considered to be the «performance», and this objective has proven to be quite difficult in regards of finding an example for it (Caylor, 2010; Ribeiro, Shan & Taylor, 2019). Recent studies have shown that in the financial information market, the “most” popular product is the profit and loss account because it shows whether or not the enterprise has achieved its basic objective of achieving an acceptable return (He et al., 2017; Hou et al., 2015). Undertakings have the possibility to add to the profit and loss account other items, rows, titles and subtotals when an International Accounting Standard requires it or when such a presentation is required for a true presentation of the financial results of the enterprise. The criteria to be respected in this case are the materiality threshold and the nature and function of the different components of income and expenditure.

In the context of the expansion of transnational companies, users of financial information are interested in the performance of the enterprise determined not on the basis of the accounting result but of the economic result (Jackson & Liu, 2010). This latter indicator cannot be accounted for by the profit and loss account because it has a more comprehensive structure than the accounting result, including items that do not translate through the profit and loss account. Users of financial information are interested in information that the profit and loss account cannot provide (Dennis, 2014). In order to meet their informational needs, decision-makers need to turn to new sources of information (Amira & Nuha, 2019). That is why the accountancy profession is called upon to create new tools to remove the information limits of the financial statements. The statement of changes in equity and the cash flow statement are the “new products” of the accounting offer (Ball, 2013). The statement of economic outturn should include the effects of all transactions and events occurring during the year, whether or not related to current operations, and which have an impact on equity (excluding shareholder or associate and distributor contributions). Also, gains or losses accounted for during the year, realized or unrealized, exceptional or extraordinary, participate in the performance of the enterprise and should therefore be included in the statement of comprehensive income (Timbate & Park, 2018).

On the other hand, given that companies can choose their accounting policies within certain limits, the results obtained reflect their objectives and not the reality (Stein, 2019). In this situation, is the outcome credible and relevant? The objectives of accounting policies differ according to the size of the enterprise and the economic environment in which it operates (Ahrens, 2008; Rozenbaum, 2018). As

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an example, it is possible to mention the reduction of the published losses, the decrease of the taxable profit, the increase or decrease of the current result, the increase or the decrease of the profit to be distributed, the temporary arrangement of the accounting results in order to reduce the risk perceived by the financial environment.

Many of the reported deficiencies were corrected during the reform (Barth et al., 2008; Cahan & Sun, 2015; Lukka, 2010). Moreover, the principle “nothing is perfect, everything is perfect” also works in accounting. In our opinion, any accounting system, however modern, converging with International Financial Reporting Standards, will never be perfect, because the world economy and, implicitly, the national economy is constantly changing (Richardson, 2011). New trends, new informational needs are emerging, and they pose a challenge to the accounting system and an invitation to reflection for accountants (Chen et al., 2017). The present chapter intends to identify the construct of a set of factors that influence the Profit and Loss Statement in the context of scarce and expensive resources.

This chapter is structured in the following way: in the first section, the authors will introduce a radiography of the current situation regarding the profit and loss account in accordance with the International Accounting Standard; in the second section, research methodology will be discussed; in the third section, the results of the study will be discussed; finally, the authors will argue the conclusions and will present this paper's limitation.

BACKGROUND

Regardless of the international accounting standard, the notion of performance in accounting has a generally accepted first acceptance. Accounting in the field of performance has first and foremost the notion of profit. Given the recent history of scandals involving accounting conduct, the credibility of the public accounting profession has dropped significantly, losing one of the core responsibilities of the professional accountant (Ribeiro, Shan & Taylor, 2019). More recent research in the field suggests that there is a growing interest in studying the ethical conduct of professional accountants (Li et al., 2017). Moreover, since the 1980s, several institutions have encouraged education in accounting ethics, and today it has come to the fact that it has been present in schools since the beginning of the accounting profession (Doukakis, 2014; Alzola, 2017). However, the accounting scandals that took place in the 2000s prove that greater emphasis is needed on the Profit and Loss Statement, but also on improving the codes of ethics (Bettner & Kate, 2013). Thus, it is noted that, the Profit and Loss Account was viewed as a complement to the information provided through the Balance Sheet, but it can be said that there has always been a fight of primordially between the Balance Sheet and the Profit and Loss Account in providing useful information to those who make decisions. Thus, the development of the corporate form of the entities brings to the fore the utility of the Profit and Loss Account in the financial reporting by increasing the interest for the performance of the entity, for the dynamic information and the decrease of the interest for the historical costs and for the punctual, static information. Despite the increased interest in this issue, there are certain deficiencies in the principles, virtues, values and rules that undermine the credibility of the accounting profession (He et al., 2017).

As the economy develops, the main interest point, performance-wise, shifts from revenue towards the profit described in the Profit and Loss Statement (Brown, 2010). This reflects the value fluxes that interacted with the increase or decrease of the wealth of the company at a certain period of time. So, the profit and loss statement highlighted the success of a company required for its survivability, or its failure to stay on the market (Khan, Khan & Elshareif, 2018).

As the financial markets are in continuous expansion, investors are becoming the privileged receivers of the financial information (Holthausen & Watts, 2001). In our opinion, in this case, the profit and loss statement becomes the main tool because it provides all the required information for the past and future performance evaluation, and also for the determination of the future cash flow risks. Also, based on the information reflected by the profit and loss statement, a pertinent analysis is created for the company's performance, a verity of indicators are calculated, either in a specific moment in time, followed by their interpretation through comparisons, either throughout a longer period of time, but correlated with certain statistic procedures.

In continental accounting, the steps of finding the result of the exercise are in close connection with the company's revenue and cost structure, while the Administrative Intermediary Balances are calculated (Li, 2010). These indicators allow comparisons throughout time in the same company or between companies. The Administrative Intermediary Balances start from the idea believing that a company is a place of turning goods into other goods, entries in exits. These transformations are done by using production factors, labor, public capital (goods and collective services), financial capital without risk and financial capital with risk. The appreciation over informational risk depends on the skills of the individuals in charge of the processes to assess the informational impact on the financial statement, on the company's performance (Schleicher et al., 2010). In consequence, the analysis of the communication system and the dialogue frequency stand for a variable that can be used in appreciating the informational risk level, as the communication frequency is inversely proportionate to the risk level.

Special attention is also given to the IASB because "information on an enterprise's performance, especially its profitability, is necessary to assess potential changes in the economic resources that the enterprise will be able to control in the future [...] which are useful in assessing the firm's ability to generate existing cash flows [...] and to formulate judgments about the efficiency with which the enterprise can use new resources" (Parker, 2012).

When preparing the financial statements, the management of the enterprise should analyze the firm's ability to continue its business. Financial statements must be prepared on a going concern basis, unless the management either intends to liquidate the enterprise or ceases business, or has no realistic alternative but to do so (Ramanna, 2008). If there is uncertainty about the business going on, it must be highlighted. Cases where the financial statements are not drawn up on the basis of accrual accounting must be highlighted alongside the basis on which they are prepared and the reason why the enterprise can no longer continue its business.

The flexibility of the provisions of the Fourth ECE Directive, concretized through the four models of presentation, as well as the possibility of choosing them by companies, is the expression of the conciliation of cultural differences between the countries of the European Union (Barth et al., 2014). French companies prefer the presentation of the profit and loss account in the form of an account, with the classification of expenses and incomes by nature, while Anglo-Saxon companies interested in meeting the information needs of investors prefer the drafting of the profit and loss account with the classification expenditure by function.

RESEARCH METHODOLOGY

In order to achieve the research objective, we resorted to the conceptual analysis of reviewing the purposes of the Profit and Loss Statement in line with the International Accounting Standards, as well as to its quantitative assessment (Yung & Root, 2019). This analysis is based on the information discovered

following the documentation process, by means of comparative research methods and critical analysis, supported by professional reasoning. We also analyzed, during the conceptual and empirical incursions, along with the risk related to socio-human factors (for example, communication process, formal and informal environment, human behavior), technical elements related to the Profit and Loss Statement.

The IASB's general framework provides for the preparation of the (profit and loss) account under the accrual accounting and consequently the release of cash flows through this document can only be achieved by processing the information contained therein, i.e. converting revenue and expenditure into receipts and payments (Barth, 2013). Financial statements prepared on the basis of accrual accounting respond to the information needs of users by providing information "not only about past transactions that generated revenue and payments, but also about future payment obligations and resources on future receipts and payments" (Byard et al., 2011).

The disclosure of US economic results is treated by the American Accounting Standard FAS 130 "Reporting Comprehensive Income" issued by FASB in June 1997. This accounting rule is opposed to all US companies preparing financial statements, except for those that do not have items that do not translate into the profit and loss account and therefore have a direct impact on equity (Baker & Bettner, 1997). Under this rule, items that do not transit through the profit account, but have a direct impact on equity, need to be detailed in a financial statement of similar importance to the others. The cumulative balance of these items should be presented in a separate line of equity, reflected in the balance sheet.

In order to avoid the double counting of elements (included both in the net result and in the economic outturn), FAS 130 allows some adjustments to the overall result of the last financial year (reclassification adjustments), such as adjustment of the economic outturn of the last financial year with the earnings on other investment titles that were included in the net result of the current exercise, but also with the other items of economic result in the form of dormant earnings during the year in which they were ascertained (Allen & Ramanna, 2013). Such adjustments may be presented in the financial statement of the financial result or in the notes.

According to the documentation made, the adoption of the Fourth Directive by the Member States of the European Union generated an abundance of profit and loss account models (Table 1). In countries like Belgium, France, Italy, Portugal and Spain, it is illegal for companies to publish their profit and loss accounts in a list format with the classification of expenses by function. Even among the countries that allow the use of the four models, there are different variants of their use. The UK has adopted all four models for the presentation of the profit and loss account. UK companies may opt to present the profit and loss account using a cost analysis either by function (costs are broken down into costs of sales, sales and administrative expenses), either vertically or horizontally or by nature (expenses materials, wage costs, external costs, depreciation costs) in a vertical or horizontal format. However, most accountants are not familiar with the profit and loss account model, vertically and horizontally, with the classification of expenditure by nature.

Looking at Table 1, we wonder why there are so many European countries that prefer to model their profit and loss account with their vertical or horizontal format analysis for their business companies.

A first argument can be a historical accident. German influence has been reflected in French accounting since the Second World War by introducing an accounting plan. Subsequently, France influenced the development of the accounting plans in Belgium, Spain and Portugal.

The second argument concerns the simplicity and transparency of the "by nature" format, although it is more detailed than the "by function" format (Andon et al., 2007; Christensen, Pei, Pierce & Tan, 2019). The format "by nature" only requires the analysis of operating expenses, such as material expenses, external expenses, labor costs, and depreciation expenses. For companies having an object of

Table 1. Models of profit and loss accounts throughout European states

	Function wise		Nature-wise	
	Vertical	Horizontally	Vertical	Horizontally
Austria	O	x	O	x
Belgium	x	x	O	O
Denmark	O	O	O	O
Finland	O	x	O	x
France	x	x	O	O
Germany	O	x	O	x
Greece	O	x	x	x
Ireland	O	O	O	O
Italy	x	x	O	x
Luxemburg	O	O	O	O
United Kingdom	O	O	O	O
Holland	O	O	O	O
Portugal	x	x	x	O
Spain	x	x	x	O
Sweden	O	x	O	x

O Allowed by national laws, x Banned

activity, it is not necessary to use a method of allocating indirect costs. The transparency of this format is due to the fact that there are no internal company decisions to be made on the basis of the accounting data and the policies used to calculate the cost of sales and the gross margin (for example, the choice of the depreciation method). Most countries requesting a “by nature” presentation also have account plans (Chen et al., 2010). Their role is to require commercial companies to maintain account balances in accordance with the national accounts plan.

The tax authorities in those countries may use the profit and loss account as a starting point for the valuation of the liabilities tax on the idea that the link to the balance symbols is transparent (Damayant, 2013). Perhaps the most relevant argument in favor of using a “by-nature” format is that this model provides the information needed to compile macroeconomic statistics. For example, in France, where the state has always been involved in business, a privileged user of financial information justifies the choice of “by nature” format. By imposing this format, the state can obtain comparable information on the added value of all enterprises that aggregate gross domestic product and other derived statistical information.

In Romania, the classification of information in the profit and loss account was based on the criteria of the nature and heterogeneity of the economic and financial transactions carried out by the enterprise (Florou & Pope, 2012). The accounting reform, started after 1990, materialized in the Accounting Law no.82 / 1991 and the Implementing Regulation approved by H.G. no. 704/1993 introduces a profit and loss account, mainly inspired by the Fourth Directive of the European Economic Communities presented in a list form, with the structure of revenues and expenses by nature. This important evolutionary step was carried out in a context that had not existed until then, namely the transition from the model of the super-centralized economy of the communist type to the market economy. This explains the appearance of controversy over the fairness of the chosen model, but in our opinion, this variation corresponded to the informational needs of the main recipient, at that time, the state.

Regulations approved by O.M.F.P. no. 3055/2009 represented a reference point since they reflected the “accounting point of view” of the Romanian economy, in the new context in which Romania is a full member of the EU, but also with the obligation of full integration into this community, which implied, among others, the continuation of the process of implementing and applying the communal regulations. It also took into account the impact of the international regulations inherent in the globalization process, which, in the case of the consolidated financial statements, included the option to draw them up, according to the Regulations in line with EEC Directive VII - based on the International Financial Reporting Standards (IFRS).

As it can be seen from the comparative analysis performed, along with the accounting practices, management decisions also have a main purpose to present a different image of the result, but without changing the business situation (Soltani, 2014). The elastic nature of the outcome limits the informational value of the profit and loss account, which sometimes can be misleading. A profitable business is not necessarily an enterprise that has liquidity. Behind profitability, it hides serious treasury issues (Bentley, Christensen, Gee & Whipple, 2018).

The profit and loss account provides information on the financial flows recorded by the enterprise at the end of the financial year in the form of profit and loss. From this explanation, one can deduced that cash profits also flow through the profit account. The answer is affirmative, in the conditions of a cash accounting, and negative, if an accrual accounting is practiced.

SOLUTIONS AND RECOMMENDATIONS

In support of the major impact that these regulations had in the respective stage of the accounting evolution, we propose the following solutions:

- § A better delimitation of the financial statements of the entities according to the fulfillment of certain size criteria;
- § The express statement of the treatment of accounting errors on the profit and loss account in the case of errors related to the current exercise, namely, on the basis of the retained earnings for errors made in previous years;
- § Introducing a new section that provides users with general purpose financial statements and their informative needs, specifying the four main qualitative characteristics of the annual financial statements (intelligibility, relevance, credibility and comparability).

FUTURE RESEARCH DIRECTIONS

Through the goals set, this chapter has touched its target. The presented and analyzed issues are a synthesized part of the vast amount of information that has been developed by the authors to create the framework for underlining the importance of producing documents providing information in such a way that, regardless of the accounting model used, it is also useful for the quality of each user. Therefore, new directions of future research have been created, such as:

- § Analyzing the impact of managerial decisions resulting from the adaptation of the accounting principles to other management methods;

- § The assessment of the informational risk within a company can be made by assessing the reiterative frequencies of such events attesting the risk presence (for example, rectifying statements and reports);
- § Analyzing the possibility of creating new tools for monitoring and measuring environmental performance/performance based on the principles of other managerial accounting methods or systems.

CONCLUSION

Controversies about the information reflected by the Profit and Loss Statement have been, and are still, generated by the difficulty of accurately determining the financial situation, as well as ethical and moral aspects related to the user-company relationship, the limit between research and accounting treatment, etc.

The freedom of choice of accounting policies by companies, which leads to an increase or a decrease in the result, is, in our opinion, one of the main information limits of the profit and loss account. We have also previously highlighted some creative accounting techniques, often in line with the laws and regulations in force, which we call the “accounting engineers”. The valuation of output stocks, the capitalization of borrowing costs, the capitalization of post-commissioning expenses of tangible assets, the preferential choice of depreciation methods are just a few examples. Often used in times of crisis, we consider that these “blunts” of accounting results do not shade, cannot minimize the role and the informational value of the profit and loss account. This is because accounting engineering mitigates the company’s difficult image, but not infinite.

Such an aspect is favored by the diversification and amplification of transnational transactions that are under the impact of different accounting and tax systems. Therefore, it is important to emphasize the importance of accelerating the process of fiscality and convergence at European level and ultimately at a global level, by adopting and applying a uniform standard.

Within this context, the management tends to omit in most of the cases that the contracting of accountancy services does not mean the outsourcing of risks for the beneficiary of such services. On the contrary, it may trigger new risks that must be taken into account. For example, the outsourcing of accounting services requires a concomitant understanding of the fact that they do not exempt the Board of directors/administrator from the liability of making sure that the services, once outsourced, are carried in a safe manner, in compliance with the current regulations, so that the risks be eliminated.

From an accounting point of view, unethical conduct can be masked fairly easily through creative accounting practices, in which professional accountants find accounting methods at the law limit so as to diminish the accounting result or present a more favoring outcome to the entity they belong to. However, in this case, the accounting approaches are law-based approaches. Thus, the question arises: are these practices evidence of ethical misconduct?

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KEY TERMS AND DEFINITIONS

Convergence of Accounting: The process by which accounting standards are developed in a manner that is able to lead to the same act or purpose, by showing the similarity of national, regional, international.

Cost: The money form of all material and labor expenses made by the company to produce and market material goods, execution works and service works.

Decision: A person or group of persons' social and deliberate act defining the purpose and the objectives of a certain action, the directions and the ways to achieve that action, all of them determined, according to a certain need, by a process of obtaining information, deliberation, and assessment of the means and consequences of carrying out that action.

Economic Management: The achievement of the budget objectives with minimum costs so that when the activity is completed the revenue exceeds the costs, namely there is a profit that ensures a level of profitability as high as possible both at general level and by product, department or service performed.

Financial Accounting Standards Board (FASB): Set up and develop generally accepted accounting principles.

Financial Management: A tool in the decision-making relating to the collection and analysis of information in order to increase the performance level of the economic entity.

Integrity: The prohibition amendment, by deleting or adding, or the unauthorized destruction of information; integrity refers to confidence in the data and resources of a system by which to manage information.

Neuroeconomic Perspectives for Economics

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INTRODUCTION

The rationality of economic agents is a classical cornerstone in economics. Neoclassical theory has modified the classic concept to “Bounded Rationality” (BR) recognizing that economic agents behave as satisficers rather than optimizers (Simon, 1957). Further, modern psychology questions BR due to emotional biases in decision-making. Kahneman and Tversky (1979) claim loss aversion as typical to economic decision-making under uncertainty e.g. periods of economic recession. Positive emotional bias as complacency may be as relevant as loss aversion (Galbraith, 1958 and 1967). Neuroeconomics is presented as a new positivist model of the integration of emotions and cognition to replace the outdated classical normative economics. Behavioral and macroeconomic implications are discussed.

BACKGROUND

Medline, PsychInfo and EconLit are searched for neuroeconomic studies of “Emotional Bias in Economic Decision-making. At this early stage Medline has registered a broad selection of existing literature on neuroeconomics. Table 1 presents 10 projects representing a diversity of economic domains. Emotional biases define as deviations from perfect integration of emotional preferences and rational reasoning assumed in Paretian optimization (1906). Emotional biases are classified according to type (Fear-based or Passionate biases in accordance with Luo and Yu, 2015).

The recognition of emotional biases in DM in the format of prejudices e.g. Enquiry concerning Human Understanding (Hume, 1748) is a cornerstone in “British Empiricism” giving rise to economic growth theory (Smith, 1776).

In modern time, Galbraith is pathbreaking (1958 and 1967) in behavioral economics. In the Affluent Society he finds that the level of consumption raises beyond individual preferences due to advertising. The neural rooting of this effect is now explained by neuroeconomics (Erk et al., 2002) demonstrating that advertising symbols of power and wealth increases motivation and consumption from the pre-conscious Reptile level. Further, Galbraith finds that crucial DM-errors in top-level industrial management often rely on managerial complacency which now is explained as a special risk associated with dominance of the left hemisphere (Goel et al., 2006). Kahneman and Tversky (1979) focuses the loss aversion effect related to economic crisis which is the single psychological study that has got the most attention among economists.

Due to the criticism of the simple paradigm of economic rationality the concept of behavioral economics was presented as a pluralistic research programs starting in the 60's organized around four groups of economists situated at Carnegie, Michigan, Oxford and Stirling universities and united by

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Table 1. Evidence on Emotional Biases in Economic Decision-Making

Author	Domain	Type of Bias	
		Fear-based	Passionate
Galbraith 1958 Erk et al. 2002	Advertising fMRI of responses to Cultural Symbols		Over-consumption
Galbraith 1967 Goel et al. 2006	US Postwar Top-management		Complacency
Kahneman & Tversky 1979	Economic Crisis	Loss Aversion	
Gountas & Corciari 2010	Consumer behavior	Pragmatism	Imagination
Dohmen et al. 2012 Frey et al. 2017	Social Distribution of General Risk Attitude Reliability and Validity of Risk-preference	Score 0-4: 47%	Score 6-10: 31%
Luo and Yu 2015	Review of Economic Psychology	Reduced Cognition	Exaggerated emotion
Larsen 2017	Review of fMRI of Economic Choice	Risk-aversers	Risk-lovers

their shared willingness to redirect economics towards new research directions. In the first phase of behavioral economics, disciplinary economics has become heterodox in the sense that mainstream economics, economics as taught of most universities, recognizes limitations and fallacies in the paradigm of economic rationality wherefore non-orthodox contributions to economics e.g. socialism or Prospect Theory are welcomed, too. Other attempts to renew behavioral economics are reviewed (Sent, 2005). A special review of the criticism of paradigmatic economic rationality proposes “Nudging as new social relationship (Thaler and Sunstein, 2008). Nudging is based on the *libertarian paternalism* that elbowing a kind way as alternative to simple emotional kindness helps to improve rational decision-making at the level of ordinary people. In all, this represents an admirable professional tolerance among economists but is also a crucial weakening of the prognostic value of economics for a massive majority of the population needing to preview the economic consequences of their choices to make them in a responsible way.

A study of consumer behavior shows a tri-partition of economic agents (Gountas and Corciari, 2010). In this study, consumer profiles relate to brain function as indicated by the Electroencephalogram (EEG). Three different and independent studies establish “Risk-preference” as basal determinant of behavior. A panel study with 22,000 respondents to a simple scale (0 through 10) on General Willingness to take Risks finds significant correlations with important aspects of behavior as career, sports, car driving and health (Dohmen et al., 2012). A sociometric study finds significant correlation between risk-preference and personality characteristics (Frey et al., 2017). A neuroeconomic review of game trials on economic choice identifies three different levels of risk-preference (Larsen. 2017).

FOCUS OF THE ARTICLE

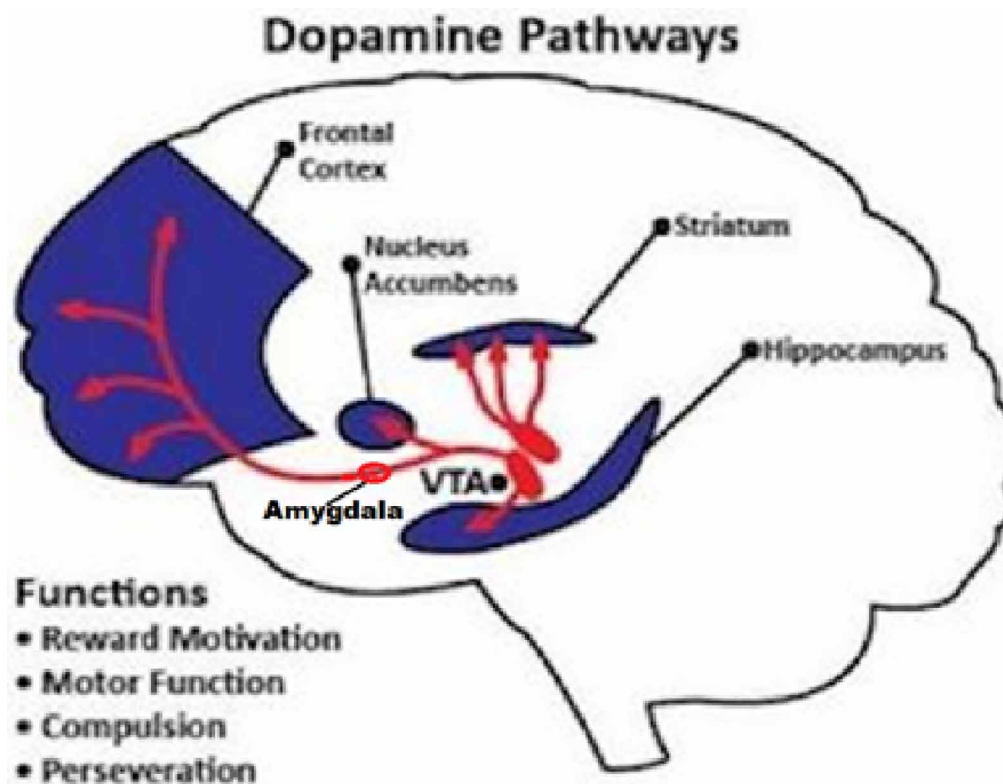
This article focuses a neuroeconomic model (NeM) (Larsen, 2017). NeM identifies seven different nodes across Reptile, Mammal and Human brain levels in the processing of economic choices:

1. Ventral Tegmentum (**VT**) in the pro-Reptile brain centers the power instinct
2. Anterior Cingulate Cortex (**ACC**) in the pro-Mammal brain originates affective emotions
3. Amygdala (**Am**), also in the pro-Mammal brain, centers the fear network
4. Orbitofrontal Cortex (**OFC**) in the Neocortex controls emotions as center of preferences

5. Dorsolateral Prefrontal Cortex (**dIPFC**) in the Neocortex centers Working Memory (WM)
6. Frontopolar Cortex (**FPC**) in the Neocortex centers association of rational and emotional information to plan long-term pursuit of the stronger reward
7. Ventromedial Prefrontal Cortex (**vmPFC**) between FPC, OFC and dIPFC centers over-all cognitive integration

The brain is not linear causality, but “circular” (cybernetic) interacting feedback loops (Wiener, 1948). The model of complex adaptive systems that has developed within computer science is client-server-integrator systems (Cybernetics of the Second Order):

Figure 1. Reward-seeking system (RSS) as Client



- The brain client is the Mesolimbic Reward-seeking system (RSS) including VT, ACC and Am (internal inhibition center) (Alcaro et al., 2007), see Figure 1. RSS as motivational network is operated as reciprocal to heart rate variability (HRV^{-1}) (Thayer et al., 2012) and functionalize:

Client $\sim RS(HRV^{-1})$

- The server is the Frontal Cortex, see Figure 1. Core elements of the cognitive function are the memory system centered in the dorsolateral Prefrontal Cortex (Baddeley, 2012), the capacity of association centered in the Frontopolar Cortex (Ryals et al., 2016) and the over-all cognitive integrator in ventromedial Prefrontal Cortex (Koechlin and Hyafil 2007; Camille and Griffith 2004).

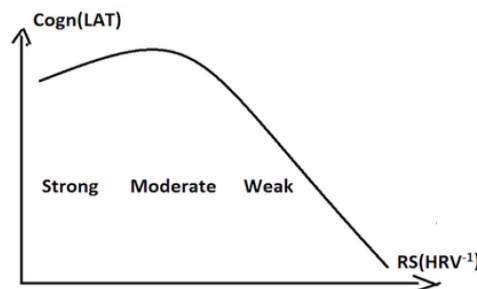
By experience Neocortex develops the ability of intuitive solutions, too (Renning et al., 2013). Cognitive activity, termed Cogn, functionalize as the degree of lateralization (LAT):

Server $\sim$ Cogn(LAT)

- The Integrator of Client and Server is an overlapping node in between the two. Anatomic is the Orbitofrontal structure at the bottom of the Frontal Cortex (OFC) a good candidate. Also, OFC is the main receiver of non-salient RSS-information passing the Anterior Cingulate Cortex (Mohanty et al., 2007). Further, OFC has a cardinal ranking of utilities (Stubborn, 2005). A neuroeconomic study identifies the vmPFC-OFC-complex as a value system constantly updating the expected utility (Levy and Glimcher, 2012). Further, OFC centers the regret function (Conscience) (Camille and Coricello, 2004). The capacity of OFC to compare subjective values is explained by an internal network informing a variety of mental functions (Padua-Schloppa et al., 2006 and 2017). OFC is identified as the value or preference center integrating **RS(HRV⁻¹)** and **Cogn(LAT)**.

The classical target of economics is maximal utility arising from simple rationality in DM. The target of cybernetic neuroeconomics is maximal adaptability. Figure 2 illustrates a parabolic relation where the Server (**Cogn(LAT)**) supports the Client (**RS(HRV⁻¹)**) more and more until the peak cognition at a moderate (risk-neutral) level of risk-preference in accordance with findings in sports medicine (Hardy, 1999). Beyond the cognitive peak, risk-preference dominates reasoning e.g. as explorative choices (Daw et al., 2006).

Figure 2. Cognition and Risk-preference



A sociometric study shows that “Risk-preference” is relatively stable for individuals and correlated with major psychological traits (Frey et al., 2017). Adaptation of the general measure to specific domains may redouble the explanatory value (Frey et al., 2017). A specific domain is financial risk-preference. Financial risk-preference is operated as “Willingness to take risks in general” on a scale from 0 through 10 in a representative survey on ‘risk attitudes’ with 20,000 respondents (Dohmen et al., 2012). The coefficients of correlation (r) on important life domains are: 1) Car driving (r=0.49), 2) Financial matters (r=0.50), 3) Careers (r=0.61), 4) Sports/leisure (r=0.56) and 5) Health (r=0.48). The skewedness of the distribution is mostly due to low female risk-preference. Also, age differentiates risk willingness for both genders (Dohmen et al., 2012).

A tri-partite economic theory on expected utility during insecurity (von Neuman and Morgenstern, 1944) has dominated behavioral economics until the Kahneman and Tversky (1979) criticism of eco-

nomic rationality. The von Neuman-Morgenstern theory is that consumer behavior differentiates between convex, concave and linear utility function of income. The challenge is now to identify the connection between Temper and shape of utility function? For this purpose, a study investigates the relationship between consumer behavior and Electroencephalogram (EEG-profile) (Gountas and Corciari, 2010):

1. Persons with a weak risk-preference have relative few EEG-connections and operate as “Pragmatics”. They respond primarily to negative incentives and less to positive financial incentives (Ojokuku and Oyedokun, 2011). Some genetic variant is associated with extreme fear responses (Munafo et al., 2008). Pragmatics aim to fulfil social norms.
2. Persons with a moderate risk-preference have many lateralized EEG-connections and operate as “Rationalists”. They respond primarily to positive financial incentives.
3. Persons with a strong risk-preference have relative many non-lateralized EEG-connections and operate as “Passionates”. A prototype of entrepreneurs (Laurie-Martinez et al., 2010). Passionates respond strongly to development facilities that strengthens their self-actualization and to live in communities that are attractive to families of any form.

Pragmatics, aiming to follow social norms, represent a linear relationship between personal income and consumption. *Rationalists* searching “value-for-money” represent a concave relation of personal income and consumption due to declining marginal utility. *Passionates* respond strongly to all kind of self-actualization facilities represent a convex relationship between personal income and consumption due to endless temptations to consumption.

SOLUTIONS AND RECOMMENDATIONS

Towards a Neuroeconomic Psychology

General psychology has identified five different groups of personally (“Big Five”) by statistical correlation studies (Goldberg, 1993). Originally, the theory of “Big Five” was advanced by two Air Force psychologists, who published a technical report in 1961 which was very little known among psychologists until the 80s. 1993 Goldberg published a multifactor statistical correlation study which confirmed the “Big Five” as the common denominators of five groups of statistical related personality characteristics. The “Big Five” are defined, as shown in Table 2.

Table 2. Definition of “Big Five” Personality Traits

Big Five Domain	APA Dictionary Definition
Openness	Differences in the tendency to be open to new aesthetic, cultural, and intellectual experiences
Conscientiousness	The tendency to be organized, responsible, and hardworking; located at one end of a dimension of individual differences (conscientiousness versus lack of direction)
Extraversion	An orientation of one’s interests and energies toward the outerworld of people and things rather than the inner world of subjective experience, includes the qualities of being outgoing, gregarious, sociable, and openly expressive
Agreeableness	The tendency to act in a cooperative, unselfish manner; located at one end of a dimension of individual differences (agreeableness versus disagreeableness)
Neuroticism	A chronic level of emotional instability and proneness to psychological distress

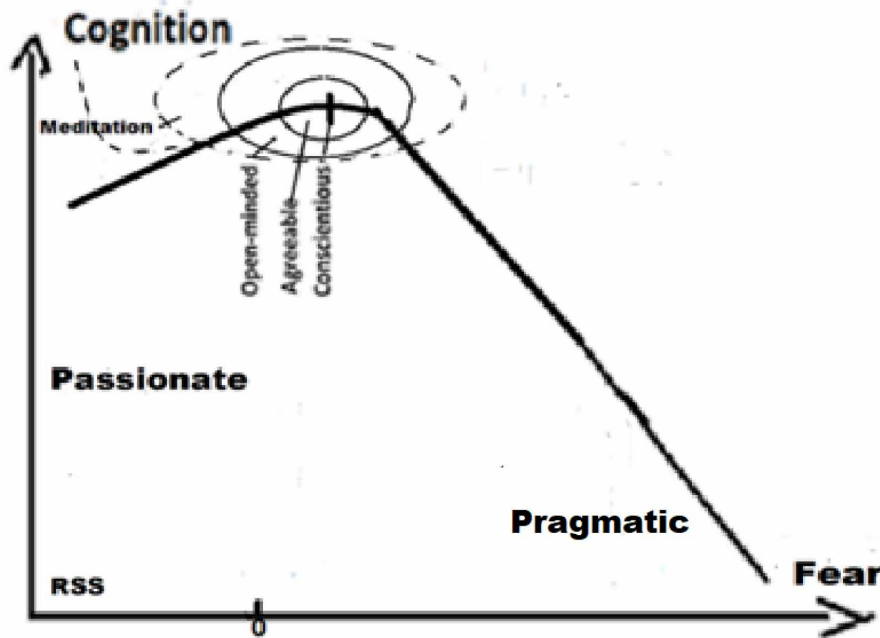
The relationship between “Risk Willingness” and the “Big Five” is investigated, too (Becker et al., 2015). A neuroeconomic psychology model with five different profiles (whereof three in the center) is ordered in accordance with the correlation-study (Becker et al., 2015). However, the naming of the poles is revised considering the diversity of related studies. The negative pole is termed “Pragmatics” instead of “Neurotics” preferring the term of the tradition of experimental economics instead of a diagnosis. Secondly, the positive pole is termed “Passionate” referring to Luo and Yu (2015)²⁵ and the inherent correlation between intra- versus extravertedness in the APA-definition and risk-willingness (Civaia et al., 2016).

The neuroeconomic dynamics of the concluded order of economic agents is illustrated in Figure 3. A share of “Passionates” are “Intraverts” with an elevated level of cognition which is indicated by a stippled curve. The hypothesis is, that that the ability to intraversion of passion is a special gift for artists and great philosophers.

The dimensions of the axes are derived from general neurodynamic in Figure 1.

Origo is the individual baseline of passion (dopamine activity) as processed by the Fear-network (X-axis) respective the Frontal cognitive activity (Y-axis).

Figure 3. Neuroeconomic Psychology



The relation between psychometrics by the Dohmen-scale and sensitivity to the “Big Five” is complementary rather than parallel (Becker et al., 2015). The Dohmen-scale is useful for quick identification of extreme Tempers in either the negative or the positive spectrum. Based on the skewedness of the distribution of risk-preferences, a score <3 indicate a risk-averse personality while scores >6 indicate a risk-willing personality. By scores in the risk-neutral interval (3 through 6), the subjective identification

with a specific psychological profile varies in accordance with mental flexibility where open-minded are the most flexible.

Impact on Microeconomics

Florida (2002) advanced the theory of “The Rise of the Creative Class” based on demographic statistics. The core of the creative class is scientists and engineers, university professors, poets and architects, people in design, education, arts, music and entertainment, whose economic function is to create new ideas, new technology and/or creative content. The classical core of the creative class comprises about 12% of the US work force. A broader definition of the Creative Class also includes knowledge-intensive occupations with a high degree of formal education. Examples of workers in this sector are journalists, health professionals, business managers and counsellors, who are considered part of the sub-group called “Creative Professionals”. Their primary job is to think and create new approaches to problems, as creativity becomes more valued in today’s global society. The core group and the sub-group of creative professionals comprised 30% of the US work force in 2000. A follow-up study from the European Commission finds that the creative class accounts for 42% of the work force in Denmark (Andersen and Lorentzen, 2005).

A redoubling the creative class in 20 years is that surprising that it has been object to numerous critics of 1) Exacerbation of inequalities in large cities and 2) Lack of causal explanation (Peck, 2005). Risk-preference is as mentioned above operated as “Willingness to take risks in general” on a scale from 0 through 10 in a representative survey on ‘risk attitudes’ with 22,000 respondents (Dohmen et al., 2012). Statistics to decide the substance of the theory of the rising creative class is presented in Table 3.

Table 3. Demographic Distribution of Economic Agents (%)

Group (Score)	Pragmatics (0-2)	Conscientious Agreeable Open-minded (3) '4-6) (7-8)			Explorers (9-10)
Males	3	7	22	15	3
Females	10	15	21	4	0
All (before) All (today)	13	22	43 22 [®]	19 40 ¹	3

Source: Recalculation of data from Dohmen et al. (2012)⁶: The shift of “Agreeable” to “Open-minded” over time by breeding and education. The rise of political protest movements by frustrated Conscientious.

¹Andersen and Lorentzen (2005).

Table 3 shows how the share of Open-minded, belonging to the creative class is redoubled in one generation. Up to the 60s most of the “In-between group” had rationalist values. Since the 60s, liberal patterns of elevation of offspring and a rising level of education have got a large part of the Agreeable to adopt the values of Explorers raising the “Creative Class”. So, neuroeconomics confirms the substance of the thesis of Florida. A common denominator of the whole creative class is self-actualization as career goal rather than traditional maximization of status (Florida, 2002). Referring to Figure 1, this means that the emphatic Mammal level (Singer, 2007) is strengthened compared to the primitive, power-oriented Reptile level (Erk et al., 2002) representing a personal evolutionary progress. The tenets of the creative class are described as the three “T’s” talent, tolerance and technology (Florida, 2002). These qualities are most dense in larger cities and especially in quarters rich in “Street level culture” as cafes, sidewalk

musicians, small galleries and bistros. Also, Explorers prefer user-driven healthcare like yoga and meditation (Hurk et al., 2011). The creative class is definite a core group in development of the digitalized, post-industrial economy whereof the Open-minded is identified as opinion-makers (“Maverns”) with a key role in the formation of group standards (Gountas and Corciari, 2010). Open-minded is today the largest sociodemographic group – especially among the younger generations – which is a completely new quality in economic behavior. Classical normative economics has the Agreeable as key person. The special quality of Open-minded or “Early movers” is the ability to translate novel qualities in the creative class to rational values (good value for money) in the large residual group of other rationalists and their Pragmatic followers.

Human capital is the aggregate of human know-how on production which is demonstrated an independent growth factor (Schutt, 2003). The rise of the creative class means faster and better dissemination of human capital and shorter penetration-time increases economic growth.

The rise of the creative class and associated “soft” values as more open-mindedness must not be confused with the classical assumption of profit maximization as long-term key driver of market-based production and development. Profit maximization is still remaining as the typical denominator of business life in a foreseeable future although a fraction of corporations is expected to accept an extended employees responsibility in the format of adopting the formal framework of B-corporations (Rae, 2012).

Macroeconomic Implications

From a neuroeconomic point of view, reinforcement of the cognitive function by wider and better levels of education is a direct means to strengthen both Open-mindedness and Conscientiousness as indicated by stronger center-orientation in the political left- and right-wing spectrum. The absolute classical ideologies of Neoliberalism versus Socialism become less attractive compared to modern mediated forms with priority of “*Effectiveness by the market*” versus “*Equality by welfare policy*” as new complementary political poles. The European Parliament Election 2019 exemplifies that the right wing has lost majority to a coalition of social democrats and social liberals. Center-oriented democratic policies elevate policy from simple fighting of contradictory opposites to a complex state of collaboration across the center which *alienates* groups of core voters at both poles, see Figure 3/Table 3. Right-wing examples are populist voter protests as Alternative für Deutschland (AfD), Sveriges Demokraterne (SD), “Brexiters” in UK and “Yellow Jackets” in France. Internally on the center-left the social democratic movement is weakened by decreasing solidarity with traditional labor unions which loses about 1% of their members per year.

In summary, the first phase of experiences with a new complementary political spectrum from center-left (social democrats) to center-right (social liberals) indicate that the negative side-aspect of polarization dominates. This state is a direct consequence of the neuroeconomic finding that complex choices, e.g. Intertemporal Choices, split the population in rationalists and risk-aversers.

Necessary conditions for a sustainable macroeconomic development are discussed below with a view on the novel neuroeconomic political psychology:

Redistribution of Income

The neuroeconomic confirmation of the social dimension of Mankind (Sanfey, 2007) means that the classical economic issue on redistributive fiscal policies becomes central to macroeconomic policy. Despite much public focus on inequality, the global tendency for the last decades has been – also in Scandinavia - that economic inequality as indicated by the Gini-coefficient is raising with globaliza-

tion as a key driver (Petty, 2014). This tendency is driven by increasing dominance of multinational companies (MNC), see Table 4.

Table 4. Key figures on the role of MNC in the USA

- MNC parents and their foreign affiliates accounted for 48% of all US Foreign Trade 2010
- MNC Parents accounted for 40% of all capital expenditures, but only 20% of the work force 2010
- MNC Parents accounted for 73% of all Research and Development expenses 2010
- The growth of MNC have been slow some years after the 2008 financial crisis. However, from the beginning of the 1990'es through 2008 the average rate of their growth in Direct Foreign Investments (FDI) was 8% p.a. or more than the double of the rest of the economy.
- A most descriptive figure of the global dominance of MNCs, is that the Top 100 MNCs since 2009 increased their net capital with 12% p.a. while the growth of global GDP has been 2-3%

Source: Barefoot 2012 / Bloomberg/PWC, 2017.

A new moderated goal of redistributive policy eliminates poverty by a negative income tax e.g. in the format of a Universal Basic Income (UBI). The idea of UBI is to assure everybody an unconditioned level of basic income where all basic human economic needs are covered wherefore consumption beyond UBI is on the flat part of the marginal utility curve. UBI suspends work as a necessity enabling people to rely on voluntary work within the market sector or in voluntary organisations. UBI is recommended by several Nobel Prize Laureats in economics (Milton, Meade, Samuelson, Simon, Solow, Tinbergen and Tobin). UBI may be prudently implemented as 40% of the median income (e.g. 1.000 USD/Month in 2018), entitled to all adult inhabitants (18+) with Citizenship and differentiated according to age and size of household parallel to other social cash payments. Under these conditions the total budget of UBI corresponds to about 12% of GDP. In advanced economies, UBI may largely be financed by 1) annulation of federal bottom tax deduction given a payroll tax of 25%, 2) set-off in existing public cash subsidies and 3) savings on compulsory social activities.

The main criticism of UBI is the worry that too many persons are going reducing the supply of labor. Firstly, UBI are typically that low that the expected decline in labor supply is minimal. Secondly, it follows from Figure 2 that reducing stresses on Pragmatics - the group of economic agents mostly affected by UBI - will improve the quality of DM in the direction of rationality. Thirdly, UBI facilitates development of alternatives to low-skill jobs to be replaced by future digitalized robotic technology.

The dynamic effects of UBI are studied empirically in a Finnish sample with about 2000 participants in the age span 23-59 years, where the participants receive a free, monthly income of 650 USD (Kela, 2019). Empirical results are expected to be published ultimo 2018. A similar sample study runs in Ontario, Canada, from which a series of qualitative interviews with participants confirm expected positive effects (Bergstein, 2018). Neither the Finnish nor the Canadian sample show any reduction in the willingness to work in the contrary they show improved quality of life.

Environmental Protection

Neoclassical economics considers third-party effects of economic transactions e.g. pollution as externalities wherefore the Neoclassical research in environmental protection is poor. Referring to Pigou (1920), neuroeconomics – recognizing not only the interdependence of man buy also solidarity - internalizes

third-party effects and recommend a tax corresponding to the cost of society. To design an economic strategy for environmental protection, it is important that the supply elasticity of renewable energy is estimated to 2.7 (Johnson, 2011) while the demand elasticity of energy is as small as -0.4 (Small and van Dender, 2007). It is simply more effective to protect the climate accelerating the transition to renewables by Pigou Taxing than to restrict energy consumption. A Pigou tax on CO₂-emission (CET) should have the format of *tax per metric ton carbon emission* in the atmosphere and be charged at the source where carbon enters the economy, at the wellhead, mine shaft, or import terminal. The tax would ultimately cover more than 80 percent of the economy's total emission of greenhouse gas. Across economic sectors, the transition to carbon neutrality faces special problems regarding 1) Civil flights and 2) Agriculture that presupposes massive research and development investments.

However, due to the complexity of the transition to carbon neutrality, the neuroeconomic approach to political psychology previews that the technical simple CET develops too much resistance in the format of right-wing protest movements. Therefore, a more realistic but weaker second-best transition, is a hybrid transition strategy (HTS) based on collaboration between democratic politicians and leading business organizations at the level of large cities (C40). The primary contribution of national politicians to HTS is financial subsidies to infant-energy-industries as sun, wind and nuclear fission. This line of infant-energy-subsidies is already followed in many industrialized countries and followed by China, too (Dena, GIZ, CNREC and CEC 2019).

Job-related Stress

WHO warns that the world faces a mental crisis by an epidemic raise in diagnosed depressions (Markus et al., 2012). In 2020, depression will be the second leading cause of world disability and 2030, it is expected to be the largest contributor to the burden of disease. More studies link depression to stresses related to economic crisis. A study from the American Institute for Occupational Safety and Health finds that "1 of 4 American workers often or very often burned out or stressed in their job" (Sauter et al., 1999). In all, stress is today a more frequent condition than poverty in welfare economies! Stress is not specific to the bottom of society, but as relevant to the large group aiming a career of self-actualization. This turns stress into a negative third-party effect to be dealt with in macroeconomics on line with the "Green-house" - effect.

A neuroeconomic strategy to stress-management is should be based on medical science according to which the basic mental quality is endurance. The health effect of improved endurance (by ventromedial Prefrontal Cortex) by physical exercise is documented (Oaten and Cheng, 2006). Reinspection of Figure 3 feeds the hypothesis, that as open-minded already have more flexibility than the conscientious, in-depth relaxation by mantra-meditation might increase flexibility even more? More studies support the hypothesis of increased flexibility by deeper relaxation:

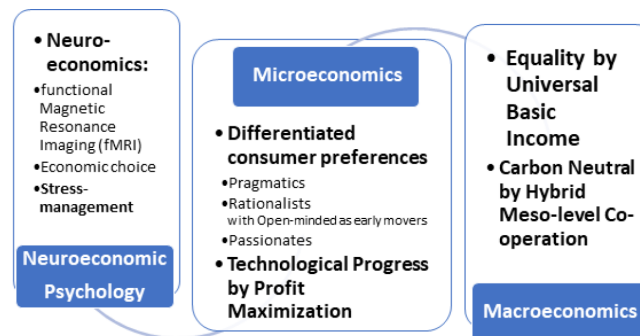
- Mantra-meditation is demonstrated as a general relaxation response in a series of studies at the Harvard Medical School (Benson, 1975)
- Improved Frontal cohesion by regular Transcendental Meditation (TM) is demonstrated (Travis and Arenander, 2006)
- A Meta-analysis across relaxation techniques shows a significant effect on state anxiety
- A Health Technology Assessment (HTA) of mantra-meditation, e.g. TM, concludes that mantra-meditation is a cost-effective health intervention (Larsen, 06)

- A study of personality characteristics of practitioners of meditation shows, that those already Open-minded are early movers too, in the adoption of meditation practices (Hurk et al., 2011)

Summary

Neuroeconomic political psychology predicts that the historical fight between Neoliberalism and Socialism is outdated due to stronger center-oriented political cooperation between social democrat and social liberal parties. Center-oriented politics advance research-based interventions towards global threats as 1) Increasing inequality of income, 2) Global warming and 3) Epidemic Job-related stress, see Figure 4. However, such progressive scenario is challenged by a new polarization between the political center and its poles. Violent right-wing protest movements and left-wing erosion of social democrat solidarity.

Figure 4. Neuroeconomic Impact on Economics



Future Directions of Neuroeconomics

Perspectives outlined in Section 4 are brief outlines arising from neuroeconomics. Implementation to benefit ordinary people requires more operational research. Across these specific topics, a top 3 research priority is outlined below.

Neuroeconomics and the Education of Economists

A progress report on neuroeconomics states that behavioral economics is the field where economists meet psychology (Glimcher, 2017). The present role of behavioral economists in the teaching of economics is that they complement other economic subdisciplines with modules that are supposed to involve psychological findings beyond rationalist economic man. This study takes neuroeconomics one step further to form a *Neuroeconomic Psychology* as novel foundation of behavioral economics with impact on all aspects of economics.

The primary follow-up of the present study is on this background to develop a new positivist approach to economics that abandons classical normative economics. Hopefully, the ideas outlined in Section 4 are inspiring for this purpose.

Development of a Frontline of Green Economists

Besides neuroeconomics an important domain of positivist economics must be economic ecology. Already HTS is presented in Section 4 as the new approach to carbon neutral economy. How can economists serve HTS? In mainstream economics the central contribution is development of Cobb-Douglas-based production models as the Dynamic Integration of Climate and Economics (DICE) presented by the Nobel Laureat Nordhaus (2007). This type of model is estimated by multiple linear regression (MLR). MLR assumes a stochastic mechanics where the reaction of the elements are independent of each other wherefore they can be estimated by historical data. New economics assumes a cybernetic system where all elements are coordinated to fulfil a specific goal e.g. preservation of the Ecosystem. Setting a new strong goal as preservation of the climate means that economic agents no longer are expected to follow historical behavioral patterns but has to change historical behaviors to fulfil the new goal. In support of HTS, what's relevant is a frontline consultancy network of green economists across economic domains. This represents a completely novel approach to both education and application of economists which it would be very relevant to have tested.

Neuroeconomics and Digital Social Media

E-commerce related to social media is fast growing economic sector. This means that fair competition between traditional and virtual stores is an issue of growing importance. On this background is comparative research in customer relations management (CRM) in physical versus virtual stores an important microeconomic issue. A point of departure for this research is (Ahmed, 2015). A hypothesis for this line of research is that knowledge on the neuroeconomic profile of the e-target group (Passionate, Rationalist or Pragmatic) is a big advantage in the design of customer relations.

CONCLUSION

The neuroeconomic model (NeM) presents a modern alternative to classical economics! NeM finds a functional correlation between *risk-preference* and *cognitive activity*. This interdependence is determined by the interaction of:

1. Reward-seeking across biological levels of evolution as autonomously modified by risk-aversion and functionalized by the heart rate variability
2. The cognitive function in Neocortex as functionalized by the hemispheric dominance
3. Reward-seeking and cognition is integrated within the Frontal Cortex centering ventromedial Prefrontal Cortex

Risk-preference is differentiated as weak, moderate or strong across economic agents. Each of the three types of economic agents – respectively termed Pragmatics, Rationalists and Passionates - have differentiated responses to financial incentives across economic domains as consumer behavior, job function, behavioral health and communication: Rationalists with a moderate risk-preference peaks cognitive activity. Rationalists focus solid, goal-directed solutions. Pragmatics seek social security while Passionates seek self-actualization.

Integrating the neuroeconomic model with general personality psychology (“Big Five”) reveals that the rationalist center-function differentiates in according to degree of flexibility whereof Open-minded are the most flexible and Conscientious the least flexible. In this way the relationship between neuroeconomics and personality psychology becomes complementary where the poles are identified by risk-preference while the differentiation between risk-neutral rationalists requires psychological sensitivity. The Open-minded is the modern microeconomic key agent due to her unique ability to “translate” innovative perceptions to rational (goal-oriented) arguments.

Recognition of the differentiation of risk-preferences implicates a new neuroeconomic political psychology with research-based macroeconomic policy-interventions regarding 1) Redistributive policy, 2) Environmental protection and 3) Stress-management. This means that the historical fight between Neoliberalism and Socialism is mediated into a new political spectrum where the poles are market-based effectiveness versus equality of income. However, this qualitative political progress is due to the increasing complexity of politics threatened by increased polarization between the political center and the poles.

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KEY TERMS AND DEFINITIONS

Behavioral Economics: The study of the effects of psychological, cognitive, emotional, cultural and social factors on economic decisions of individuals and institutions and how those decisions vary from those implied by classical theory.

Human Capital: The aggregate of human Know-How on production, is operated by UNESCO as an index of education.

Macroeconomics: The study of key factors in aggregate economy, for example, multipliers, to guide politicians.

Neuroeconomics: An interdisciplinary approach to behavioral science between economics, neurology, and psychology.

Pigou Tax: Tax on negative third-party effects, e.g. pollution, corresponding to the costs of the society.

Risk-Aversion: An automatic response in the fear network—centering Amygdala—to salient stimuli.

Risk-Preference: Value function of economic agents formed by reward-seeking, cognitive activity, and risk-aversion. It is graded as strong, moderate, or weak and operated respectively as Explorers, Rationalists, or Pragmatics.

Stress-Management: User-driven healthcare to improve mental health e.g. physical exercise, diet and deep relaxation.

Third Party Effects: Positive or negative effects of economic transactions on persons that are not directly involved.

UBI: Basic unconditional subsidy to all adult citizens corresponding to 50% of net median income.

The Dynamics of Demographic and Macroeconomic Variables in India

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“The difficulty lies not so much in developing new ideas as in escaping from old ones.” – Keynes

INTRODUCTION

These words of Keynes are very much significant in the context of this paper. Several theoretical concepts like the Phillips curve had been ruling the charts for almost half of a century. But, the question is to what extent is this model relevant for a country like India, today. Growth theory had its beginning in the years following the World War II when war devastated economies had embarked on the programme of reconstruction and development. This had called for high savings (reduction in current consumption) so that resources could be employed for investment purposes. But, in an inflationary situation, the general tendency of prices is to go upwards which has been statistically captured by the persistent upward movement of some of the aggregate price indices, viz. Consumer Price Index (CPI) or GDP deflator. Studies have shown that inflation has a highly significant negative impact on growth. Apart from causing distress for the poorer sections of the populace, the rising and variable prices also hurt the long term growth prospects by knocking the macro environment off balance. As a result, price stability figures are positioned high among the policy priorities of the Government of India. To all intents and purposes, inflation control is now considered more important than the elimination of the output gap. It is therefore important for the policy makers to know the exact relation between economic growth and inflation.

BACKGROUND

Coming to the issue of growth-employment linkage, the growth process in India shows evidence of the inability of high growth rates of output to stimulate sufficient employment opportunities. This phenomenon has been observed in India post-liberalization, since 1991. This indeed is what emerges from a more detailed consideration of the patterns of growth and employment dynamics in India. This absurdity has indeed haunted India's economy for at least half a century and has threatened the developmental policy of ensuring employment opportunities for the populace as a whole (Ghosh and Chandrasekhar, 2007). The conventional Phillips curve in essence shows the inflation-unemployment tradeoff but the question is whether the negative relation holds good for the Indian economy. Growth is incomplete in an economy where there is not enough generation of employment. Phillips (1958) in his seminal contribution had affirmed that to control inflation in an economy, employment needs to be relinquished. Subsequently, we come to the population-growth linkage and how it affects employment. Instinctively, it can be argued

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that impacts can be both favourable as well as unfavourable. If a country has larger amount of inoperative resources, the population can supply laborers which when efficiently utilized will result in a rise in the rate of per-capita GDP growth through the generation of employment. On the other hand, an increase in population can also negatively affect the growth rate of GDP through poverty, lack of capital formation as employment generation in the formal sector has been miserable. Hence, an increase in population tends to press hard on economic resources as well as job opportunities. This paper will be looking into the fact that whether population growth affects GDP positively or negatively in the Indian context. It is also clear that there is enough simultaneity among the focus variables.

The present paper analyzes this crucial issue by building up an empirical model which highlights the liaison between economic growth, inflation rate, employment and population growth in a Simultaneous Equation System (SES) framework. The spotlight then shifts to the theoretical foundations of this analysis. Precisely, our objective is to bring out the presence of simultaneity among the focus variables in our proposed model. This is followed by the issues pertaining to the empirical model and the methodology applied. Next, the econometric exercise has been carried out which helps us to pencil in the comprehensive policy implications of this research. The paper comes to a close by resolving the fusillade of questions.

BRIEF REVIEW OF SELECT LITERATURE

Empirical evidence about the relationship between inflation and growth differs with some studies finding a negligible effect of inflation on growth (for instance Chari *et al.*, 2000), some finding a negative effect (Chopra, 2015) and others providing evidence of the existence of a positive effect (Dholakia, 1995). Theoretically, the effect of inflation on growth is largely due to the inefficient use of resources and distorted investment decisions owing to inflation (Mallik and Chowdhury, 2001). Consequently, the relationship between economic growth and inflation may even end up being bi-directional. This ambiguous liaison amid inflation and growth necessitates that though rising inflation may have associated growth costs, policy efforts to suppress inflation could even negatively affect the growth prospects. On the other hand, by tolerating inflation at higher rates could lead to higher growth. In their paper, Singh and Kaliranjan (2005) empirically analyzed the employment-growth nexus and came to a conclusion that there exists an uni-directional causality between employment and growth. Also, Khan (2007) shows that the level of employment growth has a determining effect on a given rate of economic growth from the rate of change in poverty. It is based on the findings of 16 country case studies, including, India based on data available from the UNDP and the ILO. Ahmed and Mortaza (2005) have substantiated the existence of a positive relationship between inflation and growth by examining the long term dynamics of this relationship for four South Asian countries *viz.* Bangladesh, Pakistan, Sri Lanka and India. This paper concentrates completely on the endogenous relationship as opposed to the exogenous theoretical arguments already existing in the literature. The unemployment and inflation trade off boasts of a rich literature. Coming to the latest studies in the Indian milieu, Paul (2009) observed the existence of a short run negatively sloped Phillips curve based on the data pertaining to the industrial sector in India. In a different system, while investigating the relationship between inflationary expectations and monetary policy, Patra and Ray (2010) confirmed the existence of the normal Phillips curve. In another paper, Kapur (2013) came to a conclusion that both demand and supply factors drive inflation but demand side factors have a stronger impact on inflation seen in non-manufactured products. Interestingly, inflation in non-fuel commodities is seen as a more important driver of domestic inflation level rather than fuel inflation. Similar studies in this domain include, Mazumder (2011) and Singh *et al.* (2011). Both the studies essentially validate the

existence of a Phillips curve relation in the Indian context. Contrary to this school of thought, Ghosh and Chandrasekhar (2007) have theoretically taken up the issue of growth-employment linkage by evaluating the employment performance over the same period, at both the aggregate and sectoral levels. The developments unambiguously do not confirm the existence of a negative Phillips curve in the Indian context. The reason they put forward was India's growth in the last decade being epitomized by "jobless growth" phenomenon. To provide a means of productive employment for the ongoing escalation in the labour force forms an indispensable part of the purpose of inclusive growth (Rangarajan, 2006) but studies concerning population growth in an integrated framework with macroeconomic variables are very few in number. This paper in a more comprehensive set-up has taken a modest step in incorporating both macroeconomic and demographic variables. In the very recent literature in the context of India, there are hardly any research papers that have taken up this issue of linking up the dynamics of macroeconomic and demographic variables and the associated dynamics. So, where the results stand in the context of the very recent literature is difficult to figure out. But, comparisons have been made with the already existing literature as and when required.

THE THEORETICAL CONSTRUCT

In this context, we will make use of the money market equilibrium condition. Ghosh et al. (1997) in their article had used a simple money demand function to illustrate the difference in inflation performance across different exchange rate regimes. But, we will use a slightly modified version of that theoretical construct, in a different context, with the intention of theoretically establishing a relation among the variables under consideration.

Consider, a simple money demand function and from the money market equilibrium condition –

$$\frac{M_t V_t}{P_t} = y_t^\alpha r_t^\beta; \alpha, \beta > 0 \quad (1)$$

where, M and P denote money supply and price level, y is per-capita real output, r is the nominal interest rate and V measures residual velocity controlling for income and interest rate effects.¹ In constructing this money demand function, we have somewhat differed from the above mentioned paper by incorporating per-capita real output as opposed to real output. This implies that $y = Y/L$ where, Y is the real output and L is the current population in the economy.

Taking log on both sides in equation (1),

$$\log M_t + \log V_t = \log P_t + \alpha \log Y_t - \alpha \log L_t + \beta \log r_t$$

Differentiating with respect to time, we get:

$$\left(\frac{1}{M_t} \right) \frac{dM_t}{dt} + \left(\frac{1}{V_t} \right) \frac{dV_t}{dt} = \left(\frac{1}{P_t} \right) \frac{dP_t}{dt} + \left(\frac{\alpha}{Y_t} \right) \frac{dY_t}{dt} - \left(\frac{\alpha}{L_t} \right) \frac{dL_t}{dt} + \left(\frac{\beta}{r_t} \right) \frac{dr_t}{dt}$$

$$\left(\frac{dM_t}{dt} \right) \left(\frac{dV_t}{dt} \right) = \left(\frac{dP_t}{dt} \right) + \alpha \left(\frac{dY_t}{dt} \right) - \alpha \left(\frac{dL_t}{dt} \right) + \beta \left(\frac{dr_t}{dt} \right)$$

$$\hat{M} + \hat{V} = \hat{P} + \alpha \hat{Y} - \alpha \hat{L} + \beta \hat{r} \quad (2)$$

Now, $\hat{M}$ denotes the growth rate of money supply, $\hat{V}$ denotes the growth rate in money velocity, $\hat{P}$ is the inflation rate and $\hat{r}$ is the rate of growth of the nominal interest rate. Coming to $\hat{Y}$, denotes the growth rate of output whereas $\hat{L}$ denotes the growth rate of the population. So, it is clear that the focus variables of our analysis are indeed theoretically inter-related (equation 3).

From equation (2), we can write the relation as,

$$\hat{M} + \hat{V} = \hat{P} + \alpha \left(\hat{Y} - \hat{L} \right) + \beta \hat{r} \quad (3)$$

EMPIRICAL MODEL AND METHODOLOGY

The Structural Model

We have started our analysis from the financial year (FY) 1992-93 as FY 1991-92 is an outlier year in the Indian context which may lead to biased results (see Bery et al., 2009). The structural form of the model is given below have been estimated using data over the period 1992-2017:

$$\begin{aligned} Gdpgrowthrate_t = & a_1 + b_1 Gdp_{t-1} + c_1 Emprate_t + d_1 Infrate_t + \\ & e_1 iip_t + f_1 depratio_t + g_1 poplgrowthrate_t + \\ & h_1 nomdeprate_t + i_1 adilrate_{t-1} + u_1 \end{aligned} \quad (4)$$

$$\begin{aligned} Emprate_t = & a_2 + b_2 Gdpgrowthrate_t + c_2 Infrate_t + d_2 iip_t + \\ & e_2 depratio_t + f_2 adilrate_{t-1} + g_2 poplgrowthrate_t + \\ & h_2 Moneyspgrowthrate_t + u_2 \end{aligned} \quad (5)$$

$$\begin{aligned} Infrate_t = & a_3 + b_3 Gdpgrowthrate_t + c_3 Emprate_t + d_3 Moneyspgrowthrate_t + \\ & e_3 Infrate_{t-1} + f_3 nomdeprate_t + g_3 poplgrowthrate_t + u_3 \end{aligned} \quad (6)$$

$$poplgrowthrate_t = a_4 + b_4 adilrate_{t-1} + c_4 fertlrate_t + d_4 Gdpgrowthrate_t + e_4 Infrate_t + f_4 Emprate_t + u_4 \quad (7)$$

The endogenous variables are *Gdpgrowthrate*, *Emprate*, *Infrate*, *poplgrowthrate* whereas all the other variables in our model are pre-determined variables (lagged endogenous and exogenous). In this model, we have considered the growth rate of the GDP (yearly). The employment rate has been formulated as per the definitions of the ILO. The data for the variables used, namely, GDP growth rate (*Gdpgrowthrate*), Employment rate (*Emprate*), Inflation rate (*Infrate*), population growth rate (*poplgrowthrate*), nominal depreciation rate, NEER (*nomdeprate*), adult literacy rate (*adilrate*), total fertility rate (*fertlrate*), money supply growth rate (*Moneyspgrowthrate*), index of industrial production (*iip*) and dependency ratio (*depratio*) in this task has been compiled from the Handbook of Statistics on the Indian Economy i.e. Reserve Bank of India (RBI) database, the Planning Commission yearbook and Open Government Data (OGD) i.e. NITI Aayog database after shifting the base year for *Gdpgrowthrate* and *iip* to 2011-12 and reconstructing the entire series based on 2011-12 base year starting from 1992 onwards. Note that, the unorganized sector has not been considered because of the unavailability of data. Inflation has been calculated by the Consumer Price Index (CPI). The data on the adult literacy rate was available in an interval of ten years (as per CENSUS data) so it had to be interpolated and extrapolated accordingly as per the specification. Coming to the definition of money supply that has been taken into account here is M_3 or 'Broad Money'² and the growth rate of money supply is basically the growth of M_3 .

In this empirical model, the endogenous variables are highly correlated which point towards the presence of simultaneity. There also exists a high degree of correlation among other independent variables like adult literacy rate and dependency ratio. So, does it necessarily mean that we have multicollinearity in our model? The answer is no because in such a situation where the R^2 value is high and regression coefficients are individually significant as revealed by the higher t-values, then the multicollinearity issue may never cause a very serious problem (Gujarati, 2004).

Checking Identification and Stationarity as a Prelude to Estimation

- The order condition is — $K^{**} \geq G^\Delta - 1$ (where value of one endogenous variable is set at 1 via the invocation of normalization condition;

G^Δ = Number of endogenous variables included in the i^{th} equation and K^{**} = Number of exogenous variables excluded from the i^{th} equation).

- The rank condition is — $Rank(\Delta) = G - 1$ (where, Δ is defined as the matrix consisting of the coefficients of the parameters that are excluded from the i^{th} equation of the model (both the endogenous and exogenous variables) but included in the other equations of the system and G gives the number of endogenous variables.

For Equation 4:

$K^{**} = 3, G^\Delta - 1 = 4 - 1 = 3; K^{**} = G^\Delta - 1 \Rightarrow$ Order condition is satisfied.

$Rank \Delta = \text{Min}\{\text{Row}, \text{Column}\}$ so accordingly we will be chalking it out:- $G = 3$

$$Rank \text{ of } \Delta = \begin{bmatrix} 0 & -h_2 & 0 \\ -e_3 & -d_3 & 0 \\ 0 & 0 & -c_4 \end{bmatrix} = 3; \text{ Also, } G - 1 = 3 \Rightarrow \text{Rank condition satisfied.}$$

Therefore, equation (4) is just identified.

For Equation 5:

$$K^{**} = 4, G^{\Delta} - 1 = 4 - 1 = 3; K^{**} > G^{\Delta} - 1 \Rightarrow \text{Order condition is satisfied.}$$

Rank $\Delta = \text{Min}\{\text{Row, Column}\}$ so accordingly we will be chalking it out:- $G = 3$

$$\text{Rank of } \Delta = \begin{bmatrix} -b_1 & 0 & -h_1 & 0 \\ 0 & -e_3 & -f_3 & 0 \\ 0 & 0 & 0 & -c_4 \end{bmatrix} = 3; \text{ Also, } G - 1 = 3 \Rightarrow \text{Rank condition satisfied.}$$

Here, G = number of endogenous variables = 3. Therefore, equation (5) is over identified.

For Equation 6:

$$K^{**} = 5, G^{\Delta} - 1 = 4 - 1 = 3; K^{**} > G^{\Delta} - 1 \Rightarrow \text{Order condition is satisfied.}$$

Rank $\Delta = \text{Min}\{\text{Row, Column}\}$ so accordingly we will be chalking it out as,

$$\text{Rank of } \Delta = \begin{bmatrix} -b_1 & -i_1 & -f_1 & 0 & -e_1 \\ 0 & -f_2 & -e_2 & 0 & -d_2 \\ 0 & -b_4 & 0 & -c_4 & 0 \end{bmatrix} = 3; \text{ Also, } G - 1 = 3 \Rightarrow \text{Rank condition satisfied.}$$

Therefore, equation (6) is over identified.

For Equation 7:

$$K^{**} = 6, G^{\Delta} - 1 = 4 - 1 = 3; K^{**} > G^{\Delta} - 1 \Rightarrow \text{Order condition is satisfied.}$$

Rank $\Delta = \text{Min}\{\text{Row, Column}\}$ so accordingly we will be chalking it out as,

$$\text{Rank of } \Delta = \begin{bmatrix} -b_1 & -e_1 & -f_1 & -h_1 & 0 & -h_2 \\ 0 & -d_2 & -e_2 & 0 & 0 & -d_3 \\ 0 & 0 & 0 & -f_3 & -e_3 & 0 \end{bmatrix} = 3; \text{ Also, } G - 1 = 3 \Rightarrow \text{Rank condition satisfied.}$$

Therefore, equation (7) is over identified.

Since, all the equations in the system are identified it means that the model is identified. It should be noted that before we move onto to the estimation of the model, checking the stationarity of the variables becomes necessary. To check for stationarity of the variables, we go for Unit Root Test for every individual series with multiple structural breaks³ by applying the Dickey and Fuller (1979, 1981) test statistic and Akaike Information Criterion (AIC), with trend and intercept for knowing whether the series is trend stationary (TS) or difference stationary (DS). Now, the question which can arise in the reader's mind is that — was it necessary to perform the structural break test? The answer is no but still one may attempt Bai and Perron (1998, 2003) methodology to check whether there is any structural break and if so, note the dates of such a break. Actually, Bai and Perron (2006) in a later paper have argued and as Antoshin et al. (2008) puts it, “the size and power of their tests can be significantly distorted by several factors, such as — 1) a small sample size, 2) a small break size, 3) a small segment size and breaks clustering, and 4) the use of heteroskedasticity and autocorrelation corrections.” Furthermore, Antoshin et al. (2008) tries to solve the problem of endogenous structural breaks for small sample size and break size using Monte-Carlo Simulations for at least 50 observations in a series. But, given the size of the data set used in this paper such simulations become futile and it supports the stationarity property.

After conducting this unit test we see that all our variables attain stationarity at their level values (see results in Table 1) and we move on to the estimation procedure. Since there is no question of a cointegrated long run relation, one can directly move on to derive the reduced form estimates (i.e. a function of only the exogenous and the pre-determined variables based estimates) which will eventually serve up as instruments in the process of 2SLS estimation. After deriving the reduced form estimates of this

Table 1. Unit Root Results

We use the following model to test for the presence of unit roots, $\Delta y_t = \mu + \rho t + \tau y_{t-1} + \sum_{j=1}^k \varphi_j \Delta y_{t-j} + e_t$ where, μ is the constant, ρ is the coefficient on the time trend and j is the order of lag of the autoregressive (AR) process and Δy_{t-j} captures the autoregressive moving average (ARMA) effects (Dickey & Fuller, 1979, 1981). The test process is performed under the null hypothesis of $\tau = 0$ tested against the alternative hypothesis of $\tau < 0$. If the null hypothesis is rejected, it can be concluded that there is no unit root and the data is stationary.				
Variables	Level of Stationarity	Test statistic	Probability value	Order of Integration
Gdpgrowthrate	Level	-6.12	0.00*	I(0)
Emprate	Level	- 4.41	0.00*	I(0)
Infrate	Level	- 5.33	0.00*	I(0)
poplgrowthrate	Level	-5.44	0.00*	I(0)
iip	Level	-6.91	0.00*	I(0)
depratio	Level	-6.16	0.00*	I(0)
nomdeprate	Level	-5.77	0.00*	I(0)
Moneyspgrowthrate	Level	-4.98	0.00*	I(0)
adilrate_1	Level	-5.21	0.00*	I(0)
fertlrate	Level	-6.72	0.00*	I(0)

Source: Compiled by the author in Stata 13

Note: * denotes significance at 5 per cent level.

model, put it back into the original model to obtain the 2SLS estimates in this simultaneous equation system (SES) framework. Consequently, the problem of simultaneity gets resolved by using the 2SLS mechanism.

2SLS AND 3SLS RESULTS

Null hypothesis: $H_0: b_1 = 0, c_1 = 0, d_1 = 0, e_1 = 0, f_1 = 0, g_1 = 0, h_1 = 0, i_1 = 0$

Alternative Hypothesis: $H_1: b_1 \neq 0, c_1 \neq 0, d_1 \neq 0, e_1 \neq 0, f_1 \neq 0, g_1 \neq 0, h_1 \neq 0, i_1 \neq 0$

Here, by looking at the $P > |t|$ values in Table 2, it can be inferred that all the variables excepting one can explain the dependent variable which is *Gdpgrowthrate* for equation (4). Therefore, the null hypothesis is rejected for all the variables excepting, *adilrate_1* which does not seem to play any role in explaining the findings and the constant term has also turned out to be insignificant. *EEmprate* and *EInfrate* have done a great job in explaining the variation of the *Gdpgrowthrate*. It should also be noted that *EEmprate* and *EInfrate* are the reduced form estimates of the model. From the $P > |t|$ values in Table 3, we see that all the variables can explain the dependent variable which is *EEmprate* in this case. Therefore, the null hypothesis for all variables is rejected so all the explanatory variables have played a part in explaining the variation in *EEmprate*.

For equation (5),

Table 2. 2SLS estimates for the GDPgrowthrate function

Number of observations		Prob > F		R ²
25		0.00		0.99
	Coefficient	Standard Error	t-statistic	P > t
Gdpgrowthrate				
EEmprate	-2.66	1.14	-2.44	0.03*
EInfrate	-2.39	0.69	-3.50	0.00*
Epoplgrowthrate	-8..13	3.09	-2.63	0.03*
Gdp_1	-0.99	0.22	-4.51	0.00*
iip	-1.82	0.52	-3.52	0.00*
depratio	2.57	0.55	4.54	0.00*
nomdeprate	0.29	0.09	2.97	0.01*
adilrate_1	-0.13	0.15	-0.78	0.60
_Constant	16.63	36.27	0.46	0.80

Source: Compiled by the author in Stata 13

Note: * denotes significance at 5 per cent level.

Table 3. 2SLS estimates for the Employment rate function

Number of observations		Prob > F		R ²
25		0.00		0.92
	Coefficient	Standard Error	t-statistic	P > t
Emprate				
EGdpgrowthrate	-0.44	0.17	-2.67	0.02*
EInfrate	-0.43	0.12	-3.58	0.00*
Epoplgrowthrate	-10.54	3.91	-2.69	0.02*
iip	-0.33	0.12	-2.75	0.02*
depratio	1.57	0.65	2.42	0.03*
adilrate_1	4.02	1.09	3.66	0.00*
Moneyspgrowthrate	0.33	0.22	2.81	0.01*
_Constant	19.51	18.81	1.04	0.30

Source: Compiled by the author in Stata 13

Note: * denotes significance at 5 per cent level.

Null hypothesis: $H_0: b_2 = 0, c_2 = 0, d_2 = 0, e_2 = 0, f_2 = 0, g_2 = 0, h_2 = 0$

Alternative Hypothesis: $H_1: b_2 \neq 0, c_2 \neq 0, d_2 \neq 0, e_2 \neq 0, f_2 \neq 0, g_2 \neq 0, h_2 \neq 0$

For equation (6),

Null hypothesis: $H_0: b_3 = 0, c_3 = 0, d_3 = 0, e_3 = 0, f_3 = 0, g_3 = 0$

Alternative Hypothesis: $H_1: b_3 \neq 0, c_3 \neq 0, d_3 \neq 0, e_3 \neq 0, f_3 \neq 0, g_3 \neq 0$

For equation (7) we have,

Null hypothesis: $H_0: b_4 = 0, c_4 = 0, d_4 = 0, e_4 = 0, f_4 = 0$

Table 4. 2SLS estimates for the Inflation rate function

Number of observations		Prob > F		R ²
25		0.00		0.95
Infrate	Coefficient	Standard Error	t-statistic	P > t
EGdpgrowthrate	-0.79	0.69	-5.13	0.00*
EEmprate	-7.53	1.37	-5.20	0.00*
Epoplgrowthrate	0.87	1.33	3.06	0.01*
Moneyspgrowthrate	0.34	2.22	2.51	0.04*
Infrate_1	1.56	0.57	5.74	0.00*
nomdeprate	1.19	0.46	2.59	0.04*
_Constant	-15.34	2.79	-5.50	0.00*

Source: Compiled by the author in Stata 13

Note: * denotes significance at 5 per cent level.

Alternative Hypothesis: $H_1: b_4 \neq 0, c_4 \neq 0, d_4 \neq 0, e_4 \neq 0, f_4 \neq 0$

Hence, by observing the $P > |t|$ values in Table 4, it is clear that all the explanatory variables have explained the dependent variable which is *Infrate*. Therefore, rejection of the null hypothesis for all these variables is bound to happen.

Also, all the variables have turned out to be significant in explaining the variations in population growth rate (see Table 5). The results shows that the model has fit into the data exceptionally well with R^2 estimates of 99 per cent, 92.3 per cent, 95 per cent and 97 per cent for economic growth rate, employment rate, inflation rate and population growth equation respectively, in the structural form of the model. Next, we move onto the 3SLS approach.

The 3SLS approach involves the estimation of all the equations simultaneously. Identification of all the equations is essential in this approach. The 3SLS estimator involves estimation in three stages where firstly one needs to obtain the reduced form of the model. Then, obtain the 2SLS estimates and hence obtain the variance-covariance (Var-Cov) matrix of 2SLS residuals. Finally, using the variance-covariance matrix of 2SLS residuals from the second stage, GLS is applied to the composite model to get the 3SLS estimator (Zellner & Theil, 1962). The 2SLS and 3SLS (see Table 6) results are consistent with one another as seen in this case.

INTERPRETATION OF THE RESULTS

Examining GDP Growth Rate

The author finds a simultaneous relationship among the focus variables, GDP growth rate, employment rate, inflation rate and population growth rate; significantly affecting each other. The negative sign of the lagged values of the GDP growth rate indicates that the convergence hypothesis holds good for the Indian economy as found out by Khan and Ssnhadji (2001) who obtained the convergence after including a wide range of countries. There exists a negative bi-directional relationship between employment

Table 5. 2SLS estimates for the Population growth rate function

Number of observations	Prob > F		R ²	
25	0.00		0.97	
poplgrowthrate	Coefficient	Standard Error	t-statistic	P > t
adilrate_1	-0.67	0.28	-2.41	0.05*
fertlrate	1.89	0.22	8.59	0.00*
EGdpgrowthrate	-0.93	0.37	-2.51	0.04*
EEmprate	-0.91	0.35	-2.60	0.04*
EInfrate	3.01	0.94	4.15	0.00*
_Constant	12.26	15.63	0.78	0.60

Source: Compiled by the author in Stata 13

Note: * denotes significance at 5 per cent level.

rate and GDP growth rate. During 2004-09, India was placed on a high growth trajectory of around 9 per cent but if we compare the corresponding employment figures we see that they were astonishingly around a meager 13 per cent per 1000. The post economic liberalization period in India has witnessed the service sector becoming the principal contributor to economic growth but its contribution to employment generation has been dismal. Agriculture, still accounts for a major proportion of the employment in India. Going by the latest developments in this sector (say, the burning issue of farmer suicides) coupled with agriculture still being a gamble during the rainy season, have aggravated the problems. So, this significant negative relationship is quite obvious.

Population Growth rate is negatively related as expected from equation 3. We can see a positive and a significant relationship with the nominal depreciation rate implying that with increase in the growth rate of exchange rate (i.e. depreciation of the home currency vis-à-vis some foreign currency) the economic growth will be boosted and hence the rise. One of the reasons why this happens is because the depreciating exchange rate leads to higher reward from exports and hence higher GDP. This phenomenon can be considered to be an indication for the holding of Marshall-Lerner condition in the very crude sense of the term in the Indian context. The counter-intuitive (negative) sign of the adult literacy rate in the growth equation can make sense when analyzed in conjunction with the result of another study, which articulated that it may take about seven to nine years for the constructive effects of adult literacy to be felt on growth in India (Dholakia, 2003). So, adult literacy might positively affect growth, but only with a substantial time-lag.

High significance and the negative sign of the inflation rate parameter shows that there are huge growth costs associated with inflation in terms of income redistribution, tax structure, losing out on international competitiveness, etc., an evidence supporting the findings by authors like - Heer and Suessmuth (2009). This is the relationship being currently observed in the Indian economy and some other developing countries where higher predictions of inflation have maneuvered the decrease in the future growth forecasts. The dependency ratio parameter shows a positive sign in the growth equation, signifying higher labour productivity in countries with a higher dependency ratio. Last but not the least, surprisingly, over the study period, the index of industrial production growth has negatively influenced economic growth as well as employment rate (on emprate the impact of iip is negligible). These results hint at a below par performance of the manufacturing and mining sectors, and a decline in basic capital goods output with their current share in India's GDP languishing somewhere around 27 per cent.

Table 6. 3SLS Results

Equations	Observations	Parameters	RMSE	R ²	χ ²	Probability
4	25	9	1.74	0.980	38.55	0.000
5	25	8	1.03	0.911	71.98	0.000
6	25	7	2.42	0.963	28.19	0.002
7	25	6	1.01	0.954	30.01	0.001
Equation 4: Gdpgrowthrate	Coefficient	Standard Error	t-statistic	P > t 		
Emprate	-2.89	1.02	-2.88	0.00*		
Infrate	-1.19	0.55	-2.16	0.00*		
poplgrowthrate	-30.72	9.91	-3.10	0.00*		
Gdp_1	-0.19	0.19	-2.01	0.00*		
iip	-0.03	0.01	-2.45	0.00*		
depratio	1.30	0.55	2.38	0.00*		
nomdeprate	0.15	0.13	1.93	0.00*		
adilrate_1	-3.65	1.53	-2.39	0.00*		
_Constant	36.68	33.01	23.01	0.00*		
Equation 5: Emprate	Coefficient	Standard Error	t-statistic	P > t 		
Gdpgrowthrate	-0.45	0.18	-2.54	0.00*		
Infrate	-0.43	0.13	-3.43	0.00*		
poplgrowthrate	-51.18	13.16	-3.89	0.00*		
iip	-0.31	0.12	-2.61	0.00*		
depratio	1.58	0.66	2.39	0.00*		
adilrate_1	0.12	0.09	2.22	0.00*		
Moneyspgrowthrate	0.53	0.12	1.81	0.00*		
_Constant	19.59	19.37	4.01	0.00*		
Equation 6: Infrate	Coefficient	Standard Error	t-statistic	P > t 		
Gdpgrowthrate	-0.79	0.63	-3.25	0.00*		
Emprate	-7.12	0.34	-21.12	0.00*		
poplgrowthrate	0.87	1.33	3.06	0.00*		
Moneyspgrowthrate	0.33	0.19	2.72	0.00*		
Infrate_1	2.75	1.20	2.29	0.00*		
nomdeprate	0.95	0.14	6.61	0.00*		
_Constant	-15.34	17.82	-15.11	0.00*		
Equation 7: poplgrowthrate	Coefficient	Standard Error	t-statistic	P > t 		
adilrate_1	-1.43	0.41	-3.48	0.00*		
fertlrate	2.89	1.04	2.77	0.00*		
EGdpgrowthrate	-1.13	0.59	-1.91	0.00*		
EEmprate	-1.23	-0.51	-2.41	0.00*		
EInfrate	1.34	0.57	2.35	0.00*		
_Constant	18.26	5.67	3.22	0.00*		

Source: Compiled by the author in Stata 13

Note: * denotes significance at 5 per cent level.

Actually, this means growth in India in the post globalization era, as per the results given in Table 1, has been driven by growth in consumption and as such no real growth to that extent in investments in projects, auto sales, performance of corporate houses, employment generation, factory output of the manufacturing sector, etc.

Examining Employment Rate

The GDP growth rate has turned out to be statistically significant and the negative relationship is an implication of jobless growth in India which we have discussed in the preceding sections. The population growth rate bears a significant negative relationship as anticipated. The adult literacy rate supports a significant positive relationship with the employment rate and this implies that an increase in adult literacy leads to a rise in the employment growth rate. Due to the Government of India's investment in school education, especially the Sarva Shiksha Abhiyan (SSA), there has been an increase in the number of teachers employed by the Government schools throughout the country which may be a cause of the rise in rate of employment. The dependency ratio parameter signifies that a higher dependency ratio in India is an indication of a rise in the employment rate. Phillips curve suggested a tradeoff between the rate of inflation and unemployment which could assist the government to lower unemployment at the expense of higher inflation by pursuing the Keynesian expansionary policies. The liaison between employment and inflation has turned out to be negative significantly, contrary to the Phillips curve. One of the reasons for this may be the presence of a massive informal sector in the Indian economy. The growth of employment in the informal sector is not accounted for in the GDP and the growth rate of employment in the formal sector is comparatively low (Bairagya, 2012). So, a demand-pull inflation coming from the large informal sector dominates the impact coming in from the formal sector employment and hence is leading to this paradoxical result. This establishes the fact that India follows a Keynesian system of Government expenditure. The Phillips curve relation is a long run phenomenon and data for twenty three years may not be sufficient enough to claim such a proposition but still the results are in conformity with the vast literature on the "jobless growth" phenomenon which India has been experiencing for the last ten years (since the US crisis in 2008).

Examining Inflation Rate and Population Growth Rate

The lagged value of inflation rate has a positive and highly significant relationship with inflation. Thus, the results support the adaptive inflationary expectations hypothesis. Money supply growth rate has turned out to be statistically significant thereby affecting the inflation rate. The sign of the parameter is positive as the growth of the money supply component promotes inflation. This is consistent with the concept of "Quantity Theory of Money" as argued by Ashra et al. (2004). The bi-directional link between employment and the inflation rate has already been talked about in the preceding section. The population growth rate has a positive impact on the inflation rate. Also, GDP growth rate has turned out to be statistically significant in forecasting the inflation rate. Theoretically, all these are justified because a rise in the level of population means a greater amount of consumer demand which in turn fuels up the prices. Also, the nominal exchange rate (NEER) is highly significant and thus positively related to inflation.

The significance of the general fertility rate in the population growth equation in the model has been theoretically justified. The level of adult literacy has negatively affected population growth in this study. This implies that adult literacy has acted as a catalyst in the process of population control coupled with a strong consortium of Community Health Centres (CHCs), Primary Health Centres (PHCs) and Sub

Centres (SCs) active in the execution of family planning programmes. However, the General Fertility Rate (GFR) has been on the high so the achievements of family planning programmes still remain an unresolved mystery. The recent statistics of GFR reported by the Government of India (GoI), being 3.10 per cent advocates that these are disturbing signs which warrant immediate attention as there exists a negative effect of a rise in population growth on the macroeconomic variables *viz.* growth and employment status. Interestingly, an increase in the level of income or employment opportunities reduces poverty (Ahluwalia et al., 1979; Sala-i-Martin, 2005) which indirectly functions as a catalyst in the reduction of population growth. But, the reverse causality does not hold in the model. Now, to point out the fact that poverty reduction actually retards population growth, at the basic level, the author carries out a simple correlation analysis between head count poverty levels and population growth⁴ in India for the period under consideration (*till the year 2011-12). The correlation value is 0.56 and is significant at the 5 per cent level. This supports the findings by van de Walle (1985), Islam (2004) that poverty levels in India have gone down along with population growth rates.

CONCLUSION

Every economy prospers on a strategy for faster growth of productive employment together with sustaining a stable position between growth and inflation. Despite the historically unprecedented economic performance, India continues to maintain incongruity between the rate of economic growth and the growth rate of employment (6.6 percent in 2017; unemployment rate of 6.06 per cent in February 2018). As already mentioned, a major proportion of the workers are in the non-agricultural economic activities and work in the informal sector where they tend to suffer from a massive quality shortfall in the employment conditions, in terms of, low productivity, minimal earnings, pitiable working conditions and lack of social protection measures (NCEUS, 2009). Presently, the challenge for India is to not only generate new productive jobs but also to improve the quality of existing jobs. In addition to this, India has failed to play satisfactorily in the field of controlling inflation (4.96 per cent (till July 2018)). Presently, India is going through a phase of high inflation which has cast a negative impact on its economic growth (Madhavankutty, 2018) as shown by the results of the model. So as to keep a thorough check on the rate of inflation, both the Reserve Bank of India (RBI) and the Government of India (GoI) must be more cautious in their approach. If the government recommends a policy for achieving the objectives of price stability then objectives like GDP growth and employment position must also be taken into account simultaneously. But, in India, the objectives of price stability and inflation have always been at loggerheads (Jose, 2016). The author feels that when all the aforementioned measures are implemented properly in conjunction with one another, possibly then, our much coveted dream of an economically prosperous India can come true.

The framework developed in this paper is innovative in the sense that it provides an insight into how a researcher can correlate the effects of demographic variables on macroeconomic variables. Our results have highlighted that population growth has negatively influenced economic growth in India. In the recent years, the size of the working age cohort has increased given the number of dependents but since India could not orchestrate for productive employment opportunities, the potential acceleration of growth anticipated in due course of time lead to economic deceleration. Though, we have not particularly focused on the topic of 'demographic dividend' but the results clearly bear an indication that during the period considered, India has been unable to realize the benefits stemming from demographic profile changes (Bloom, 2011; Mitra & Nagarajan, 2005). Had India been able to take advantage of the circumstances,

the story could have been different altogether. Nevertheless, ten years down the line, the inference could be different given the fact that initiatives taken by the government for generating productive employment opportunities are successful in their mission.

FUTURE RESEARCH

The novelty of this paper also lies in the theoretical justification of the fact that macroeconomic objectives in the Indian economy are mutually dependent. This experiential configuration can be broadened by incorporating variables such as fiscal deficit, savings, the trade-openness ratio and financial inclusion. Carrying out the Error Correction Mechanism and Granger Causality would have added another dimension had the time series considered been long enough, say over a 40 year span. To further comment on the long run time series properties, the researcher can modify this model by inserting a dummy — one for the pre-liberalization period and another dummy for the post-liberalization period. This implies that there will be a set of results from 1970-1990 i.e. in the pre-liberalization period and another from 1993-2017 in the post-liberalization period. Comparing such results will be indeed interesting. Another interesting extension for a researcher would be to carry out a similar exercise for other countries in Asia or across the world in a panel data set-up to see the variation in the results. These are some of the areas where this paper can be extended.

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KEY TERMS AND DEFINITIONS

Census: A census is the modus operandi of methodically acquiring and recording information about all the members of a given population in a given geographic area. The term is used most frequently with national population and housing censuses; other common censuses include the likes of agriculture, business, and traffic censuses.

Demographic Dividend: Demographic dividend occurs in the process of demographic transition when the proportion of working people in the total population is high and more people have the potential of productively contributing to economic growth.

ILO: The International Labour Organization (ILO) is an agency of the United Nations mainly dealing with labour problems, particularly, the international labour standards, social protection, and work opportunities for all. At present, there are 187 member states in the ILO, 186 of the 193 UN member states plus the Cook Islands.

Jobless Growth: Jobless growth is an economic phenomenon where an economy experiences a situation of growth coupled with a decreasing level of employment.

Quantity Theory of Money: In monetary economics, the quantity theory of money states that “the general price level of goods and services is directly proportional to the amount of money in circulation, or money supply”. In its simplest form, the theory is expressed as:

MV: PT (the Fisherian Equation):

Each variable denotes the following: M = Money Supply

V: Velocity of Circulation (the number of times money changes hands)

P: Average Price Level

T: Volume of Transactions of Goods and Services

The original theory was considered orthodox among the 17th century classical economists and was overhauled by 20th-century economists: Irving Fisher, who formulated the above equation, and Milton Friedman.

Reserve Bank of India: The Reserve Bank of India (RBI) is India's central banking institution, which controls the monetary policy of the Indian rupee.

Simultaneity: Simultaneity is a specific type of endogeneity problem in which the explanatory variables are jointly determined with the dependent variable and thus, the error term is correlated with the explanatory variables.

Stationarity: The statistical properties like mean, variance, autocorrelation, etc. of such a time series are all constant over a period of time. Statistical forecasting methods generally use this stationarity property through mathematical transformations in the process of predicting how the future varies in comparison to the past. It, thus, aims to identify whether there is unit root in the time series process or not.

ENDNOTES

- ¹ The fundamental findings do not depend on any specific structure of the Money Demand function. The functional form that we have considered in our model is of the Cobb-Douglas type.
- ² M_3 = currency with the public + other deposits with the Reserve Bank of India (RBI) + demand deposits of banks + Time deposits with commercial banks (Fixed deposits, Recurring deposits)
- ³ See for details Agarwal and Ghosh (2015) to get a clear idea about multiple structural breaks in India.
- ⁴ For details on how population growth affects poverty in different levels of transitions read Merrick (2002).

The Economics of Unemployment

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INTRODUCTION

U. S. Bureau of Labor Statistics (BLS, 2018) reported that America employer payrolls increased by 201,000 workers in August 2018. However, the BLS Labor Force Statistics' Current Population Survey (CPS) revealed the U.S. labor participation was only 62.7%. Furthermore, the U.S. Census Bureau CPS indicates 96,157,000 adult Americans did not work in August 2018. The unemployed included 5,534,000 individuals that wanted a job but could not find one. Additionally, 1,443,000 reported they were available for work, wanted a job, and had searched for a position the prior 12 months. However, disturbingly, 598,000 working-aged Americans said they are not available to work even though they worked the prior year. The latter included individuals whose reasons for not working were "not ascertained."

BACKGROUND

To understand America's misunderstanding regarding the actual number of unemployed adults nationally, one must understand the science of economics and its history. Economics has been defined as the science of production, services, and consumption (Minsky, 1986). Smith (1776) argued there are four types of fixed capital: (1) useful machines and instruments of trade; (2) building and means of procuring revenue; (3) improvements of land; and (4) the acquired and useful ability of all the inhabitants or members of a society. Smith expanded upon the value of a nation's inhabitants by stating that the acquired usefulness of members of a society should be maintained by education, study, and apprenticeship and that investments in workers is equal to investments in machines (Rindermann, 2008). Smith (1776) also argued that humanitarian efforts, altruism, and sympathy are an unreliable guide to moral behavior. Furthermore, he argued that people are not under the control of their passions and emotions and could not be trusted to look out for the welfare of the common man (Ashraf, Camere, & Lowenstein, 2005, p. 134, 135).

The abject poverty, inequalities, and unwinnable war that led to the Russian Revolution and the creation of the Soviet Union was built upon those principles. Karl Marx and Thomas Malthus interpreted Smith's theories to mean economic markets and prosperity should be the entitlement of all of a country's residents, not just the wealthy (Beattie, 2018). The result was the rise of Socialism, an economic model that valued the employees (producers) or over the suppliers (employers) and promoted the typical working class' ability to work as the most important and asset of a nation (Beattie, 2018, p. 1-3)

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European socialism scientists Henri de Saint-Simon, Charles Fourier, Robert Owen, Pierre-Joseph Proudhon, and Mikhail Bakunin, however, had opinions in direct contrast with Smith's capitalistic theories (Arato, 1989). The issue was who would care for the working class to ensure they were able to prosper during times of economic growth. As a result, new voices from the West began to question both theories. Notably, Leon Walras, a French economist, tried to resolve the conflict by creating a model that used mathematical principles and statistics to create probabilities and scale to determine manage the volatility of supply and demand (Beattie, p. 6). The mixed economy theories of John Maynard Keynes rose to the top in America, and Keynesian economics, which argued government should intervene to balance economics, became the prevailing thought for decades. However, not everyone agreed with the constraint in Keynesian theory that stated that everyone who wants a job should be able to have one. This disagreement put pressure on the financial the banking and investment sections.

Minsky (1986) wrote, "There is nothing in the economic theory of either Keynes or Kalecki that points to the welfare state as the way out of the special instabilities that capitalist economies exhibit." When Keynesian economics failed to correct the 1991 – 2001 American recession, a new school of economic thought, the Rational Expectancy Theory (RET), rose to dominance. Grounded by the theories of John Muth, RET proponents once again promoted that trickle-down economics are what America's financial sector needed and promoted the idea of "natural unemployment" that argues the laws of supply and demand should determine how many people are employed based on production needs. RET argues that a "healthy" unemployment rate should range between 3% and 7% and that there is no such thing as "zero unemployment." Furthermore, RET argues that employers should have the freedom to hire only employees with certain skills sets. RET opines efforts other than what is ineffectual (Nash, 2018).

Arthur Lewis sought to bridge the gap between the competing economic theories by beginning a field of developmental economics focused on investments in human capital, which led to the creation of the Human Capital Theory (HCT). HCT proponents consider long-term unemployment as wasted human capital or the failure of a nation to transform raw human energy and power into highly productive assets capable of sustaining an economy under any condition. This theory argues the ties between investments in a nation's people (human capital) is so intertwined with investments in financial capital, organizational capital, intellectual capital, structural capital, relational capital, customer capital, social capital, innovation capital, and process capital that lack of investment in one area will negatively impact investments in the others (Edvinsson & Malone, 1997). Further, Nafukho and Brooks (2004) argue that a nation's wealth rises, and falls, on the backs of leveraged human capital.

METHOD

The literature review sought to answer the research question: *Why are so many Americans not unemployed?* The overall goal of this study is to conduct a rigorous empirical review and examination of literature focused on the economic policies that influence unemployment in America. The purpose was to provide general definitions of the philosophies and perspectives from research, theorists, and practitioners regarding unemployment and collect sufficient works to classify and code the literature for synthesis. The intent was to critically appraise the phenomena of unemployment research from a broad range of perspectives.

Cooper's (1988) Taxonomy of Literature Reviews for an integrated exhaustive coverage with selection criteria was used as the framework (Cooper, 1988). A preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) statement and checklist was adopted to establish the

Table 1. ERIC database keyword search terms and results

Search Terms	Results
S1: Structured unemployment	2
S2: Chronic unemployment	58
S3: Long-term unemployment	109
S4: Wasted human capital	2
S5: Human capital management	82
S6: Human capital theory	403
S7: Economics and Unemployment	318,454
Total Keyword Search Results	319,110

rationale and scope for the review and for pre-planning the methodological and analytical structure of the literature review process.

Five steps were completed. First, the authors identified and used keywords to search for literature related to unemployment. Second, the authors searched the EBSCOHost database for works using previously established criteria. Third, the authors examined literature abstracts for relevance to the research question and to identify exclusions. Fourth, the authors weighed selected literature using a hierarchy to facilitate judgment regarding the quality of evidence using a statistical approach. Fifth, the authors used a systematic process to organize, synthesize, and prepare the findings of the review for publication, dissemination, and translation into practice.

Data Sources, Search Strategies, and Preliminary Screenings

Seven unique keyword phrase searches for English studies were conducted between October 28 through November 17, 2018. The intent was to complete the work and prepare it for publication in 2019. Keyword phrases searched were: “unemployment”, “structured unemployment”, “long-term unemployment”, “wasted human capital”, “human capital management”, “human capital theory”, and “unemployed workers.”

The EBSCOHost account was also used to search for and find four seminar study keyword Boolean searches by title and author during separate searches. The inclusion of these works in the systematic review was necessary because the classic works were of central importance to the topic and provided the conceptual framework for this study and literature syntheses. Table 1 identifies the 319,110 works identified using the keywords indicated.

Preliminary Screening Exclusion Criteria

The authors used preliminary screening (P) to narrow the focus of the review and to exclude works deemed as duplicates, not directed toward the topic, not U.S. worker-focused, or unavailable through University of North Texas’ EBSCOHost. Table 2 provides an outline of the studies excluded during the preliminary screening process.

Table 2. Literature exclusions by reason

P1: Duplicates	0
P2: Not directed toward topic	6
P3: Not USA working adult exclusive	22
P4: Not available	7
Total Literature Exclusions	35

Selection Criteria Screening

The authors identified 145 English works published and unpublished in peer-reviewed scholarly journals, conference papers, proceedings, dissertations, theses, and working papers written between 1980 and 2018 based on the thorough search and exhaustive keyword searches, and the authors read the abstracts of the identified sources. Additionally, the authors excluded several seminal studies and theoretical works of central importance to the topic based on their acceptance within the scholarly community as indicated by number of citations. Works not available through the ERIC database or not accessible through the University of North Texas' EBSCOHost were also excluded.

Data Gathering, Selection, and Organization

Table 3. Literature exclusions by reason

E1: Lacked conceptual fit	1
E2: Lacked inference clarity	3
E3: Lacked topic generality	2
E4: Lacked validity or reliability	1
Total Literature Exclusions	7

Between September and December 2018, a neutral or unbiased principal investigator determined which works would be included. The investigator used as little personal interpretation as possible while selecting relevant literature for consolidation and synthesis using a statistically valid approach.

The authors used Microsoft Office 2016 Access to arrange literature by title, authors, year of publication, participant population, sample size, primary findings, and limitations. Additionally, the authors organized the literature conceptually so that works related to the same ideas or research methods would be analyzed categorically and methodologically.

Moreover, the authors wrote the literature review for the public, specialized researchers, policy-makers, and other stakeholders to use during decision making. The intent was to also publish, disseminate, and translate the information and evidence for a wider audience if accepted and cited as evidence by the economic and socio-science bodies of knowledge.

Selection by Classification

To ensure independent and dependent variables were examined for causal relationships, the authors selected a wide variety of studies for synthesis to understand relationships between unemployment theories and variables. This study grouped subsets for analysis of interrelationships among mediators and moderator variables (See Figure 1), which identifies the groupings of coded works by classification.

Figure 1.

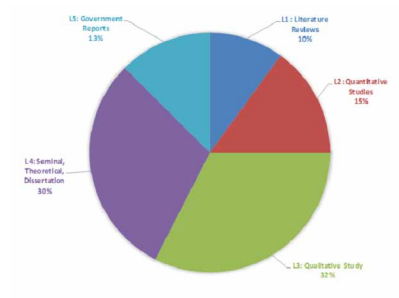


Figure 1 shows literature selected by study type and characteristics. This study grouped subsets for analysis of interrelationships among mediators and moderator variables, which identifies the groupings of coded works by classification.

Coding and Weights by Classification

The principal investigator coded, weighed, and assigned a value to both published and unpublished literature. Table 3 provides the ranking of the literature from “L1” to “L5” based on the determined relevance and significance of the work by classification as outlined below.

Table 4. Literature coding and weights by classification

Search Terms	Results	%
L1: Literature reviews	4	10.5%
L2: Quantitative studies	2	5.3%
L3: Qualitative studies	1	2.6%
L4: Seminal, theoretical, dissertation works	26	68.4%
L5: Governmental/economic reports	5	13.2
Total Literature Exclusions	38	

Data Extraction

Researchers extracted and synthesized relevant data to create statements by weight and quality, then combined the statements into a summative statement. The authors wrote the narratives to describe the syntheses and tables were included to display study designs, variables, outcomes, and context.

Data Analysis and Syntheses

Researchers will combine extracted data with type and present them as a coherent summary of the evidence that answers the research questions to enable researchers to draw conclusions. Descriptions of the volume and characteristics of the evidence by type, including details related to research design used, variables studied, outcomes measured, and contextual settings will be defined. The authors also provide statements regarding the consistency of evidence and summaries of relevance.

FINDINGS

The goal of this study was to integrate and generalize the information from multiple sources and identify and resolve inconsistencies or conflicts. The review seeks to answer the research question: *Why are so many Americans unemployed?*

Researchers have defined prolonged periods of unemployment as a persistent, structural phenomena (Dorsi et al., 2017, p. 164) that significantly reduces a worker's ability to find new employment (Bivens & Shierholz, 2014, p. 381; Birkenmaier, 2016, p. 202; Krueger, Cramper, & Cho, 2014, p. 229; Mutijani, 2009, para. 5) and robs them of their overall feelings of well-being and quality of life (Watson & Deller, 2017, p. 6). Moreover, unemployment can be particularly devastating to minority heads of households and other disadvantaged populations especially (Ganong & Nel, 2015, para. 5; Sherraden, 1985, p. 407). Analyses of the long-term unemployed have documented how their subjective well-being (Alexander, 2018, p. 24; Lucas, 2014, p. 386) is devalued and how this eventually leads to depression and anxiety about the future (McClure, 2018, p. 153).

While Keynesian economists feel the government has a responsibility to intervene to help ensure everyone that wants a job can have one (Keynes, 1937, p. 215; Ashraf, Camerer & Loewenstein, 2005, p. 145), the Rational Expectancy economists feel it is not the government's role to disrupt free-markets by incentivizing employers to hire (Gali, 2017, p. 37-38; Labonte, 2018, p. 38; Minsky, 1986, p. 5; Muth, 1962, p. 335). Rational Expectancy proponents continue to argue for free markets, including the rights to outsource jobs overseas to pay cheap wages and to avoid paying taxes (Janoski, 2014, p.173). These economists continue to argue for free markets even as American streets turn into crime-ridden war zones (Chiricos, 1987, p. 212).

Proponents of the Human Capital Theory, however, feel that investments in human capital makes good business sense (Beattie, 2018, para. 3; Hwang, 2017, p. 7; Nichols, Mitchell, & Lindner, 2013, p. 3). Human Capital theorists argue that policymakers should hold employers responsible for giving America's youth a fighting chance at having a decent life (Annie E. Casey Foundation, 2012, p. 15; Gould, Mokhiber & Wolf, 2018, p. 22) by investing in job training that can help American workers close their skills gaps so that they can become competitive, productive workers (Altig, 2012, para. 1; Crump, 2012, p. 6; AltigGreenstone & Looney, 20011, p. 18)

Limitations

Limitations to this study include the researchers' decision to limit searches to the University of North Texas EBSCOHost and Google Scholar databases. Another limitation was that the results from EBSCOHost were filtered by relevancy and only the first 40 results were screened. Additionally, studies published before 1980 were excluded.

DISCUSSION AND IMPLICATIONS

Over 200 years ago, Adam Smith once wrote:

“Fourthly, of the acquired and useful abilities of all the inhabitants or members of the society. The acquisition of such talents, by the maintenance of the acquirer during his education, study, or apprenticeship, always costs a real expense, which is a capital fixed and realized, as it were, in his person. Those talents, as they make a part of his fortune, so do they likewise that of the society to which he belongs. The improved dexterity of a workman may be considered in the same light as a machine or instrument of trade which facilitates and abridges labor, and which, though it costs a certain expense, repays that expense with a profit.”

Considering Smith's observations, regardless of their differences, America's economist should agree that wasted human capital or, in the context of this study, the long-term and chronic unemployed, is expensive to both families and commerce. One respected economist, Arthur Okun, used mathematical equations to prove for every 1% increase in unemployment, America's economy's Gross National Product experiences a 2% drop (Okun, 2015). Therefore, despite perceptions that job training programs are public welfare, history indicates such expenditures are investments.

FUTURE RESEARCH DIRECTIONS

Based on the findings, the authors recommend that a more expansive review be conducted to identify points of agreement and disagreement between economists related to unemployment and its impact to the economy. The research should include cost-benefit comparison of public assistance expenditures for unemployed workers compared to investments in job training programs.

CONCLUSION

The findings of the literature review infer that one would think American policymakers and businesses need look no further than the 2018 federal budget expenditures for answers. American taxpayers are paying substantial amounts for social services, (U.S. Department of Health & Human Services, 2018, p. 3), crime and incarceration (U.S. Department of Justice, 2018, p. 5), and unemployment insurance (U.S. Department of Labor, 2018, p. 2) each year, which research ties to long-term unemployment. There, the failure to consider alternatives assumes current U.S. economic policies that ignores the plight of 96 million unemployed Americans may be putting the country on an unsustainable path. The alternative appears

to be to promote investments in job training programs designed to close the American workforce's skills gap. This would represent an investment in American workers (Janoski, p. 173).

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KEY TERMS AND DEFINITIONS

Cyclical Unemployment: Cyclical unemployment is the component of overall unemployment that results from economic upturns and downturns.

Economics: Economics is a social science concerned with the production, distribution, and consumption of goods and services.

Expectations Theory: Expectations theory attempts to predict what short-term interest rates will be in the future based on current long-term interest rates.

Frictional Unemployment: Frictional unemployment occurs during a period when workers are searching for new employment or transitioning from their old jobs to new ones.

Full Employment: Full employment is an economic situation in which all available labor resources are being used in the most efficient way possible.

Human Capital: Human capital is an intangible asset or quality not listed on a company's balance sheet.

Keynesian Economics: Keynesian economics is an economic theory of total spending in the economy and its effects on output and inflation.

Natural Unemployment: Natural unemployment, or the natural rate of unemployment, is the minimum unemployment rate resulting from real, or voluntary, economic forces.

Rational Expectations Theory: The rational expectations theory is a concept and modeling technique that is used widely in macroeconomics.

Unemployment: Unemployment occurs when a person who is actively searching for employment is unable to find work. Unemployment is often used as a measure of the health of the economy.

The Role of Technology in Thana–Capitalism

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INTRODUCTION

We live in digital times, where events are covered and disseminated and consumed by a wider audience in seconds. This instantaneity paved the ways to the rise of a new digital culture where we can travel without even moving. The virtual reality has situated as the hallmark of a new 4.0 society (Warschauer & Matuchniak, 2010). To put the same in other terms, technology not only changed our current means of production but also the lifestyles as well as our habits, behaviours and social interaction with others (Gold 2012). The introduction of robots and virtual reality may very well erode the social ties since lay-citizens are certainly pressed to interact with an artificial “Other”. Doubtless, this is the end of hospitality as we know it (Korstanje 2017). In a seminal text, Jacques Ellul exerts a radical critique on “the technological society” shedding light on the negative effects of autocracy which are imposed by the logic of instrumentalism proper of the capitalist system. The legitimacy of the ruling elite is enhanced while the workforce passively accept the notion of efficacy as a form of genuine development. This creates a climate of extreme competence where only there is one winner and the winner of course takes it all. Ellul alerts that someday, humankind will be strictly controlled by Machines which move per their own ends. These automat robots are the direct result of an excess of rationality. He even toys with the belief that technology was conducive to the culture of capitalism in which case the logic of instrumentality mediates between citizens and their respective institutions (Ellul, 1964). Scholars are divided respecting to the role played by digital technology in the liberal world of consumers. Notably influenced by the legacy of Max Weber, Ellul was a pioneer in warning the grim future of humanity which may be subordinated to the exploitation of the liberal market. However, other voices like Guy Sorman (2008) claim that the forces of progress activate conservative counter-reactions that are oriented to prevent a more egalitarian society. Detractors of technology and its progress only are limited to tell part of the truth, which means the aftermaths of new techniques in the fields of the economy but ignoring those achievements promoted by technology as the expansion of life expectative or the improvements in healthcare overt recent years. As Korstanje and Skoll put it, neither good nor bad technology depends on the use people did. Concerned by the paradoxes of Chernobyl, modernity showed that technology enrooted in a world of complexities and uncertainty would be as “a runaway train” very hard to control. The paradox was that the same instrument will make of our life a safer place to dwell become in a global threat that very well jeopardizes our existence on this planet (Korstanje & Skoll 2014). Here some questions arise: what is the role of Technology in our modern World, is technology a mechanism of control or censorship in democratic societies? in what way?

Although technology facilitated plenty of liberties and rights for humankind over the recent centuries, which is protected by the contours of democratic institutions, no less true is that democracies still exert censorship over those voices which may place the system in jeopardy. In Medieval Times, writers or

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thinkers whose texts were critical to the established status quo –i.e the King or the Catholic Church- were jailed, tortured and condemned to death. The violence was culturally and legally legitimated not only by the law but also by the power emanating from the divinity of the King. This seems to be the figure of Leviathan brilliantly described by Hobbes in his texts. The publication and resulting dissemination of books was limited to those voices strictly conducive to the interest of the King. Likewise, the idea of power associated to the capacity of the Monarch to instil terror in the community. Rather, in postmodern times, censorship is preferably achieved by the editorial over-production without limits and no matter whom or under what theme the writer focuses on. While we typeset –in Google- the name Karl Marx or Max Weber, thousands of entries appear. From the right to the left-wing, much has been written about classic authors. Since our mind is limited in the understanding, we would read only a small portion of all deployed works and publications. While in the medieval times the books are destroyed and thrown to the fire, in the postmodern days, books are systematically over-printed. In the capitalist ethos where liberty plays a vital role, consumers re-channel their whims and desires into standardized forms of behaviour. The overproduction leads to people not to understand the real causes of the events. For those lay-readers who are not familiar with the fields of sociology, it is very hard –if not impossible- to understand the rise and evolution of modernity. In fact, some may launch to read ten or twenty books but they will not understand what they read. In the post-modern days, hence, censorship is strictly entwined to the material forces of production, as well as affordable technology which is used to stimulate the consumerist culture. Based on the notion of liberty (or democracy) as the mainstream cultural value, capitalism overproduces information as an efficient instrument towards misunderstanding. Conducive to mass-consumption, freedom and democracy delineate the contours of societal order making the produced commodities affordable to consumers, but in so doing opens the doors for an atmosphere of conflict and discontent as never before. It is important not to lose the sight of the fact that this moot-point was brilliantly remarked by Ulrich Beck in his book *Risk Society towards a new modernity*. Beck critically debates to what an extent the process of flexibility has recreated a new condition for postmodernity. The problem lies in the fact that the society Beck observed, just after the 9/11 as well as stock market crisis in 2008 does not exist anymore. We coin the term “Thana-capitalism” to describe this new emerging society, where the Other’s suffering (not risk) became the main commodity.

Although this point will be detailed in the next sections, let’s explain readers that the term Thana-Capitalism denotes a new stage of the capitalist system where death is the main commodity to be exchanged. Not only the modern tourists consume death visiting spaces of mass death or cities which were whipped by natural disasters, but also we consume death through videogames, media and movies (to name only a few) (Korstanje 2016). The society of risk, as it was imagined by U. Beck, sets the pace to Thana-capitalism. In this emergent facet, not only technology played a vital role in subordinating social practice to gazing but also paved the ways for the needs of captivating the suffering of others. In times of Thana-capitalism, risk sets the pace to death as a mediator between citizens and their institutions. We mean to Thana, as a derived term from Thanatos (Greek) from Death. In the days of Thana Capitalism, global audiences gaze spectacles which are based on news, the content of disasters, mass-death or trauma. Citizens who are prone to gaze others’ death enthrall their own status as a part of privileged-class.

Theoretical Background

Over the decades, common questions asked on the evolution of science in Occident. Three different academic waves explored the interconnection of technology in the maturation of science. Econometrics, which initiate the first family of studies, signalled to mathematical algorithms to produce top-down

knowledge. Everything which cannot be visually tested was systematically rejected as a source of genuine knowledge. Human habits, not number were the key factors that distinguished these emerging disciplines from the economy. If classic science was prone to the premise of objectivity between observer and observed, sociology and anthropology gradually instilled a hermeneutics dialectics of knowledge which based on individual experience gave innovative outcomes (Cuevas 2005). Though this premise was already-evinced by young Marx, since the means of production mould the ideology for the society to understand the environment, it is tempting to confirm that technologies are subsumed under a historical dialectic imposed externally by an elite. This suggests that things are used to accomplish broader goals, but the underlying meaning for what we use these different objects is externally and culturally imposed by a privileged class (Marx, 1975; 1967; Marx & Engels, 1983). This raises a more than the interesting question, is technology a platform to alienation?

For H. Marcuse, the alienatory nature of technology rested on its capacity to alter the cultural background of society, which legitimized the asymmetries of classes (Marcuse 1991). Capitalism has imposed an “economy of desire” which absorbs the wages of work-force (Korstanje 2015). In this respect, David Harvey (1989) argues that modern means of production blurred the borders between space and time, accelerating the gift-exchange process. The oil embargo after 1972 produced a serious crisis to West which decentralized the economic system to the extent, that the concept of reality as it was envisaged by Enlightenment set the pace to multi-layered view of reality (Harvey 1989). In this context, French philosophy pivoted a radical criticism against the role played by technology and science in this ever-increasing process. From Weber and Sombart’s days, there was no other critical thinker as Jean Baudrillard that attacked the epistemological core of capitalism. For Baudrillard, capitalism has successfully expanded in view of the alternations of the epistemological viewpoint in what reality means. The visual technology in these times has not only altered the perceptions of citizens accelerating the intersection of time and space but the proliferation of textuality. In sharp contrast to other ages, modernity is based on the rise of computers where the meaning of publicity associates to the electronic World. To understand this better, he cites the example of Precogs, in *Minority Report* film, anticipate to the crime before it is committed. This reminds that the visual appearance of events does not imply they are happening in present; as these crimes were forecasted by Precogs in a future that modified the present or potential criminal, now pseudo-events are virtually shaping our sensual realm (Baudrillard, 1986; 1995; 2001, 2002). As Virilio puts it, technology played a leading role not only blurring the borders between past and time but effacing the difference between reality and pseudo-reality. In consonance with Baudrillard, Virilio understands that modern science remains subordinated to the interests of the market, instead of searching in the true, to solve the problems of citizens. More interested in supporting the financial mega-corporations, science embraces the paradigms of simulation, which reflects complex algorithms to understand the future. One of the chief aims of science, adjoined to technology, is to prevent the risks that may place the capitalist system in jeopardy (Virilio 2010).

Virilio’s account is oriented to exploring the limitations of modern science which today are not concerned with understanding issues, but forecasting hazardous events in order for the current system of consumption not to be affected. Doubtless, it opens the doors for a more creative discussion to understand to what extent science and the society of risk are inextricably interlinked.

Knowledge in the Society of Risk

The idea of a society of risk was coined by German Sociologist Ulrich Beck in observance of the role of nuclear technology in Chernobyl, Ukraine. This sudden disaster not only shocked public opinion

worldwide but also evinced the vices and limitations of experts in the manner technology are manipulated. Those instruments which originally would be featured for the benefits of humankind now result in global risks that put society upside down. In this vein, Beck adheres to the thesis that the presence of risk makes societies more egalitarian since all classes are united by the same problems. Paradoxically, this accident created a radical shift in how knowledge is produced and disseminated to lay-people. With the advent of the society of risks, consumption replaced ethics in the line with the fact that hope for full employment sets the pace to insecurity and fear. While lay-people advanced in their knowledge of the world, risks appealed to a process of “reflexibility” where the top-down authority of experts was placed under the scrutiny (Beck, 2002; 2009; 2015).

Following this ground-breaking contribution, Anthony Giddens goes on the open points unexplored in Beck’s account. For Giddens, capitalism and industrialism are different projects which originally worked dissociated each other. Taking his cue from the “attachment theory”, Giddens understands that social ties are represented in the ontological security developed by individuals from their childhoods. At the time, the emerging force of tradition is eroded by post-modernity; the ontological security of citizens will be seriously damaged. Trust serves as a “protective cocoon” in order for people to face the daily threats produced by the system. Without the blessing of trust, lay-citizens are more frightening of the future and will look shelter in technology. The process of reflexivity engendered more horizontal circuits of authority, and of course, the system of experts is confronted with the knowledge accessed by lay-people. To wit, the legitimacy of experts in the fields of medicine, to set an example, will depend on the credibility the professional instil in patients. In this stage, trust plays a crucial role configuring the social basis of a society that enthralled global risks as the mediators between citizens and their institutions (Giddens & Pierson, 1998; Giddens 1991, 1999). In consonance with Virilio, Giddens advises that in a near future, knowledge will be regularized by means of reflexivity in a way that will lead science to be prone to discover elements that help to forecast risks instead of studying facts. At a first look, what would be more than interesting to discuss is to what extent, in post-capitalist societies, the use of digital-technology produces more efficient censorship.

In regards to the dichotomy of Surveillance and censorship, a must-read book is *Liquid Surveillance*, authored by D. Lyon & Z Bauman (2013). Both agree though 9/11 has not created the current state of hyper-surveillance in modern capitalist societies, no less true is that this traumatic event accelerated its condition of reproduction. The already existent technologies are posed not only to make for public spaces, or households a safer place, but also to remind the importance of those persons who can pay for private security or closed-circuits of satellite control. This book suggests two significant ideas. First and foremost, the state is unable to protect its citizens because the power was conferred to trade. The modern nation-state is obliged to give solutions for problems created elsewhere. This engendered a sense of anomie, by which the citizens feel vulnerable. Secondly, the introduction of surveillance technology makes an unsafe world. The quest of order that characterizes human existence is determined by the needs of change. The paradox lies in everything that we do, is to create a sense of stability we never will reach before death. If the society of risk imagined by Beck considered the risk as a result of the action, liquid surveillance goes in another direction.

As this argument is given, Rebecca Fiske reviews the intersection of the state of exception with the law-making process, a strand ignited by Schmitt and recently continued by Agamben. Fiske starts from the premise that any law derives from the authority of Gods, and remain affordable for humans in case of emergency. The paradox with this doctrine is that while the notion of exemption supposes breaking the law, sovereign serves as a symbolic gatekeeper. While this applies very well for tribal societies, in industrial organizations where divinity exerts a moderate influence, the sense of exemption prevails.

Fiske acknowledges that after 9/11 US committed some human right violations, in the name of security and well-being. While emergencies allow the delegation of further powers to the executive branch, the judiciary often does not express any worry. This pattern would be very dangerous for democracy because it leads to dictatorship. After 9/11 the society of risk passed to a new stage where the spectacle of disasters would be the mainstream cultural value. Risk society mutated to Thana Capitalism, in the same way, the sense of protection set the pace to the needs of gazing others' death (Korstanje 2016). This will be fleshed out in the next lines.

The Rise of Thana-Capitalism

To some extent, not only Giddens but also Beck took the wrong side of the road in their analysis of capitalism. There is nothing at the end of class-society in postmodernity. Neither classes have disappeared, nor are citizens living in a more egalitarian society. In the society of risk, some groups make the decisions that generate those risks other more vulnerable groups will face. Given this condition, those classes which monopolize the financial resources to mitigate risks are situated at the top of society, while lower classes are condemned to experience the catastrophes triggered by decisions that are made in external circles. Lower-classes are far from controlling risks in a Thana-Capitalism, they are subject to witness their effects alone.

Throughout the Medieval Times, the access to knowledge was restricted to few hands. Without "The Printer", which was invented by Johannes Gutenberg's, the produced information was monopolized by the Catholic Church. Those agents, who defied the status quo, were coactively repressed and condemned to death. This was an oft-used tactic of censorship that instilled panic in the population. Violence and death were everywhere and a peasant has an expectative of life of almost 30 years. However, the invention of the Printer changed everything, enhancing the accessibility to books to lay people. The pressure and sense of control orchestrated by the Prince set the pace to subtler forms widely based on alienation and standardization. As Marshal McLuhan puts it, printing press accelerated a real revolution in European thinking to the extent to produce a mega-system of global communication (Global Village) where the efficacy of the system was given by its ability to gather information. However, in this universe, this information was not equated to a critical thinking. Hence, the expanse of high-tech has not made from this society a better place, they were oriented to create "false identities" which are imposed and individually negotiated by the agents. High-tech enrooted in the culture to produce habits in users. In one direction, the creation of movable types was a turning point to reproduce thousands of books, which led towards a society of information, whereas unfortunately it was created a "tyranny of visual culture" cemented a standardized-culture (McLuhan, 2011).

In our current days, the society of risks examined by Giddens and Beck has gone forever, or at least it has mutated into a new form: *Thana-Capitalism*. Risk-Capitalism essentially was associated with bio politics and the needs of life, Thana Capitalism centres on the opposite, death. In sharp contrast to Medieval Age, in Thana-Capitalism people have a high expectancy of life, but live frightened by the possibility of death. Consumers are fascinated to witness spectacles where others are affected, killed or tortured. Death has become the main cultural value in this new society, where 24 hours per day, TV and Journalism only transmit news linked to death. News that oscillates between disasters, terrorist attacks or local crimes daily captivates an audience more interested to feel more special than consternated for a run-a-way World. In many newscasts, it appears a message that says "images may hurt your sensibility", or Warning, videos and images not for children". At a closer look, even if the audience in the developed

societies is bombarded to catastrophic news with the end of keeping the society in an on-going state of emergency, no less true is that death has become in a form of entertainment.

As Phillipe Aries eloquently observed, the expectancy of life was notably expanded but this does not resonate the quality of life. For the medieval peasant, the act of dying was normal and death was surely everywhere. Over the years, humankind has controlled death while making it more savage and wild. Today we are afraid of death as never before. Our modern attempts to domesticate death has liberated a much deeper uncertainty (gap) which is filled by the Media (Aries 1975)

To wit, five indicators are of paramount importance to observe the end of the Risk-Capitalism and the rise of Thana-capitalism.

Differences between Risk and Thana-Capitalism

Risk-Capitalism Thana-Capitalism	Politics Decentralized Chaotic	Economy Segments Total Competence
Production Consumption Survival of the fittest	Main Value Risk Death	Event Oil Embargo (1972) 11 September of 2001
Reaction Risk Management Victimization	Pressure Group OMG Victims	Censorship. Fear Over-production of information

We mean OMG as Object Management Group. Further, Table 1 shows the differences between Risk and Thana-Capitalism. The society drawn by Giddens and Beck corresponds with Risk-Capitalism. The organization of this system was centred on a decentralized mean of production where globalization attracted heavy investment in any part of the world. The maximization of profits and the reduction in costs was the main goal of risk-society. Even under-developed countries were more attractive for investors because the lower work-force costs respecting to central economies. As Taylor Gooby (2004) noted, the same technology that expanded the expectancy of life and enhanced the quality of life of elderly class produced a serious imbalance in the social security costs because active workforce should absorb an ever-growing demand of retirees that threatened the balance of the system. Secondly, the adoption of new technology to efficiently maximize profits of capital-owners reduced the supply of jobs for a prioritized blue-collar class. All these events conjoined to the oil Embargo caused by the Arab Israeli war produced a serious glitch in the good fare state that initiated a new version of capitalism, more based on fear as a dissuasive element of control. In *Governing through Crime*, J. Simon evinced how ruling elite appealed to create “an evil-doer” in order for the workforce to accept economic policies otherwise would be widely rejected (Simon 2007). Neoliberalism alluded to the sensationalism and fear disasters wake up in a society in order to ensure a logic of exploitation over workforce (Klein 2007). Since the main cultural value in the society is a risk, the reaction of citizens corresponds with the management of risk, which is associated with the needs of protection. As this backdrop, citizens go to the private market in the absence of nation-state, whereby the paying of a quota of capital they get a temporal sense of security. By means of the buying insurances for protection, the society of risk still produces new commodities to be exchanged in a global market. The tactic of discipline or censorship over citizens depends on the degree of the fear elite can produce in society. Frightened by the presence of global fears that can end with life as we know, citizens are sensitive to the market to pay for the security the state does not grant. However, one thing is using technology to predict disasters, and others go to the high-tech to produce a “theatralization of disasters”. In the second case, death is enthralled as an attractive factor of western culture in the contemporary World.

During the risk society, people lived afraid the disaster will be next to take place. The specialized literature suggests that risks are not disasters. Risk is a potential danger which can occur or not. Therefore, the society of risk was oriented to a future. Understanding the dangers hidden in the future will be an efficient attempt to protect society. Thana-capitalism, rather, promotes disasters in order to entertain a global audience dubbed as “death-seekers”. Seeing how others die serves as a symbolic platform for the watcher to feel how outstanding he or she is. This is the reason why terrorism or news related to terrorist attacks are covered instantly by the media. We are fascinated by the state of disaster produced by risk society. Technology not only has disciplined the real external or internal threats but it has commoditized lower classes’ suffering as a new type of cultural entertainment (Korstanje 2016).

Doubtless, 9/11 was a founding event for the rise of Thana Capitalism. From this moment on, not only Western audience acknowledged that the world was an unsafe place to be, but they witnessed how their high-tech and transport applications can be used as weapons to the cultural core of the world. In this new era, coaction and violence were futile and censorship was politically manipulated to cause misunderstanding in lay-people. The term Thana-Capitalism stems from the word Thanaptosis which was originally coined by poet William C Bryant to symbolize the cycle of life and death. We live in order for others to die, and we will die so that others can live. Furthermore, Thanatos (Θάνατος) comes the name given to a demon who represented the personification of “death”. In this new stage, capitalism signalled to a much complex system of production which exploited the symbolism of death. Since the conditions of production passed from a decentralized model to a chaotic one, where all agents enter in the competence with others for surviving, the doctrine of Thana-capitalism follows doctrines of social Darwinism where protection set the pace to the Survival of the strongest. Sometimes, holiday-making and vacations give some hints on how societies are changing. Our parents went to beaches or relaxing sites to spend their days while now tourists are excited to visit spaces of disaster as Chernobyl, Katrina in New Orleans or even the ground zero in New York. Sociologically, if holidays-makers have developed an Apollonian sense of beautiness, now they are in quest of spaces of mass-death and suffering to revitalize the psychological frustrations they daily experience in their respective societies. Death has gained traction in thana-capitalism, captivating the admiration and becoming in a real tourist-attraction for many international segments (Bloom 2000; Stone & Sharpley 2008; White & Frew 2013). Knowing further on what purposes people travel exhibits a valid way of understanding of what values society is organized (Korstanje 2015). Is dark tourism a sign of egoism or a real attempt to understanding Death?

Several decades back, George H Mead, one of the fathers of symbolic interactionism, questioned why paradoxically many people are prone to read or listen of bad news presented by journalism, at the time they show preference by these types of news. What is our fascination for other’s suffering? He assertively concludes that the self is configured by its interaction with others. This social dialectic alludes to anticipation and interpretation as two pillars of communication-process. The self feels happiness by other’s suffering because it represents a rite necessary to avoid or think in own pain. Starting from the premise the self is morally obliged to assist the other to reinforce its sentiment of superiority, Mead adds, this is the ethical nature of the social relationship (Mead, 2009). The same remarks may apply for thana-capitalism.

Undoubtedly, the myth of Noah sounds one of the main stories of the Bible which was commoditized by the cinema industry. Such a myth not only explains but also legitimizes the material asymmetries produced by Thana-Capitalism. Let’s remind readers that this God annoyed by the corruption of human beings, mandated to Noah to construct an ark. His divine mission consisted of gathering a pair by species to achieve the preservation of natural life. The world destroyed by a great flood will be reconstructed by the species protected by Noah. At a first glance, as the myth was ethically formulated, a formal message

is based on the importance of nature and the problem of sin, corruption. But unconsciously, it poses the dilemma of competition where Thana-capitalism is centred. At any tournament or game, there can be only one winner. Not only the creation but also Noah is the witness of other's death, other's mass-death. The curiosity and fascination for death come from this founding myth. The fact is that it can be found in Reality shows as the big brother, a game widely studied by sociologists and detractors of visual technology rests on this principle. The main message of this game is only one participant is the chosen one to win. The doctrine of selective-oriented salvation, enrooted in Protestantism claims for (though from different angles) understanding death as a token of vulnerability, lack of purity. The question of whether people are happier when disaster takes place in other neighbourhoods, it is still unclear the intersection of disasters and social bondage (Korstanje 2015; 2016).

It is important not to lose the sight that shrines reminding spaces of disasters are dispositifs politically enrooted in the "spectacle of disaster", as discussed in the earlier sections, a term coined by Jean Baudrillard. By thematising on disasters the community accelerates its recovery understanding the lesson left by the nature. Humankind from its inception is aimed at disciplining not only the nature but death. Like disasters, death can suddenly take room in our life (without previous notice). As a result of this, survivors feel a much deeper anxiety which is placated by the elaboration of specific-contextualized rites. The notion of trauma does not relate to the pain, but to the possibility the tragic event repeats in a near future. In the context of total obliteration, survivors develop a narcissist character where they believe they have survived because their bravery, moral virtue and strength (outstanding and heroic traits). This type of reaction helps the community to recover to adversity while generating sentiments of nationalism, superiority or ethnocentrism when this narcissism goes beyond the normal conditions. The superiority of survivors, in this vein, depends on the other's misfortune. Unless this sentiment of narcissism to be regulated, it produces a clear rupture that affects social solidarity. Survivors feel they are super-heroes or special people touched by Gods, their mandates not only are sacred but also just. At this moment, this sentiment of superiority feeds back a much deeper stage of victimization where survivors feel that pain is the only mean to reach happiness. Quite aside from this, their losses make them special for others who have not faced the same situation. In Thana-capitalism the Other's suffering reinforces a self-heroic aura of superiority where the viewer feels special –at least for some minutes-. Thana-capitalism in sync with existent visual technology, not only exploits these types of climates but also obscures the causality of events. French ethnologist, Marc Augé acknowledged that the mass-media portrays tragic events blurring the connection between causes and consequences. News or stories focus on the effects instead on a clear diagnosis of reasons behind. As a result of this disasters' are continuously repeated once and once again (Augé, 2002). Not surprisingly, mass-media disseminates on a daily basis, news containing stories of victims to reinforce the above-described sentiment of Narcissism.

CONCLUSION

In the days of *Thana-capitalism*, death is the main commodity which is produced and disseminated by the media worldwide. As in dark tourism practices, people are interested to gaze the Other's suffering but in fact, far from being closer to others, it reinforces their happiness not to be touched by death. Since thana-capitalism is based on a social Darwinism where all are struggling against all to survive, others' death endorses an exclusive sign of supremacy for those who are still alive. Metaphorically speaking, life is understood as a thrilling race where only a few selected participants win. In reality shows like Big Brother, or Films like Hunger Games, there is only one winner. The competence of all against all

is promoted by a cynic leader who looms from the darkness. This suggests that participants of these games not only are unfamiliar with their real probabilities to fail, in view the fact that they are moved by their own egocentrism but they are unable to cooperate with others to defeat the ruling elite. Is this a continuation of Social Darwinism?

It is safe to say that without social Darwinism, Thana-capitalism would never exist. As discussed throughout this chapter, at time of researching for some issues the records visible in the media prevent a coherent understanding of social issues, this multiplication of information paved the ways for a paradoxical situation where only a few hands monopolize what can be or not written. If in medieval times, the censorship was oriented to violence now it is related to liberty and the scattered information that leads to misinformation. This is only possible in a new era, dubbed as “Thana-Capitalism”. Nowadays, technology offers a fertile ground to visualize the suffering of “Others” connecting our self to death, whereas stimulating the over-production of information. With the benefits of hindsight, this chapter holds the thesis that death, censorship and technology are inextricably intertwined. In medieval times where death was a very common thing in day-to-day life, produced-information was reduced to limited circles. The lower technical condition of production was prone to use violence to exercise censorship to the peripheral voices.

Lines for Future Research

The argument held here may find much criticism in liberal thinkers, who argues that capitalism helped not only to crystalize democracy but making of this world a less violent realm (Pinker, 2011). However, the problem of capitalism rests on the belief that few deserve much, while the rest are on the ruin. Almost 2% of the global population concentrates 90% of the produced wealth. In a recent book, Maximiliano Korstanje (2015) alarmed that this postmodern world can be compared to the film Hunger Games, or the reality shows Big Brother. In both settings, participants are dominant of their conciseness because they remain unfamiliar with the real probabilities to fail. These competencies, like liberal market, are based on the premise of social Darwinism that claims for “the survival of strongest”, which means that the glory of only one equals to the failure of the whole rest. Participants not only over-valorise their own skills but are confident of their strongholds. The stimulation of competition in the labour market, emulated by the entertainment industry, resulted in two interesting dynamics. The vulnerability of rank-and-file workers associated with the decline of the well-fare state facilitated the capital-owners to increase their profits and wealth, while the risk was adopted as a new value for modern workers. After all, the spectacle of disasters confers to workers the idea they are co-manager of their own fate. As things come from worse to worst, workers not only are responsible by decisions others make but in Thana-Capitalism, elite eludes its responsibilities to fail in paving the conditions for fairer wealth distribution.

On another hand, capital flourishes in a climate of liberty to move across the world. The doctrine of liberty (democracy) stimulates in workers the needs of consuming, in terms of Donohue, a type of freedom from “want”. The change from a society of producers to consumers took hit after the 40s decade. Ideologically, Americans have felt “superior” to other nations because they are enthralled as the main democratic and prosperous society; although more egalitarian at the surface, American citizens are subject to more work and consumption but less leisure. This happens because, in a pro-consumer society, workers are bombarded with emulation and advertising creating the needs to buy. This not only jeopardized their real liberty to choose but affects seriously to democracy. Detractors of capitalism, who pushed their focus on the arbitrariness of producers, were involuntarily responsible or conducive to the formation of a global society of consumers. Those denunciations on an economy that protect the interests

of producers as well as the needs to adopt consumption to break the material asymmetries among classes, were two guiding concepts to the formation of a globalized version of capitalism, which paradoxically was prone to mass-consumption but producing serious vulnerabilities (Donohue 2003). Despite the hot-debate ignited in this chapter, we feel the much deeper investigation is necessary in order to provide an all-encompassing model to understand these times where death seems to be exchangeable in every sphere of society. Precisely, in Thana-Capitalism digital information acts as a mechanism of censorship successfully orchestrated by over-abundance.

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KEY TERMS AND DEFINITIONS

Censorship: It means the suppression of free speech rights or any right to express own ideas.

Digital Surveillance: The use of digital technology to control others, citizens, and the life of a nation.

Globalization: It refers to a cultural project of integration of economies and networks which leads to multiculturalism and interchange of worldviews.

Risk Society: It is the ways a society reacts against the rise of risks. Risk society alludes to the needs of forecasting future to prevent potential threats that may affects societal order.

Thana-Capitalism: This represents a new term just coined in this manuscript where death situates as the main commodity of good exchange process and current economic systems. Thana capitalism replaced risk society after 9/11.

Section 2

Business and Organizational Development and Research

Organizational Policy Learning and Evaluation Using Monte Carlo Methods

2

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INTRODUCTION

Organizations continually need to develop new policies and undertake policy evaluations in a variety of contexts with a view of determining their feasibility and the possibility of adopting them. Such policies may be internal ones relating to the procedural structures or workflows within the company, or ones that relate to its management or operational strategies, e.g. should the company use a particular advertising channel. A key consideration in the course of policy evaluation is the underlying environment within which the policy learning and evaluation is performed. It is often the case that the dynamics of the environment is of such a level of complexity that the result of each evaluation tends to exhibit significant variability which is governed by a variety of factors of a non-deterministic nature.

In order to systematically determine the feasibility or optimality of a new policy or strategy, it is necessary to observe its performance and monitor the outcomes of repeated trials. Repetitive sequential trials are important and necessary in order to ensure reliability and ongoing effectiveness particularly in an environment which is subject to chance influence and where complete information on all the underlying factors are not available. Such trials need to be undertaken in a methodic manner and they need not be limited to:

1. Evaluations carried out by a single organization; i.e. such evaluations can be undertaken by different stakeholders representing the interests of different organizations
2. Evaluations carried out prior to adoption or acceptance; i.e. such evaluations can continue well beyond the acceptance or delivery phase.

In general, such evaluations may be undertaken with varying degrees of stringency – more stringent criteria should be adopted for safety critical operations, while less stringent ones may be used for non-mission critical policies.

We shall make use of an example particularly relevant to current concerns to illustrate some of these points. Recently there have been heightened global concerns regarding aviation safety, as multiple fatal crashes have occurred across different parts of the world relating to a particular model of aircraft, which took place within the space of only a few months. To be concrete, we shall use Model X to denote the particular model of the aircraft, where the policy in question is to adopt Model X for service. At the

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very beginning of the process, it starts with a learning stage – one needs to learn whether Model X is sufficiently safe to be in service. Such learning is done by carrying out repeated flights (trials) of the aircraft, with each trial labeled a success or a failure. In the context of reinforcement learning, a success corresponds to a reward, while a failure corresponds to a punishment. Subsequent to the initial stage, in a strict sense learning still continues and never stops as ongoing data are gathered about the safety of Model X. There are three types of organizations involved in the evaluation process, and these include:

1. The manufacturer of Model X
2. The aviation safety certification authority
3. The many client companies that use Model X for its daily operations.

Each flight of Model X may be regarded as an evaluation trial, and hopefully each flight would be uneventful and be labeled as success. Unfortunately, such were not the case for Model X. While the first type of organization concluded from their own pre-delivery trials resulted in overall success and acceptability, such success did not continue to hold subsequent to aircraft delivery. After delivery took place, trials did not stop but continued to be carried out by the client organizations. While these trials were still labeled as success at the very beginning, the policy was put in doubt due to some disastrous outcomes, which resulted in the termination of the policy (i.e. ending the adoption of the Model X for service) and the global grounding of the aircraft.

In most practical situations, the cost of carrying out such learning trials can be significant. We thus see in our example that through repeated trials resulting in outcomes of either reward or punishment, one establishes the feasibility of the new policy and completes the learning phase. Sometimes subsequent to the learning phase, the new policy, if learned successfully (i.e. when the rewards to punishments ratio is sufficiently high), may be adopted from that point onwards without it being questioned or evaluated afterwards. In some situations, one tends to assume that the learning is primarily done during the pre-adoption phase. In most situations, however, even after the policy is adopted, ongoing validation and monitoring is still carried out and this is especially necessary for safety-critical and mission-critical operations, as illustrated in this aviation example. If in the course of ongoing monitoring, there is an overwhelming number of punishments observed, then the adoption of the policy may be called into question, and termination of the policy may be necessary.

In this Chapter, we shall explain how reinforcement learning can be leveraged for organizational policy evaluation, and describe how to deploy a Monte Carlo approach to learn and estimate the underlying structure of the environment by making use of the observations gathered in the course of the evaluation process. We shall provide practical rules for such learning reinforcement scenarios where rewards and punishments for both the pre-adoption phase as well as the post-adoption phase are received. To be concrete, we shall continue to use a scenario of aviation safety, as we believe this scenario is sufficiently general and of particular relevance and currency to present day concerns. Despite this, we wish to point out that many other everyday learning situations are similar to this; examples include trialing a new machine translation algorithm, learning the effectiveness of a new advertising channel, and route discovery in self-drive vehicles.

BACKGROUND

Some definitions of terms or concepts will be useful before we proceed further. These will be used in the rest of this Chapter and are given as follows.

1. **Intelligent Agent:** an intelligent agent, usually equipped with sensors and actuators, is an autonomous entity directing its action towards achieving its goals within a given operating environment
2. **Monte Carlo Methods:** Statistical estimation methods that involve the use of a significant random component
3. **Multi-agent:** a multi-agent framework is one that multiple intelligent agents operate and interact, with the action of one agent affecting the actions and decisions of other agents
4. **Reinforcement Learning:** reinforcement learning is concerned with how agents should act within an environment where rewards and punishments are handed out for their actions, with the aim of maximizing reward and minimizing punishment
5. **Stopping Rule:** A stopping rule in a reinforcement learning situation is a rule that determines if an agent should terminate a learning episode as a result of the number of rewards or punishments received
6. **Supervised Learning:** in supervised learning, an agent is given labelled input/output pairs with the aim of the agent correctly associating the input with the output after undergoing some training
7. **Unsupervised Learning:** in unsupervised learning, an agent is to find previously unknown patterns in data without pre-existing labels.

An autonomous agent in reinforcement learning learns through the interaction with the environment to maximize its rewards, while minimizing or avoiding punishments. In most practical situations, the underlying environment is non-stationary and noisy (Ziebert *et. al.* 2008, Arulkumarn *et. al.* 2017, Wu *et. al.* 2016), and the next state results from taking the same policy may not result in the same outcome every time but appears to be stochastic (Ipek *et. al.* 2008). In (Brafman *et. al.* 2002), Brafman and Tenenholtz introduces a model-based reinforcement learning algorithm R-Max to deal with stochastic games. Such stochastic elements can notably increase the complexity in multi-agent systems and multi-agent tasks, where agents learn to cooperate and compete simultaneously (Panait *et. al.* 2005, Tampuu *et. al.* 2017). As other agents adapt and actively adjust their policies, the best policy for each agent would evolve dynamically, giving rise to non-stationarity (Busoniu *et. al.* 2008, Albrecht *et. al.* 2018). In these studies, the cost of a trial to receive either a reward or punishment can be seen to be significant, and ideally, one would like to arrive at the correct conclusion by incurring minimum cost. In reinforcement learning algorithms, one is always in the hope to rapidly converge to an optimal policy with least volumes of data, calculations, learning iterations, and minimal degree of complexity (Moore *et. al.* 1993). To do so, one should explicitly define the stopping rules for specifying the conditions under which learning should terminate and a conclusion drawn as to whether the learning has been successful or not based on the observations so far.

Establishing stopping rules, is an active research topic in reinforcement learning, which is closely linked to the problems of optimal policies and policy convergence (Wei *et. al.* 2017). Conventional approaches mainly aim for relatively small-scale problems with finite states and actions. The stopping rules involved are well-defined for each category of algorithms, such as utilizing Bellman Equation in *Q*-learning (Watkins *et. al.* 2008). To deal with continuous action spaces or state spaces, new algorithms, such as the Cacla algorithm (Hasselt *et. al.* 2009) and CMA-ES algorithm (Hansen *et. al.* 2003) are

developed with specific stopping rules. Some stopping rules for stochastic reinforcement learning under different assumptions have been proposed and studied in (Panda *et. al.* 2018, Hong *et. al.* 2015). Still, most studies on stopping rules are procedure-oriented and do not have a unified measurement where comparison may be facilitated.

In our study here, in addition to learning from the observations in the pre-adoption and post-adoption phases, we also focus on the stopping criteria, so that what has been observed and learned can form the basis of policy decision making.

A DECISION FRAMEWORK FOR POLICY EVALUATION

Learning Criteria and Basic Formulas

Here, we are dealing with a learning sequence each of which either incurs a positive reward or negative reward (i.e. punishment). We are interested in determining whether the sequential observations indicate overall success or failure. Evidently, if the number of positive rewards gathered is much greater than the number of negative rewards, then the conclusion drawn from the learning episode should be success, while if the opposite is true, then the corresponding conclusion should be failure. Consequently, through such learning sequences, the policy may be gradually reinforced and built up.

In order to proceed with the quantitative analysis, we first let p and q (with $p + q = 1$) denote the probabilities of receiving a positive reward or negative reward respectively for a given observation. Later on, in keeping with the Monte Carlo approach, we shall derive estimates for p and q which capture the stochastic structure of the learning environment. For example, if $p > q$, then clearly the final conclusion should be learning success. An error often committed is that when the first few observations are all negative, one would terminate prematurely and return a verdict of failure for the learning episode. Let us consider the stopping rule:

Rule A: *An agent stops a learning episode upon observing r positive rewards. The learning episode can be concluded as a success or a failure according to whether the number of positive rewards is sufficiently greater than the number of negative rewards.*

This is in fact a family of rules since there are two parameters that need to be specified. The first is r , and the second is related to “sufficiently greater”, both of which need to be indicated in a more detailed and quantitative manner.

Consider the probabilistic model of *Rule A*. Let the random variable T be the number of observations preceding the first positive reward; i.e. T may be regarded as the waiting time to the first positive reward, measured in number of observations. Since after the occurrence of the first reward, the process probabilistically repeats itself again, so that we shall calculate the waiting time W_r of the r th positive reward. In Appendix A, it is shown that the mean and variance of W_r are given by

$$E[W_r] = \frac{rq}{p}, \quad (1)$$

$$\text{Var}[W_r] = \frac{rq}{p^2}. \quad (2)$$

Furthermore, the probabilities $\Pr[W_r = k]$ may also be obtained as,

$$\Pr[W_r = k] = \binom{-r}{k} p^r (-q)^k, k = 0, 1, 2, 3, \dots \quad (3)$$

Since W_r is the sum of independent identically distributed random variables, when r is appreciable, it may be approximated by the normal variate by virtue of the Central Limit Theorem (Feller, 2008) so that

$$W_r \sim N\left(\frac{rq}{p}, \frac{rq}{p^2}\right), \quad (4)$$

where $N(\mu, \sigma^2)$ denotes the normal distribution with mean μ and variance σ^2 . Thus, the probability $\Pr[W_r > b]$ may be approximated by

$$\Pr[W_r > b] = \int_{\frac{bp-rq}{\sqrt{rq}}}^{\infty} \frac{1}{\sqrt{2\pi}} e^{-\frac{t^2}{2}} dt = 1 - \Phi\left(\frac{bp-rq}{\sqrt{rq}}\right), \quad (5)$$

where Φ is the standard normal distribution.

B. Monte Carlo Estimation

Here, we shall estimate p from the trial observations. Let ρ signify the ratio of the average number of negative rewards to the number of positive rewards, which can be obtained from (1)

$$\rho(p) = \frac{E[W_r]}{r} = \frac{1-p}{p}. \quad (6)$$

It is interesting to note that the rewards ratio is linearly correlated to the probability ratio of negative rewards to positive rewards q/p . For successful learning, a necessary condition for an optimal policy is to have the number of negative rewards strictly less than the number of positive rewards or $\rho < 1$. From (6), this is equivalent to $q < p$, implying $p > 1/2$.

In our Monte Carlo estimation problem, we shall determine the inherent stochastic structure of the environment by estimating p from the actual observed rewards ratio W/r , where W is the sample mean of W_r . From (6), solving for p , we can form the estimate

$$\hat{p} = \frac{1}{1 + W/r},$$

and we see that $\hat{p} > 1/2$ if $W/r < 1$.

Generally, we wish to have a small value for ρ , so that the average number of negative rewards received is much less than the number of positive rewards, i.e. $q \ll p$. In Figure 1, the change of $\rho(p)$ is shown as p varies over the range (0,1), where ρ reaches unity at the point (0.5, 1). We see that as p tends to 0, the rewards ratio ρ tends to infinity. It intuitively suggests that if the probability of receiving a single positive reward is small, the number of negative rewards on average will be high. In order to have a small rewards ratio for successful learning, so as to maximize the relative number of positive rewards, p should be significantly greater than 1/2.

As mentioned above, the indication of “sufficiently greater” in *Rule A* requires quantification. Here, we pre-specify a particular fraction of negative rewards ρ^* (< 1), so that upon the completion of a learning episode, i.e. r positive rewards are observed, if the actual number of negative rewards W is such that $W/r < \rho^*$, the learning is concluded as successful; otherwise, it is regarded as a failure. Possible values of ρ^* may be 30%, 50% or 70%, depending how stringent is the learning correctness criterion. In any case, either type of error – i.e. wrongly concluding success or wrongly concluding failure – is unavoidable, as in standard statistical testing. In the case of $\rho^* = 100\%$, we have $W = r$, and it would be difficult to draw a definite conclusion concerning the learning outcome, and to be conservative, one would therefore conclude that the learning has been unsuccessful.

Probability of Exceeding Cost Bounds

The mean value, being a single statistic, is often not sufficient as it fails to fully reflect any statistical fluctuations. In many cases, as in the advertising example, the cost of observation is significant. Let c be the numerical representation of the cost associated with an observation. Having specified r , a minimum observation cost of rc must

therefore be incurred. What is uncertain is the number of negative rewards obtained, and ideally to achieve minimum cost, this number should be bounded. Supposing we would only sustain a maximum cost of bc for observing b negative rewards, we shall estimate the probability P_b that the learning cost for this component exceeding this bound. From (3) above, this is given by

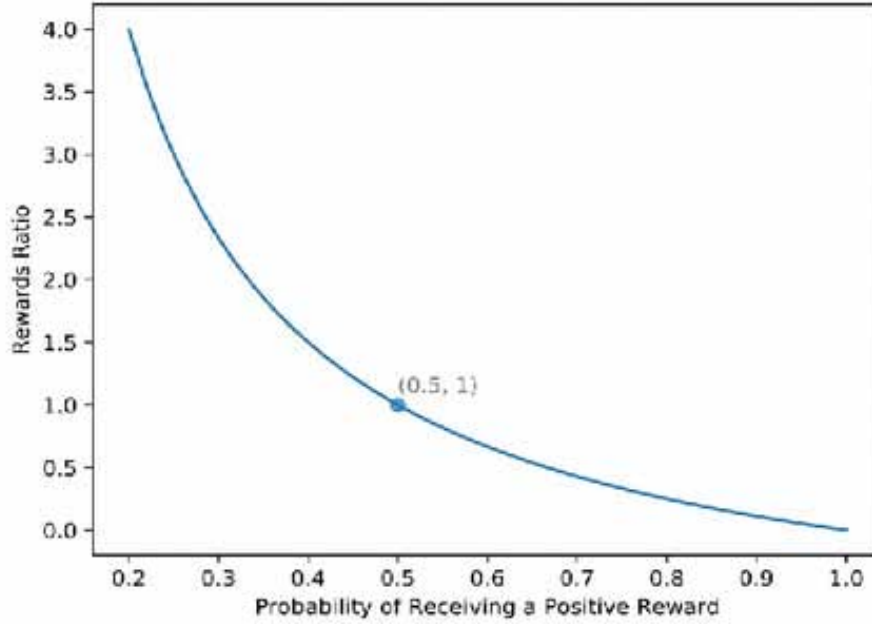
$$P_b = 1 - \sum_{k=0}^b \Pr[W_r = k] = 1 - \sum_{k=0}^b \binom{-r}{k} p^r (-q)^k. \quad (7)$$

The computation associated with (7) is somewhat laborious. As indicated above, when the value of r is large, we can make use of the normal approximation (5).

A COMPETING MULTI-AGENT LEARNING FRAMEWORK

In *Rule A* above, the termination of a learning episode is triggered whenever a fixed number of positive rewards r is obtained, irrespective of the number of negative awards accumulated in the process of doing so. Sometimes, however, this may not be desirable, especially when an inordinate number of negative rewards have been accumulated, in which case, termination should take place earlier along with the conclusion of policy learning failure. Therefore, one is comparing the number of positive rewards gathered against the number of negative rewards, and the learning is concluded as success or failure according to which of these achieve the majority.

Figure 1. Changes of Rewards Ratio



More precisely, this may be viewed as a multi-agent game with two competing agents A and B , in which A is responsible for giving out the positive rewards, while B , the negative rewards. This framework is not unlike the game theoretic approach in statistical decision theory, where both the statistician and nature are regarded as players in the game of estimation, and also this may be regarded as a kind of stochastic game (Brafman *et. al.*, 2002). While we shall focus on the agents A and B , we note that there is a further agent, the learner, so that three agents exist in this situation. Here, when an observation results in a positive reward, then A would gain a score of one, while when an observation results in a negative reward, then B would gain a score of one. When either score first reaches a given threshold h , then this will trigger a termination and the learning episode is concluded as success or failure according to which agent attains the threshold score first. Therefore, we have the following stopping rule:

Rule B: A learning episode stops upon either agent, A or B , first reaching the threshold of h rewards. The learning episode can be concluded as a success or a failure according to which agent attains the threshold first.

Here, without loss of generality, we shall let $h = 2m+1$ be odd, where m is an integer, and similar to Section III, we let p and q , with $p + q = 1$, signify the probabilities of receiving a positive reward and negative reward respectively for a particular observation. In other words, for a given observation, agent A wins with probability p , while agent B wins with probability q . We shall call p the *winning propensity* of A , and q the *winning propensity* of B . We see that it is essentially the winning propensity that governs which agent will ultimately win the game in the long run. Appendix B derives the probability P_m that the learning is successful (i.e. agent A wins) according to *Rule B*, which is given by

$$P_m = \sum_{k=0}^{2m} \binom{4m-k}{2m} p^{2m+1} q^{2m-k}.$$

Table 1. Probabilities of Learning Success

m	p	q	P_m	m	p	q	P_m
1	0.5	0.5	0.5000	5	0.5	0.5	0.5000
	0.6	0.4	0.6826		0.6	0.4	0.8256
	0.7	0.3	0.8369		0.7	0.3	0.9736
	0.8	0.2	0.9421		0.8	0.2	0.9990
	0.9	0.1	0.9914		0.9	0.1	1.0000
2	0.5	0.5	0.5000	10	0.5	0.5	0.5000
	0.6	0.4	0.7334		0.6	0.4	0.9035
	0.7	0.3	0.9012		0.7	0.3	0.9964
	0.8	0.2	0.9804		0.8	0.2	1.0000
	0.9	0.1	0.9991		0.9	0.1	1.0000

Table I computes P_m for different values of p , q , and m . We see that, as expected, when $p = q = 1/2$, $P_m = 1/2$, since neither A nor B has any advantage over its opponent. As p increases, however, P_m will increase, reaching almost certainty as p increases beyond 0.8. If we regard p as a

measure of A 's winning ability per trial; then when $p \gg q$, most trials will be scored by A , so that winning the entire game (i.e. reaching h first) is almost a certainty, and this is especially so for higher values of h . It is interesting to see that when h or m is sufficiently high (e.g. $m=10$), a moderate advantage for A (e.g. $p = 0.6$) is enough to almost guarantee success. On the other hand, $1 - P_m$ gives the probability that agent B wins, where the measure of B 's winning probability per trial is given by q . For instance, when $q=0.4$, then B stands a chance of around 27% of winning the game when $m=2$, and a chance of winning of around 10% when $m=10$.

Returning to the Monte Carlo estimation problem, by observing P_m , i.e. by computing the observed proportion of time that agent A wins, it is possible to infer the underlying probability p . While unlike in Section III, where an explicit formula exists linking directly the observations to the estimate, such explicit relationship is not available here. Nevertheless, as can be observed from Table I, useful estimation bounds can be drawn to determine whether $p > 1/2$ or $p < 1/2$. We see that it is quite reasonable to estimate $\hat{p} > 1/2$ whenever $P_m > 1/2$, and this would seem sufficient for most practical purposes.

LEARNING SITUATIONS WITH CONTINUOUS SUCCESSES OBSERVED

In some situations, such as the routine introduction of a new product or service, one would tend to assume that the policy in question will never be revoked (i.e. withdrawal or recall of the product). In a business environment where nothing can be regarded as totally certain, there is a small but non-zero probability that the policy would fail no matter how many times that it has been validated by consumers. In such situations, an organization would still wish to know the probability of this happening, since a small probability amplified across a huge product range may result in an appreciable probability.

Let there be N evaluations so far, and these evaluations may include those carried out by the company offering the new product prior to putting it on the shelf, or evaluations carried out (implicitly) by consumers after they have purchased the product. Supposing the outcomes of all N evaluations resulted in

successes, then the probability f that the next evaluation (use) will result in a failure is given by (Feller, 2008)

$$f = 1 - \frac{N+1}{N+2}.$$

This is obtained from Laplace rule of succession, which estimates the probability that the sun will rise tomorrow, given it has always risen in the past. We note that from the above equation that the probability f tends to zero as N becomes large. However, if the number of products M is also large, then the probability of any one of them failing is

$$1 - (1 - f)^M.$$

which can be appreciable.

FUTURE RESEARCH DIRECTIONS

A useful assumption that we have adopted is that positive rewards and negative rewards occur independently. In future, it may be useful to relax this assumption and incorporate Markov chains into the analysis. Usually a single-step Markov chain should be sufficient, but for safety critical systems where a high degree of accuracy is required, then a multi-step Markov dependency will be necessary. It is likely, however, that the corresponding analysis and Monte Carlo estimation procedures will be considerably more computationally intensive.

Secondly, the rewards and punishment structure in this Chapter mainly follows the execution of a stochastic random walk process where each step of the walk is assumed to be of unit length. In future, more general random walk patterns may be used, where the step size may in turn be a random variable. This more general model should be more versatile and may be used to represent varying degrees of reinforcements and punishments which would subsume the present situation as a special case.

CONCLUSION

Since learning environments are often noisy and seldom static nor deterministic, by exploiting the random data collected in the course of the evaluation process, the use of Monte Carlo estimation methods is therefore able to provide useful estimates of the underlying environment. Indeed, if stochastic elements are absent, the same outcome will always occur, obviating the need for repeated observations. This Chapter focuses on policy learning and evaluation that occur in a wide variety of application contexts. We first consider a situation where the cumulative number of rewards is pre-specified and fixed, which constitute the criterion for stopping the learning episode. By observing the random positive to negative rewards ratio, a meaningful estimation of either learning success or failure may be arrived at. In most practical situations, the cost of observation can be significant, and this has been incorporated into our model, with the probabilities of exceeding the observation cost bounds also given.

We next consider a multi-agent framework where the handing out of positive and negative rewards are viewed as being performed by agents. Thus, the final learning outcome is determined by a kind of stochastic game with the associated agents competing against each other. The stopping criterion here is determined by when and how the game is won. For this scenario, the respective probabilities of learning success and relevant measures of interest are obtained. Here, winning achieved by the appropriate agent will result in the successful adoption of the policy, and a procedure for estimating the underlying stochastic environmental structure, as represented by the winning propensity, from the observed random agent winning frequencies is also employed.

In addition, we also consider situations for product evaluations where the policy success rate is high but the product range is large, and have also presented a simple formula for estimating the probability of possible policy termination.

The results that we have derived for different learning scenarios are given in relatively simple quantitative terms, mostly using counting of occurrence frequencies and elementary statistical measures. The relative simplicity of the results suggests that these can be directly and usefully applied to effective organizational policy evaluation and review for many situations.

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APPENDIX A

The following provides the justifications of the results of Section III.

Let the random variable T be the number of observations preceding the first positive reward; i.e. T may be regarded as the waiting time to the first positive reward, measured in number of observations, then

$$\Pr[T = k] = pq^k, k = 0, 1, 2, 3, \dots \quad (1)$$

The probability generating function $G(z)$ of T is given by

$$G(z) = \sum_{k=0}^{\infty} \Pr[T = k] z^k = p \sum_{k=0}^{\infty} q^k z^k = \frac{p}{(1 - qz)}. \quad (2)$$

Note that after the occurrence of the first reward, the process probabilistically repeats itself again, so that we have for the waiting time W_r of the r th positive reward

$$W_r = \sum_{k=1}^r T_k, \quad (3)$$

where each T_k has the same distributional characteristics as T . From (Feller, 2008), the probability generating function of $G_r(z)$ corresponding to W_r may be obtained

$$G_r(z) = G_1(z)^r = \left[\frac{p}{(1 - qz)} \right]^r. \quad (4)$$

To get a better understanding of behavior specified above, it is useful to obtain the average waiting time W_r and its variance when r positive rewards are observed. From (4), the mean and variance of W_r can be derived

$$E[W_r] = G'_r(1) = \frac{rq}{p}, \quad (5)$$

$$\text{Var}[W_r] = G''_r(1) + G'_r(1) - G'_r(1)^2 = \frac{rq}{p^2}.$$

Furthermore, the probabilities $\Pr[W_r = k]$ may be readily obtained from the expansion of (4),

$$\Pr[W_r = k] = \binom{-r}{k} p^r (-q)^k, k = 0, 1, 2, 3, \dots$$

APPENDIX B

The following provides the justifications of the results of Section IV.

In order to attain h for either agent, the number of observations Ω will fall within the range

$$2m + 1 \leq \Omega \leq 4m + 1.$$

If f_k represents the probability that A wins at observation number $4m+1-k$, which occurs if and only if A scored $2m$ successes in the first $4m-k$ observations, and subsequently score a final success, then f_k is given by

$$f_k = \binom{4m-k}{2m} p^{2m+1} q^{2m-k}.$$

The probability that A reaches the threshold first, irrespective of the observation number, is therefore given by

$$P_m = \sum_{k=0}^{2m} f_k = \sum_{k=0}^{2m} \binom{4m-k}{2m} p^{2m+1} q^{2m-k}.$$

That is, P_m gives the probability that the learning is successful (i.e. agent A wins) according to *Rule B*.

Understanding Organizational Development With a Continuum of Care Model

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INTRODUCTION

Most non-profit organizations move through a life cycle of stages that are comparable to human development (Born, 2000). These stages define the change of organizational processes that contribute to the evolution of non-profit organizations. Although these stages are well defined in the literature, the manner in which a non-profit organization transitions between stages is driven by a myriad of factors, such as: leadership, governance, financial capacity, and staffing (Simon, 2012). These factors influence not only the development of non-profit organizations, but also their long-term sustainability.

In this article, a case study of the Yee Hong Centre for Geriatric Care will be presented to illustrate its development throughout the non-profit organizational life cycle. The Yee Hong Centre was specifically chosen as its adoption of a continuum of care model has become one of the primary drivers of the organization's development. However, as with other non-profit organizations, the Yee Hong Centre continues to face new challenges in maintaining its current level of success. This article will provide a conceptual understanding of how the continuum of care model can be applied to contribute to the organization's sustainability.

BACKGROUND

According to Lester, Parnell, and Carraher (2003), most non-profit organizations follow a five-stage life cycle consisting of: existence; survival; success; renewal; and decline. Although the cycle is presented in a seemingly linear fashion, not all non-profit organizations proceed through the five stages in such a manner. In fact, some organizations may regress to an earlier stage or skip to a later stage, while others may remain in one stage for an extended period of time. Still, some organizations, such as the Yee Hong Centre, may transition through multiple stages, but remain far from the final stage of decline (Lester, Parnell & Carraher, 2003).

What accounts for the variance in organizational development? Simon (2012) argues that there are seven distinct factors that influence the development of a non-profit organization. These factors include:

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- Governance: the role of the board of directors in driving the long-term planning and development of the organization;
- Leadership: the role of senior executives in translating the organizational mission into reality;
- Financing: the organization's source of funding and fundraising to sustain its operation;
- Administrative systems: the establishment of formal systems, procedures, and policies within the organization;
- Products and services: the tangible or intangible benefits that customers gain from the use of the organization's products and services;
- Staffing: the human resources required to sustain the operation of the organization; and
- Marketing: the organization's promotional and outreach efforts (Simon, 2012; Varga Consulting, 2017).

The importance of each factor and the influence that it exerts on the organization depend largely on the stage of development that the organization is at (Simon, 2012). For example, in early stages where an organization is only beginning to form, leadership is considered to be more important than staffing, as the organization requires strong leaders with the capacity to gather resources and translate their vision into reality. Over time, however, staffing eventually becomes more important as the organization grows in stability and human resources become necessary to maintain daily operation (Simon, 2012).

Regardless of the developmental stage, most non-profit organizations, including the Yee Hong Centre, must consider the seven aforementioned factors in order to successfully plan for long-term sustainability (Simon, 2012). However, what sets the Yee Hong Centre apart from other non-profit organizations is its adoption of a continuum of care model that has provided guidance for the organization's planning and delivery of services (Gulliford, Naithani, & Morgan, 2006). Since its establishment in 1994, the Yee Hong Centre has dedicated itself to a mission of "enabling Chinese Canadian and other seniors to live their lives in the healthiest, most independent, and dignified way, through [a] continuum of excellent, culturally appropriate care" (Yee Hong Centre for Geriatric Care, 2017). This continuum of services assumes that:

- Aging is a dynamic process;
- Needs differ between individuals and change across the life course;
- Holistic health includes not only physical, but also emotional, psychological, social, and spiritual well-being; and
- A continuum of services is necessary in order to meet these changing needs and promote quality of life (Liu, Wong, Chu, & Leung, 2017; Gulliford, Naithani, & Morgan, 2006).

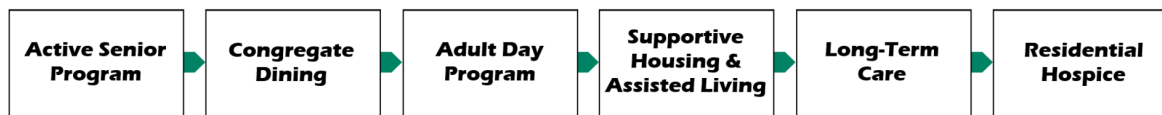
With these assumptions, the Yee Hong Centre developed a diverse range of core and support services that cater to the changing needs of seniors and their families from retirement to end of life (see Figure 1) (Liu et al., 2017).

Core services form the foundation of the continuum and include: an active senior program, congregate dining, an adult day program, home support services and assisted living, long-term care, and residential hospice. Needs may change and seniors may be required to transition into other services that better meet their needs, as such, support services have also been developed to complement core services. These support services include: caregiver support and education, client intervention and assistance, friendly visiting, medical services, programs and services development, transportation, and volunteer development. Each of these services work in tandem to provide a seamless continuum of care that can address

Figure 1. The Yee Hong Centre's continuum of services (Liu et al., 2017)



The Continuum of Services



Support Services

- Client Intervention & Assistance
- Caregiver Education & Support
- Transportation
- Friendly Visiting
- Volunteer Development
- Advocacy
- Chronic Disease Self-Management
- Play Intervention for Dementia (PID)

the needs of seniors and their families at different points in the life course, in turn promoting their health and quality of life (Liu et al., 2017). This article argues that this model of care, which now serves as the organizational mission, has significantly driven the organization's growth and development. In the following section, a closer examination of the Yee Hong Centre's transition through the non-profit organizational life cycle will demonstrate how the continuum of care model has played an important role as a primary driver of organizational development.

CASE STUDY: YEE HONG CENTRE FOR GERIATRIC CARE

Stage One: Existence

The first stage of the non-profit organizational life cycle is marked by the ability to gather sufficient monetary and in-kind resources to support a newly developing organization (Lester, Parnell, & Carraher, 2003; Pacific Continental Bank, 2011; Varga Consulting, 2017). In the 1980s, when Dr. Joseph Wong observed that many Chinese seniors living in mainstream long-term care homes had unmet needs, he gathered support from friends and volunteers to advocate for the development of a culturally appropriate long-term care home (Liu et al., 2017). Although Dr. Wong's proposal to build a long-term care home for Chinese seniors was initially met with many obstacles, the support that he gathered from the community helped him to overcome them. The subsequent completion of a needs study also provided support for

Dr. Wong's proposal and, more importantly, demonstrated that a long-term care home is not sufficient to meet such a diverse range of needs. As a result, the first Yee Hong Centre was built in 1994 with a basic continuum of services that included not only a long-term care home, but also a community centre, social housing complex, and medical centre (Liu et al., 2017). Despite the uncertainty of the organization's existence at the time, the dramatic growth in community support generated enough momentum that drove the Yee Hong Centre into the next stage of organizational development.

Stage Two: Survival

In the second stage of the non-profit organizational life cycle, organizations attempt to establish internal processes and structures as well as their competitive advantage to distinguish themselves from competitors. At this stage, organizations strive to generate enough revenue to sustain operation (Lester, Parnell, & Carraher, 2003; Varga Consulting, 2017). Following the establishment of the Yee Hong Centre, a board of directors that governed the organization was formed (Yee Hong CARE-Learning, 2016). At the same time, staff and volunteer recruitment proceeded at a rapid rate in order to establish the necessary structures to sustain the Yee Hong Centre's operation. Other than securing government funding, Dr. Wong also established the Yee Hong Community Wellness Foundation to support the organization's fundraising and public relations efforts. This ensured a healthy mix of financial resources to sustain the operation of the Yee Hong Centre (Yee Hong CARE-Learning, 2016).

While these internal structures were being formalized, the Yee Hong Centre's continuum of services quickly expanded. Dr. Wong's initial vision of building a culturally appropriate long-term care home became a spring board for the development of a continuum of services that grew to include community services such as an active senior program, an adult day program, home support services, and caregiver support and education. This rapid expansion of services not only garnered increasing support from the community, but also secured additional funding to help the Yee Hong Centre pass the survival stage (Yee Hong CARE-Learning, 2016; Lester, Parnell, & Carraher, 2003; Varga Consulting, 2017).

Stage Three: Success

The third stage of success is defined by formalized organizational structures and processes. By the time an organization has reached this stage, it has successfully transitioned from a period of uncertainty to stability (Lester, Parnell, & Carraher, 2003; Varga Consulting, 2017). Multiple levels of management have been established, allowing senior executives to focus on strategic planning while middle management oversees the organization's daily operation (Lester, Parnell, & Carraher, 2003). A strategic plan has also been established to guide the development of the organization and maintain sustainability (Pacific Continental Bank, 2011; Varga Consulting, 2017).

The dramatic growth of the Yee Hong Centre during the initial two stages has led to a rapid expansion of the organization's continuum of services. Dr. Wong's vision evolved into the establishment of four long-term care homes and a community and professional services division that serve approximately 20,000 seniors and their families across Toronto every year (Liu et al., 2017). At present, the Yee Hong Centre maintains its status at the success stage by continuously expanding and improving its continuum of services to meet the changing and growing needs of seniors and their families. In particular, the Yee Hong Centre regularly promotes client engagement through the use of client satisfaction surveys, quality improvement meetings, and ongoing dialogue with seniors and their families. This allows the organiza-

tion to continuously review its continuum of services and make improvements that address the needs of seniors and their families.

Stage Four: Renewal

The fourth stage of renewal is a period of rejuvenation, innovation, and creativity (Lester, Parnell, & Carraher, 2003; Varga Consulting, 2017). At this stage, non-profit organizations are looking for new ways to reposition themselves in the sector in order to prevent a decline in success and possible spiral into bankruptcy (Lester, Parnell, & Carraher, 2003). This can occur in the form of change in any of the seven aforementioned factors that influence non-profit organizational development (Simon, 2012). For instance, changes in governance and leadership could prevent a non-profit organization from further decline by realigning the organizational mission with community needs and inducing positive change within the organization (Simon, 2012; Varga Consulting, 2017).

Although the Yee Hong Centre has not yet reached the stage of renewal, it must continue to look beyond its current success and be proactive about implementing measures that prevent decline. For instance, the organization has undergone various leadership changes since its establishment and each new leadership team has brought with it a new wave of changes that propelled the Yee Hong Centre into greater success. More recently, the current leadership team has begun exploring social enterprise opportunities as a means of maintaining sustainability and creatively meeting the changing needs of seniors and their families. Examples include developing a line of incontinence products for seniors and incorporating technology such as virtual reality to engage younger generations of seniors. All of these initiatives were developed based on client needs and aim to further strengthen the current continuum of services. Nevertheless, more proactive approaches that benefit the organization in the long run need to be taken if the organization is to sustain itself in this changing economy (Lester, Parnell, & Carraher, 2003; Struthers, 2003). In the following section, maintaining non-profit organizational sustainability, specifically using the continuum of care model, will be discussed.

SOLUTIONS AND RECOMMENDATIONS

Given the success of the Yee Hong Centre, it is natural to assume that the organization will be able to sustain itself in the long run. However, “the key to long-term sustainability is knowing and understanding the stage an organization is in, and taking steps to be successful within each phase” (Pacific Continental Bank, 2011). Recognizing that the Yee Hong Centre is at the stage of success does not imply that efforts to prevent decline are unnecessary. Rather, in an environment where resourcing patterns for non-profit organizations are ever changing, more proactive approaches must be taken to ensure that the Yee Hong Centre continues to flourish (Struthers, 2003). Coblentz (2002) states that institutional, financial, and moral sustainability are of utmost importance in planning for the future of a non-profit organization. All aspects must be managed equally well in order to maintain sustainability.

Institutional Sustainability

At the heart of every non-profit organization is a mission, a story of how the organization came into existence and what it attempts to achieve to better its community (Coblentz, 2002). A sustainable organization will have developed both short- and long-term strategic plans that guide the organization’s

activities and define the needed resources to achieve its mission. However, even with solid strategic plans in place, non-profit organizations must maintain a certain level of flexibility as their environment constantly changes. As such, strategic plans can only act as a guide to help organizations use their resources as effectively as possible (Coblentz, 2002).

At its current stage of development, the Yee Hong Centre continues to maintain a strong focus of its mission. The organization reviews its strategic and annual operating plans on a regular basis to ensure they continue to be aligned with its mission. However, it is the continuum of care model that will help guide the organization's strategic planning in the long run. Specifically, the model's assumptions that aging is a process and that needs change over the life course can offer valuable insight into the types of services the organization should provide to meet client needs, as well as how to provide them in the most effective and efficient manner. Effective strategic planning, in turn, will help translate the model's assumptions into practice, thereby providing a direction for how to maintain institutional sustainability.

Financial Sustainability

According to Struthers (2003), some of the most successful non-profit organizations have implemented various resourcing practices, such as fundraising, core resourcing, event driven revenues, and partnership resourcing, to maintain financial sustainability. The Yee Hong Centre, in particular, has historically focused on core resourcing and fundraising as its primary sustainable measures. The organization heavily relies on government funding to support many of its community programs and long-term care, while its foundation regularly hosts fundraising events to generate sponsorships and donations. Nevertheless, an overreliance on any resourcing practice can prove detrimental if the resource is withdrawn or reduced (Struthers, 2003). In today's changing economy, it becomes paramount for non-profit organizations to diversify their resources to avoid any risk of bankruptcy or long-term deficit (Coblentz, 2002).

Despite a traditionally heavy reliance on core resourcing and fundraising, the continuum of care model can offer new directions for diversifying the resourcing practices of the Yee Hong Centre in order to maintain financial sustainability. Striving to provide a comprehensive and effective continuum of services requires a thorough understanding of the external environment and the needs of clients. This understanding can pinpoint the organization towards new areas of development that could create opportunities to either bring in additional resources or to improve the organization's financial management practices (Struthers, 2003; Coblentz, 2002). For instance, the organization has previously identified a duplication of services within the community (i.e., providing the same service to the same group of clients within the same geographic area). Rather than continuing to pursue this path of service duplication, the organization instead diversified its resourcing practices by increasing its partnerships with local communities and educational institutions to enhance the efficiency and accessibility of services. This not only provided an additional resource for the organization, but also improved the quality of services. In the long run, the Yee Hong Centre will need to continue to improve its financial management practices to maximize revenue while generating additional sources of funding, such as grants, user fees, and social enterprise initiatives, to support financial sustainability (Coblentz, 2002).

Moral Sustainability

Institutional and financial sustainability must be coupled with strong human resources if a non-profit organization is to achieve long-term sustainability (Coblentz, 2002). It is the staff and volunteers that help non-profit organizations to realize their mission and achieve financial stability. Moral sustainability

is about managing staff morale and requires strong leadership, effective and transparent communication at all levels of the organization, as well as clear expectations, policies, and procedures for staff to perform competently (Coblentz, 2002).

The Yee Hong Centre has always prided itself in a strong team of staff and leaders who are highly committed to the organizational mission. To date, it has grown into a multi-site organization that serves approximately 20,000 seniors and their families across Toronto every year (Liu et al., 2017). One of the main drivers of this growth of human resources is the continuum of care model. Although establishing continuity of care continues to be a challenge (Bergman et al., 1997), the Yee Hong Centre's persistence in developing a comprehensive continuum of services has attracted many likeminded staff with the same passion and dedication to the organizational mission. To continue to strengthen moral sustainability, the Yee Hong Centre can apply the same principles behind the continuum of care model to staff management. By enhancing the organization's understanding of staff needs and goals, it can implement appropriate practices to improve staff support and development. Ultimately, this can enhance overall staff morale and contribute to long-term moral sustainability (Coblentz, 2002).

FUTURE RESEARCH DIRECTIONS

Continuity of care is becoming increasingly prevalent in the senior service sector (Bergman et al., 1997; Leatt, Pink, & Guerriere, 2000). Research has demonstrated a growing need for a better coordination of services to improve the effectiveness and efficiency of care (Leatt, Pink, & Guerriere, 2000; Veras et al., 2014). Although the community at large has yet to implement a well-coordinated system of service delivery, the Yee Hong Centre has taken the first step by translating the continuum of care model into practice (Leatt, Pink, & Guerriere, 2000). Over time, the model has become an integral foundation that continues to guide the organization's planning and delivery of services.

As the senior population continues to grow and change, the Yee Hong Centre will, however, need to place a heavier focus on sustainable practices to maintain its success. The organization will be required to engage in long-term strategic planning, taking into consideration the current funding landscape and how to best make use of resources to meet the needs of a growing senior population (Struthers, 2003). Transition planning may also become another point of focus as seniors live longer and healthier lives. This may suggest a change in the focus of services offered as well as in how to support seniors as they transition through their life course (Veras et al., 2014). Other than staying current with the changing demographics of clients, the Yee Hong Centre may find it helpful to review internal processes to promote employee health and wellness (Coblentz, 2002). In addition to taking proactive measures to address the external environment, the organization must plan ahead in order to prepare for employees who are considering retirement in the near future as well as younger employees who may wish to continue to further their career within the organization.

Although this article focused upon one particular non-profit organization, it would be of value to study the development of other organizations and how they have coped with various challenges over the course of their development. Of particular interest is the implementation of the continuum of care model at different levels of systems and how it may benefit other non-profit organizations in their development. Future research on the effectiveness of the continuum of care model could bring valuable knowledge to leaders in the non-profit sector.

CONCLUSION

The Yee Hong Centre has embarked on a journey of growth and development. Despite the obstacles that Dr. Wong and his supporters faced along the way, they marched forward with their dream of providing culturally appropriate care for Chinese seniors. Over the course of the Yee Hong Centre's development, the continuum of care model proved to be an important contributor in propelling the organization forward. More importantly, the model also contributed to the development of sustainable measures for the organization. Specifically, this article examined the Yee Hong Centre's institutional, financial, and moral sustainability and how they can be effectively managed using the continuum of care model as a blueprint. With an ever changing funding landscape and community needs, sustainable non-profit organizations will need to stay ahead by understanding their organization within the life cycle as well as establishing long-term strategic plans that efficiently and effectively make use of resources to achieve the organizational mission. In the future, it would be valuable to examine and compare the development of other non-profit organizations and the application of the continuum of care model at different levels of systems.

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KEY TERMS AND DEFINITIONS

Continuum of Care: A model of care that provides a seamless transition of health and social services for clients.

Core Resourcing: A type of resourcing practice that funds the primary operations of an organization.

Non-Profit Organizational Life Cycle: A developmental cycle for non-profit organizations that defines distinct stages and their associated activities and processes.

Resourcing Practice: A practice to gather resources that provide support to organizational activities.

Social Enterprise: A type of organization that uses commercial methods to maximize social impact.

Strategic Plan: A plan that defines an organization's direction and how it will be translated into practice.

Sustainability: The ability of an organization to maintain or enhance current operations towards the pursuit of its mission.

Does the Organizational Change Induced by the Pre-Implementation of an IS Proceed as a Planned Process?

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INTRODUCTION

The pre-implementation process of an IS is characterized by procedures of selection and evaluation, which is rather in a pattern of change in a planned process. However, the research on organizational change gave rise to several approaches according to which, the change can be explained by other processes (political, interpretative, incremental and complex).

By this research, the authors seek to answer the question: Does the induced change in the context of the GBS pre-implementation process refer to a planned process or may the observed change have other characteristics relating to other explanatory processes of change?

The purpose of this research is to explain the progression of change during the pre-implementation phase of a GBS that is envisaged as a planned process in the literature. Better empirically describing this process allows managers to better target change support actions during this phase. In order to achieve the objective of the research, a qualitative study by case study is conducted in Basic Bank, one of the leading bank establishments in the Tunisian market as part of its project of implementation of a GBS especially during the process of its pre-implementation.

Based on this result, it is recommended to practitioners who wish to lead a change within their organizations to envisage the managerial actions from the outset of the project in order to reduce the potential conflicts of interest between actors.

BACKGROUND

The pre-implementation evaluation of an Information System (IS) is of major importance (Mussi et al. 2018). Indeed, during this phase, it is possible to identify issues which were likely to affect implementation and use of the new system (Mussi et al. 2018). The pre-implementation process, as part of a project to implement integration solutions IS such as Global Banking System (GBS), consists in a study leading to the selection of an ERP software, software developer, and consultant (Hustad and Dag Hakon, 2011; Mourrain and Deltour, 2016). This process is characterized by the specifications preparation, the target and the functional coverage definition, the software developer choice, etc. (Al Mashariand and

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Al- Mudimigh, 2003). Markus and Tanis (2000) claim that failures in the pre-implementation process may escalate the rest of the project. According to Velcu (2010), the failures in this process could lead to an overall unsuccessful implementation. The ERP pre-implementation process has proved to be a particularly critical stage (Markus and Tanis, 2000; Verville et al., 2007; Razmi and Sangari; 2013; Mourrain and Deltour, 2016; Mdimba et al., 2017). Indeed, it's a demanding *"process which required a high level of knowledge and competencies about the system, and tough negotiation processes between project leader, vendor, resellers and consultants"* (Hustad and Dag Hakon, 2011, p.1). This can generate a change in the organization.

This change is characterized by the tracking methods and selection procedures and evaluation of the software package (Kaur and Mahanti, 2008, Kutlu and Akpinar, 2009), which is rather in a pattern of change in a planned process (Kotter, 1995; Soeini and Miri, 2011; Pichault, 2013). However, the research on organizational change gave rise to several approaches sometimes paradoxical. According to these approaches, organizational change can be explained by other processes such as the political process, the interpretive process, the incremental process and the complex process (Vas and Ingham, 2002; Vas and Jaspart, 2010; Pichault, 2013). Organizational change during the pre-implementation process of the ERP is little studied in the literature. According to Hustad and Dag Hakon (2011), the pre-implementation process of the ERP projects need for more empirical studies.

PRE-IMPLEMENTATION PROCESS OF AN INTEGRATED SYSTEM AND EXPLANATORY PROCESS OF CHANGE

In this section, the authors present the theoretical framework, describe the research methodology and explain the results and their discussion.

Theoretical Framework

The theoretical framework of this research has been organized into two subsections. In the first, the authors describe the main characteristics of the pre-implementation process of an integrated system. The second is devoted to the presentation of the different explanatory processes of change.

Description of the Pre-implementation Process of an Integrated System

The implementation of integrated systems such as ERP had induced organizational change since the selection of the software until its effective use. During the pre-implementation process, evaluation and selection of the software are an essential element of ERP projects. According to Wei et al. (2005, p.47), *"companies must choose a flexible ERP system and a co-operative vendor that is responsive to customer needs"*. The system selection should be made in alignment with the competitive strategies and goals of the enterprise (Wei et al., 2005). These authors apply the Analytic Hierarchy Process (AHP) method of Saaty (1980) for dealing with the ambiguities involved in the assessment of ERP. This method *"synthesize decision makers' tangible and intangible measures with respect to numerous competing objectives inherent in ERP system selection and facilitates the group decision-making process"* (Wei et al., 2005, p.49).

Several authors characterize this process by tracking method and selection and evaluation procedures (Kaur and Mahanti, 2008, Kutlu and Akpinar, 2009), which is rather in a pattern of change in a planned

process. However, the literature on organizational change shows the existence of several explanatory processes of change.

The Explanatory Process of Change

The works on the change can be divided into two perspectives: the works on the study of the contents of change and others dealing with its process. Studies forming part of the first perspective neglect the temporal dynamics on the progression of change that is considered by the works on the process of change. These studies consider the change as the passage of a state 1 to a state 2 (Thiéart, 1980). This passage records an empirical observation of a difference in form, quality or state of an entity (individual work, group work, the strategy of an organization, program, product, or an entire organization) in the time (Van de Ven and Poole, 1995). In order to operationalize this empirical observation concerning the progress of change in time, several authors (Lewin, 1947; Weick, 1969) recommend recourse to the cutting process in different phases.

This research is a continuity of studies dealing with change as a process. A summary of studies on this perspective sets the process of change as a planned response to environmental pressures and to the forces on the inside of the organization (Alas, 2008) thus reflecting the way to go between a departure state and arrival state (Thiéart, 1980).

Van de Ven and Poole (1995) found the existence of a theoretical pluralism to explain the progress of change. They identified four theories that may serve as building blocks for explaining processes of change in organizations: life cycle, teleology, dialectics, and evolution. This theoretical pluralism could lead to a partitioning of perspectives leading to isolated research lines.

To understand the progression of change, Van de Ven and Poole (1995) argue in favor of the mobilization of these different theories. These theories allow explaining and illuminating the theoretical underpinning of “the evolution of organizational change”. Based on these approaches as well as on the literature on organizational change, several authors have proposed the explanatory process of the of change progression (Vas and Jaspert, 2010; Pichault, 2013). The explanatory process of change may thus be defined as a modeling of the change progression.

Five explanatory processes of change are identified from the literature review: the planned process, the political process, the interpretive process, the incremental process, and the complex process.

- According to the planned process, the progression of change is marked by a succession of phases, monitoring of procedures, setting of objectives, participation stakeholder and the possibility of amending and adapting along the way.
- According to the political process, the change progression is marked by power struggles, continuing negotiations between the interests of different stakeholders within the organization and a regular mobilization of the project steering instances.
- According to the interpretative process, the progression of change is marked by a consideration of the actors’ perceptions, their actions and reactions, information on the different possibilities objectives achievement and justification of the choices made.
- According to the incremental process, the progression of change is marked by building on previously developed choice and the impact of other projects carried out in parallel within the organization (sharing of resources).
- According to the complex process, the progression of change is marked by unexpected phenomena, stops and blocking.

For this research, the authors seek to study the induced change in the context of a pre-implementation process of the GBS to verify whether it pursues a planned process or the observed change may have other characteristics that fall within other explanatory processes of change (political process, interpretative process, incremental process, and complex process).

Research Methodology

In this section, the research methodology, data collection methods, the coding device, the research context in Basic Bank and the project of implementation of the GBS that the authors followed during its pre-implementation process are presented.

Search Method with a Single Case Study

Yin (2003) advocates the single case method if the study focuses on understanding a process in its real context and for which the boundaries between the studied phenomenon and its context are not obvious. The selection of case is dictated by the research question that recommends that preferably the company is currently conducting a change project. Basic Bank, which the authors integrated while working on the project of implementation of GBS, meets this criterion.

Data Collection

Data collection is performed by retrospective semi-structured interviews conducted with 17 members of the project team, a non-participating observation and document analysis.

The authors seek to understand the organizational change by mobilizing the explanatory process of change as part of GBS implementation project during its pre-implementation process. Thus, the authors choose to interview project team members since they are better informed. This team is composed of a business pillar and a technical pillar. The business coordinator and technical coordinator ensure project management. It is organized into 21 functional domains (technical and business) with 2 transverse domains (change management and target organization). Each functional domain is formed of one or two leader(s) and contributors. Interviews are conducted with the senior management (Project Owner), project management (business coordinator and technical coordinator), and 14 domain leaders. Each interview lasted from one to two hours and were all recorded and immediately transcribed.

The observed facts, remarks, comments and interpretations resulting from the interaction with the staff as well as informal discussions are systematically recorded in a research paper. The collected data were subjected to content analysis (Bardin, 1993).

Data Coding

As advocated by Miles et al. (2013), the condensation of data was carried out by thematic coding. Prior to empirical data collection, a code starting list was established based on a review of the salient literature. The chosen unit of analysis is a sentence extract or even a paragraph of the transcript.

The authors have chosen more inferential coding in order to identify trends (patterns) that can be accredited to any proposed theoretical processes (Vas and Ingham, 2002). The descriptive inference, a methodological approach inspired both from grounded theory (Glaser and Strauss, 1967) and techniques for analyzing qualitative data (Miles et al., 2013) assumes an interactive relationship between descrip-

tion and explanation (Vas and Ingham, 2002). The authors add that descriptive inference also highlights the important role of interpretation that allows a better understanding of the studied phenomenon. The authors have mobilized the indicators proposed by Pichault (2013) that allowed classifying interview extracts according to the five explanatory processes of change derived from the literature. The authors have also opted for multiple coding when a text segment seemed to simultaneously represent several categories to avoid “forcing” the data to a particular category (Vas and Ingham, 2002).

Two types of coding were performed (Miles et al., 2013):

- A multiple coding was performed by the authors to ensure the internal consistency of the coding. A month later, all the interviews were subject to a second coding. The confrontation between the first coding and the second one has defined a reliability coefficient of 90 percent.
- A multi coding was independently performed by a second management science researcher so as to ensure the coding reliability: extracts randomly taken from interviews are coded by a second researcher in management science. The reliability coefficient calculated between encoders is 82 percent.

The calculated reliability coefficient by both coding types was superior to 82%; this would justify the reliability of the results (Miles et al., 2013).

Case Overview Basic Bank and Project of Implementation of GBS

Founded in 1976, Basic Bank is one of the leading bank establishments in the Tunisian market and one of the largest financial institutions in North Africa. It offers its customers (individuals, SMEs, and big companies) a comprehensive and innovative range of products for its activities in Tunisia and abroad. It often acts as a pioneer in the introduction of new banking goods and services in the Tunisian market (e.g. credit cards, remote banking products, and bank assurance products). Basic Bank employs 2,454 persons and is based among other things on a network of more than 1,000 correspondents worldwide. It has owned since numerous years, one of the first information systems that have been customly designed to meet the customs' needs and specificities by its teams. Today, this system no more allows the bank to grow serenely and with greater efficiency. To support its growth and development, Basic Bank chooses to implement an integrated solution. The product that will be set up is Global Banking System (GBS), that is to say, an integrated information system specifically adapted to banking and covering most requested features (customer and accounts management, agency operations, ...) as well as regulatory aspects (accounting). The solution that Basic Bank has chosen at the end of a selection process is the “P24¹” software of developer “Package²”. P24 is open and integrated software that offers a wide and rich functional coverage. It is implemented in more than 600 banks in the world.

Search Results

This section is devoted to explaining the observed change during the process of pre-implementation GBS.

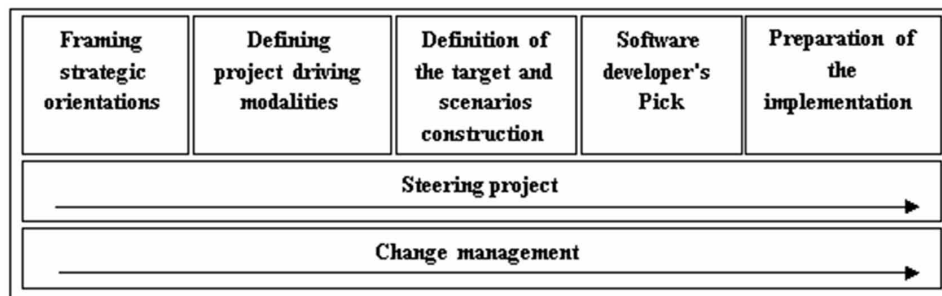
Planned Process

Basic Bank has appointed a Deputy Managing Director (DMD) to oversee the project and define the decision-making bodies. The DMD has appointed, in turn, a business coordinator and a technical coordinator to carry out this project.

During this process of pre-implementation, the people involved have developed tender specifications that were sent to the software developer. These tender specifications provide a description of the existing IS, organization and project planning. They also set the framework of the provision, the characteristics of the project and the conditions for its success.

Data show that this process corresponds to a cut process, well-studied way, in several stages. Through the collected data, the authors reconstructed this process which lasted 7 months (Figure 1).

Figure 1. Pre-implementation Process of Global Banking System



The framing strategic orientations are the first stage of the pre-implementation process of GBS. In this stage, it was a question to deepen and clarify the strategic objectives defined for the bank, finalizing the project scope and identifying the highlights of the scenario construction. This stage culminated in the declination of the strategic challenges into operational objectives and identification of IS impacts. Members of the project team, with the assistance of external consultants, defined **the project driving modalities**. In this second stage, they have structured the project in functional areas, organized project governance, designated participating resources to the project (business and IS) and planned the meetings by functional areas.

Members of the project team have developed a list of workshops to perform, workshop participants and deadlines. The third stage corresponds to the **definition of the target and scenarios construction**. This is to determine the functional target by functional area and the major challenges by business. This stage culminated in the finalization of the overall target and scenarios construction of each functional area.

The fourth stage is the **software developer's pick**. In the preparatory work for this stage, it was a question to validate and/or complete the list of targeted software developers, adapt the content and modalities of the consultation, update and complement the existing consultation file for sending to software developers and prepare workshops examination of tenders. Then the members of the project team began the deepening works. This was to follow up requests for information, strip the offers using the test set out in the fourth stage to select the best performing software developers, identify the key questions addressed to the software developers as well as additional information, organize the deepening workshops and prepare a folder of choice for the senior management. Finally, the last stage corresponds to the **preparation of the implementation**. It is devoted to the definition of the optimal trajectory to reach

the target, structuring of the building site in operational projects (objectives, scope, priorities, project actors, ...), prioritization of all functional and technological projects and the first estimate of the teams to be formed. In parallel to all of this work, there are two transverse stages namely the **steering project** stage and the **change management** stage. The design of steering tools, team leadership and monitoring the overall consistency of deliverables represent the preoccupations of the **project steering** stage.

In the stage of **change management**, it was a question to design and implement the communication on the project. At the end of this pre-implementation process, Basic Bank selected the P 24 system, and signed the contract with its software developer “Package”. The agency area leader said: “This decision was made in the announced times”.

This period is characterized by:

- A cutting multi stage;
- A formal identification of a structure dedicated to the project direction directly attached in the senior management;
- A clear definition of the role of project director;
- A specification of a tender specification;
- And a definition of a precise timetable.

Thus, the planned process explains the change progression during the process of pre-implementation of the GBS. However, the change during this process is also characterized by continuous negotiation between the different actors involved. This aspect is a feature of the political process.

Political Process

During the pre-implementation process of the GBS, there has been a great mobilization of various actors of the bank representatives a variety of interests. This mobilization of people appears in the formation of a project team, the temporary participation of several individuals from different bank structures and the specification of the decision making bodies of the project. The operation mode of these participants is based essentially on organizing meetings as part of various committees in order to follow project progress, validating and exchanging the Broad Guidelines and taking major decisions related to the project. 11 interviewees specify that, as part of the first meetings concerning the strategic study of the redesign project of Information System (IS), the makers of Basic Bank (strategic owner, senior management and direction of an information system) were faced with three possible scenarios:

- an iso-functional migration of the current system: improvements to the current operating system;
- “*The best of breed*”: choose the base that will adopt the bank’s referential and around which the most appropriate applications on the market for Basic Bank (Credit, market, guarantee, ...) will be integrated;
- Acquire a *Global Banking System (GBS)*.

The existence of these three alternatives creates coalitions each of which defends a particular choice, as shown in the following interview excerpt conducted with the strategic owner: “*I was among the people who fiercely defended a development in-house. I pushed towards the alternative to rewriting our programs by our teams for not being at the mercy of the people from outside [...] The new director of the information system did not accept. He showed much concern about the alternative of internal*

development. He oriented the decision to purchase a Global Banking System". Once the final decision is made in favor of the acquisition of GBS, the project works is organized around 12 functional areas, a transverse area and a technical area in order to choose the best system for Basic Bank. The leader 2 of area tests Coordination says: *"around 90 people, the best employees of the bank (business and technical) have been the drivers of the choice of our new system"*.

The examination of tenders was effected by carrying several meetings. Each of them lasted a half day per domain. 14 meetings were conducted: 12 meetings were dedicated to functional areas, a meeting to discuss cross cutting themes and a meeting to discuss the technical aspects (internal document). This stage, characterized by several discussions and negotiations, culminated in the pre-selection of the two best offers namely: SAMW³ and P24. On the deepening stage, the project team asked the pre-selected software developers for demonstrations and case studies to better understand the functionalities of the different systems. These demonstrations and case studies are conducted in the premises of Basic Bank. The leader of the area Controls, Security and Habilitations specifies: *"there have been meetings with suppliers to present their products. Each gave four presentations"*. Visits, at other banks in Tunisia and abroad of similar size to Basic Bank, already using the system are performed. These visits were an opportunity to see work in real exploitation, the two pre-selected systems and that for the entire perimeter to cover. This stage is characterized by the emergence of several negotiations between actors. Indeed, all the interviewees emphasize the specificity of the Tunisian context regulatory, as described by the leader of the area Means of payment: *"The currency regulation (check, teleclearing) does not exist abroad"*. This specificity leaves emerge the formation of two major interest groups:

- A set of actors want to acquire the SAMW system because P24 does not exist in the Tunisian market. In fact, the "Package" software developer does not know the specificities of the Tunisian regulations. So some people have shown some concern for such a choice. The strategic owner says: *"computer scientists and people of administration preferred SAMW because there are Tunisian banks that use this system"*.
- Businesses are for the purchase of P24, as expressed in the strategic owner: *"I have fought for P24 because I liked it in the "area international". On this area, he was the best compared to other"*.

The final choice made by the senior management was in favor of the P24 system of the software developer "Package".

The pre-implementation process of the GBS is characterized by arbitration and negotiations between the actors involved. Thus, the political process explains the progression of change during this process. For a complete understanding of the progression of change that characterizes this pre-implementation process of the GBS, the data show the importance of the mobilization of the interpretive process.

Interpretative Process

The pre-implementation process of the GBS is sustained by a collective representation of the environmental threat. This collective representation is attributable to the emergence of the Basel II norms. These norms impose on banks the calculation of new ratios, which necessitates the use of updated information and particular modes of calculation that escape the current, IS of Basic Bank. The collective representation of the environmental threat is also driven by Tunisian regulations.

Indeed, the banking sector knew the emergence of the law ascribing the approval in favor of universal banking. This law favored the establishment of a more liberal environment for the execution of banking

activities by suppressing the legal separation among the “development banks” and “commercial banks”. From now on, each establishment is accredited as a “universal bank” that can specialize according to its strategic choices. This approval as universal banks increases the competition.

This competition is found more severe because of the privatization process of the banking sector that is accelerating by opening itself to foreign partnerships. As part of this bank privatization movement in recent years, the Tunisian State has undertaken the cession of important parts of the capital of some banks in favor of foreign banks (Central Bank of Tunisia, 2015).

Bank staff recognizes the urgency of recasting their IS. All interviewees say that the current IS showed off its operational limits and has become deadpan. It represents a heavy weight ahead of the development of the profession. Thus, the current IS of Basic Bank is a major obstacle to the development of its various activities. This has favored the emergence of a collective need in Basic Bank of the necessity of change. This collective representation of the need to implement a GBS to face competition facilitates the achievement of a consensus. Indeed, despite the negotiations in the process of system selection, the final decision of the acquisition of P24 was taken in the announced deadlines. 15 interviewees point out that the selection system is based on a folder of objective choice. The people involved in this process analyzed the responses of the software developers on the basis of five criteria:

- functional coverage of the system;
- its technical characteristics;
- the project approach for its implementation;
- the soundness of the software developer and;
- the financial offer.

The justifications for the choice to carry out has required analysis and convincing approach, as expressed by the leader of area Agency: *“a comparison between the two solutions in connection with the bank’s needs was made in depth”*. The different areas have classified software developers according to a fixed rating scale.

The teams that worked on the pre-selection of the system proposed recommendations to the senior management who chose P24 by publishing the reasons for that choice in a circular note to all staff of Basic Bank: *“thanks to the continuous mobilization of Basic Bank teams and on the basis of a folder duly educated and objectified that we were able to take our decision. The package offers a wide and rich functional coverage, a coherent project approach and a competitive financial offer. P24 is also an open and highly integrated information system”* (Senior management). The justifications put forward in the different choices made by the bank show that change is characterized by the generation of a shared vision about the project among stakeholders, as expressed by the leader of area Agency by giving its opinion on the choice of P24: *“I am convinced that the Bank has made the best choice by opting, as part of the overhaul of its information system for the implementation of GBS P24 which has the advantage of being an integrated system, open and scalable,...”*.

The change during the pre-implementation process of GBS is characterized by:

- The propagation of a collective representation as to the need of the overhaul of IS of the bank ;
- The justification of the different choices made as part of the selection of the new system.

The planned process, political process, and interpretative process explain the change during the pre-implementation process of the GBS.

Discussion of Results

The planned process explains the change during the pre-implementation process of the GBS. This is explained by the importance of planning in change projects (Vas and Ingham, 2002; Andreeva, 2008; Vas and Jaspert, 2010; Pichault, 2013). The planning effort is first manifested by the appointment of a project manager and construction of a project team to ensure the change implementation (Pichault, 2013). Then the planned change is characterized by the development of tender specifications, the setting of a budget envelope and the defining a precise timetable (Pichault, 2013). Finally, the planned approach is an approach characterized by a cutting phase (Vas and Ingham, 2002; Pichault, 2013). For each, the direction sets interim targets (Vas and Ingham, 2002; Pichault, 2013).

The political process also explains the change during the pre-implementation process of the GBS. The result is explained by the existence of a diversity of actors involved (senior management, business, IT experts, consultants, etc.) in conducting the project (Pichault, 2013). It is also explained by the emergence of coalitions and conflicts of interest in the conduct of change (Vas and Ingham, 2002).

The change during the pre-implementation process of the GBS is also explained by the interpretative process. Indeed, the change is characterized by the appearance of a climate marked by a collective interpretation of the urgency of change. The shared collective representation is provided by mobilizing the changes that have characterized the banking sector (increased competition, the Basel II norms).

This result confirms the statement of Pichault (2013) which found that the emergence of the interpretive process in the change experienced by COM 2010 is explained by a collective representation of environmental threats (competition, deregulation, etc.)

FUTURE RESEARCH DIRECTIONS

Based on this result, it is recommended in future research to follow the evolution of change throughout the process: from pre-implementation of change to its consolidation. This will provide a dynamic model showing the evolution of change throughout the process of implementing a new IS. Such a research can serve as a basis to other future researches dealing with change management with the aim of defining managerial actions adapted to the evolution of change so as to succeed it.

It is also recommended to practitioners who wish to lead a change within their organizations to envisage from the outset of the project the actions of the change management for reducing the conflict of interest and manage conflicts between actors. It is also recommended to the members of the project team and the senior management to explain and justify the choices and make collective decisions to ensure a shared collective representation. This allows adhering all the actors to change and accordingly minimize resistance to change.

CONCLUSION

This research focuses on explaining the progression of the change induced in as part of a pre-implementation process of a GBS. Particularly, it is to check whether the observed change pursues a planned process or it may have other characteristics which fall within other explanatory processes of change (political process, interpretative process, incremental process, and complex process).

Table 1. Chronological matrix of pre-implementation process of the GBS

		Structuring of the project		Choice of a software solution			Preparation for implementation
		Framing strategic orientations	Defining project driving modalities	Definition of the target and scenarios construction	Software developer's Pick/ Preparation phase	Software developer's Pick/ Deepening phase	
Explanatory process of change	Planned process	- Decline of the strategic challenges into operational objectives and identification of impacts IS ; - Finalization of the project scope.	- Organize the project in functional areas; - Designate the participating resources (businesses and IS) ; - Elaboration of the list of workshops, participants and planning.	Preparation of a construction scenario			Macro implementation plan.
	Political process			- Conducting functional workshops for the determination of functional target by functional area and the major challenges by business. - conduct technical workshops.		Launch of negotiations for the selection of the software developer.	
	Interpretative process				- Update the consultation file. - Elaboration of grids and conditions for counting. - Pre-selection and preparation of deepening workshops software developers / operational	- Discussions on the scenarios: insurance of a shared collective vision. - Justification of proposed choice: folder of choice objectified.	

To this end, the authors have integrated a Basic Bank, the leader of the Tunisian market bank as part of its project of implementation of a GBS especially during the process of its pre-implementation. The results showed that during this period the change is explained by the planned process, political process and interpretative process (Table 1).

According to Table 1, besides the prepared planning (goals to be achieved, deadlines to be met), the change was characterized by the appearance of conflicts of interest and negotiations to select a software

developer. The change was also characterized by the intervention of the senior management to justify the choices made. This has let emerge a collective change representation by the actors. The change in the pre-implementation process of the GBS is thus explained by the planned process, political process and interpretive process.

The results of this research enrich the previous work on the study of change during its launch phase which envisages it very often as a planned process.

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KEY TERMS AND DEFINITIONS

Change Process: Planned response to environmental pressures and forces within the organization (Alas, 2008), translating the path from departure to arrival.

Complex Process of Change: Change is marked by unexpected phenomena, stops and blocking.

ERP: Set of application software modules with an integrated architecture used by an organisation as their primary engine for integrating data, business processes and information systems across its business value chains in real time (Ngai et al., 2008).

Explanatory Process of Change: The modeling the progression of change.

Global Banking System: Enterprise Resource Planning (ERP) Systems in Banking sector.

Incremental Process of Change: Change is marked by building on previously developed choice.

Interpretative Process of Change: Change is marked by a consideration of the actors' perceptions.

Planned Process of Change: Change is marked by a succession of phases, monitoring of procedures and setting of objectives.

Political Process of Change: Change is marked by power struggles and continuing negotiations between the interests of different stakeholders within the organization.

ENDNOTES

¹ The software name is fictional with respect to confidentiality rules.

² The software developer's name is fictional with respect to confidentiality rules.

³ The software name is fictional with respect to confidentiality rules.

Automating the Generation of Test Items

2

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INTRODUCTION

With an ever increasing demand for more knowledge in our economy, organizations require methods of assessment to evaluate the skillset of their workers to produce new ideas, make new products, and provide new services. The ability to create these ideas, products, and services will be determined by the effectiveness of our educational programs. Education provide students with the knowledge and skills required to think, reason, communicate, and collaborate in a world that is shaped by knowledge services, information, and communication technologies (e.g., Binkley, Erstad, Herman, Raizen, Ripley, Miller-Ricci, & Rumble, 2012; Darling-Hammond, 2014). Educational testing has an important role to play in helping students acquire these foundational skills. Educational tests, once developed almost exclusively as a right-of-passage to satisfy demands for accountability and outcomes-based summative testing, are now expected to provide teachers and students with timely, detailed, formative feedback to directly support teaching and learning. With an increasing focus on formative learning principles being adopted to guide our educational testing practices, where assessment-related activities provide constant and specific feedback to modify and improve learning, assessments are being administered more frequently (Black & Wiliam, 1998, 2010). But when testing occurs more frequently, more test items are required. These additional test items must be created efficiently and economically while maintaining a high standard of quality. Fortunately, this requirement for frequent and timely educational testing coincides with the dramatic changes occurring in educational technology. Developers of local, national, and international educational tests are now implementing computerized tests at an extraordinary rate (Beller, 2013). Computerized testing offers many important benefits to support and promote key principles in formative assessment. Computers permit testing on-demand thereby allowing students to take the test at any time during instruction; items on computerized tests are scored immediately thereby providing students with instant feedback; computerized tests permit continuous administration thereby allowing students to have more choices about when they write their exams. In short, developments in computing technology enables the infusion of formative principles into our testing practices that would not have been previously possible.

Despite these important benefits, the advent of computerized testing has also raised formidable challenges, particularly in the area of test item development. Tests now require access to large numbers of diverse, high-quality test items to implement computerized testing as items are continuously administered to students. Hundreds of items are needed to develop the test item banks necessary for computerized testing. Unfortunately, creating test items is a time consuming and expensive process. Each individual item is written, initially, by a content specialist and, then, reviewed, edited, and revised by groups of content specialists (Gierl & Lai, 2016; Rudner, 2010). Hence, item development has been identified as one of the most important problems that must be solved before we can fully migrate to computerized

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testing because large numbers of high-quality, content-specific, test items are required (Haladyna & Rodriguez, 2013; Webb, Gibson, & Forkosh-Baruch, 2013).

One emerging test item development method used to address this challenge is *automatic item generation* (AIG) (Gierl & Haladyna, 2013; Irvine & Kyllonen, 2002). AIG is a relatively new but rapidly evolving research area where cognitive and psychometric modeling practices guide the production of tests that include items generated with the aid of computer technology. Research on AIG has adopted different perspectives, including the use of natural language processing and artificial intelligence (e.g., Gütl, Lankmayr, Weinhofer, & Höfler, 2011; Moser, Gütl, & Lui, 2012; von Davier, 2018), frame-semantic representations (e.g., Cubric & Toasic, 2010; Higgins, Futagi, & Deane, 2005), schema theory (e.g., Singley & Bennett, 2002), and semantic web-rule language (Zoumpatianos, Papasalouros, & Kotis, 2011; Leo et al., 2019). The purpose of this chapter is to describe and illustrate the most practical method for generating test items, which is template based. By template-based AIG, we mean methods that draw on *item models* to guide the generative process. Gierl and Lai (2013, 2016, 2018) developed a three-step process for template-based AIG. In step 1, content specialists create a cognitive model for AIG. A cognitive model is a representation that highlights the knowledge, skills, and content required to generate new test items. In step 2, an item model is developed to specify where the cognitive model content is placed in each generated item. An item model is a template that highlights the variables in a test item that can be manipulated to produce new items. In step 3, computer algorithms place the cognitive content into the item model. With this process, hundreds of items can be created from a single item model. The purpose of this chapter is to describe how AIG can be used to generate test items using the selected-response (i.e., multiple-choice) format. To ensure our description is both concrete and practical, we illustrate template-based item generation using an example from the complex problem-solving domain of the medical health sciences. The chapter is concluded by describing two directions for future research.

BACKGROUND

Gierl and Lai (2013, 2016, 2018) described a three-step approach for template-based AIG. In step 1, a content specialist creates a cognitive model for AIG. In step 2, an item model is developed to specify where the cognitive model content is placed in each generated item. In step 3, algorithms place the cognitive content into the item model.

Step 1: Identify Content For Item Generation

To begin, the content for item generation is identified by the content specialists. This content is identified using design principles and guidelines that highlight the knowledge, skills, and abilities required to solve problems and perform tasks in a specific domain. A cognitive model for AIG is a representation that organizes the cognitive- and content-specific information into a structured representation of how the content specialist expects that examinees will think about and solve problems. Recently, Gierl and Lai (2016) proposed the *key features* cognitive model for AIG. With this model, item generation is guided by the relationships among the key features specified in the cognitive model. It is used when the attributes or features of a task are systematically combined to produce meaningful outcomes across the item feature set. The use of constraint programming in step 3 of the AIG process ensures that the relationships among the features yield meaningful items. The key features cognitive model is most suitable

for measuring the examinees' ability to assemble and apply key features within a domain as well as to solve problems using these key features.

Step 2: Create Item Models

In step 2, an item model is developed to specify where the content from the cognitive model must be placed to generate new items. An item model is a template that specifies the features in an item that can be manipulated to generate new items. Item models (LaDuca, Staples, Templeton, & Holzman, 1986) specify which parts of the assessment task can be manipulated for item generation. For a selected-response item type, it includes the stem, the options, and the auxiliary information. The stem is the part of an item which formulates context, content, and/or the question the examinee is required to answer. The options contain the alternative answers with one correct option and one or more incorrect options or distractors. Auxiliary information includes any additional material, in either the stem or option, required to generate an item, including digital media such as text, images, tables, diagrams, sound, and/or video. The stem and options can be divided further into elements. These elements are denoted as non-numeric values (i.e., strings) and numeric values (i.e., integers). By systematically manipulating the elements, many items can be generated from one item model.

Step 3: Generate Test Items Using Computer Technology

In step 3, computer algorithms place the cognitive model content specified in step 1 into the item model developed in step 2. Different types of software have been written to generate test items (e.g., Gütl et al., 2011; Higgins, 2007; Higgins et al., 2005; Singley & Bennett, 2002). Gierl, Zhou, and Alves (2008) introduced and demonstrated the use of the computer program IGOR (which is the acronym for **Item GeneratOR**) for template-based AIG. IGOR is a JAVA-based program designed to assemble test items using the items models from all combinations of elements specified in the cognitive model. Once the content is specified in step 1 and the template is created in step 2, IGOR systematically places the content into the template to produce new items as part of step 3. IGOR has been used to generate items in the content areas of mathematics, science, social studies, architecture, logical reasoning, dentistry, nursing, medical education, business management, and non-verbal reasoning.

Generating Distractors for Selected-Response Items

For the selected-response format, items must not only include a stem with a corresponding correct option, but also include a set of incorrect options or distractors. These incorrect options are typically designed from a list of plausible but incorrect alternatives linked to misconceptions or errors in thinking, reasoning, and problem solving. Using a traditional item development approach, a set of distractors are created by a content specialist that is specific to each item. But because AIG produces hundreds of items, an alternative approach is needed to create a correspondingly large number of plausible but erroneous distractors.

Three different methods can be used to generate distractors. The first method for generating distractors is often employed when the elements manipulated as part of the item generation process are first specified. Recall, elements are the variables identified by content specialist and then manipulated using computer algorithms to produce new items. A distractor can be specified as an element that contains content that is related to the correct option but still yields an incorrect response. To identify the content for this element, content specialists identify a list of plausible but incorrect options that are appropriate

for all possible items generated with a given item model. Then, distractors are randomly selected from this pool of plausible but erroneous content and added to each generated item. Hence, this method is called the *distractor pool method with random selection*. It is based on the assumption that a pool of plausible distractors can be created. A sample of these plausible distractors are selected at random to complete the item generation process. The strength of this method is its simplicity. This method can yield large numbers of distractors. The weakness of this method resides with the two strong assumptions required to use this approach. First, it must be assumed that all pooled distractors are equally plausible for all generated items. Equal plausibility is a strong and, in many cases, restrictive assumptions. Second, there is little reasoning to guide how distractors are paired with the correct option because pairing is achieved with random assignment. The distractor pool method with random selection is most appropriate for case-specific item generation, where a well-defined set of distractors are known to be plausible across a large number of the generated item.

To improve the plausibility of the distractors, rules and rationales that yield errors or misconceptions can be used to create distractors. Distractor rationales are short description provided by the content specialist to ensure that the reasoning which underlies each option is explicitly stated. When rationales are available, distractors can be systematically generated such that each distractor matches with the rationale. Hence, this approach is called the *systematic generation with rationales method*. It is based on the assumption that algorithms, rules, and procedures can first be articulated by content specialists and then used to create plausible but incorrect alternatives. The strength of this method is that the distractors are much more specific and, hence, plausible and appropriate, especially when compared to the previous method. There is also a precedent for this approach as systematic generation using distractor rationale has been used in quantitative- and rule-based content areas, such as mathematics and science, to produce incorrect options (Haladyna & Rodriguez, 2013). This method also has some weaknesses. For instance, plausible but incorrect rationales must first be created for each option by the content specialist. This process can be time consuming. Algorithmic or rule-based manipulations must also be permissible for every incorrect option. In some content areas and in some reasoning and problem-solving situations, generic rules or robust algorithms may not be available to guide the development of distractor rationales.

To overcome the weaknesses of the first two methods, a third method for distractor generation is also available. It is called *systematic distractor generation* (Lai, Gierl, DeChamplain, & Boulais, 2015). This method is closely linked to the cognitive modeling approach to AIG. Recall that to generate an item stem and correct option, specific information must be collected in the form of a cognitive model (i.e., step 1 in the three-step AIG process). The systematic distractor generation method also involves specifying information related to errors and misconceptions in the form of a cognitive model in order to generate plausible but incorrect options. The process of modeling incorrect options is more complex compared to modeling the correct option because the item stem is constantly changing in a generative item development system. As a result, the small number of constraints required to ensure that information presented in the stem yields a correct response must be counterbalanced with a much larger number of constraints required to ensure the information presented in the incorrect options is erroneous but plausible. Also, more than one incorrect option is required for a selected-response item. Typically, three, sometimes four, incorrect options must be produced for each generated item. Systematic distractor generation has many strengths. For example, it can be used in diverse testing situations and across many content areas because of its generality. It is also an adaptive method because distractors are selected conditionally using the associate information in the stem and the correct option. Finally, the features that lead to the correct and incorrect options are explicitly identified. This method also has weaknesses. Systematic distractor generation requires that specific information be collected for each distractor. Because selected-response

items contain two or more incorrect options, this specific information is required for each item in order to model the distractors. Currently, it is a time-consuming method requiring data collection from content specialists. Recent developments from Shin, Guo and Gierl (2019) demonstrated a topic modeling approach to automate the process described above to complement the generation of distractors. In this approach, content in biology is first clustered into various topics through topic modelling, then topics distances are used to determine the selection of distractors. However, a wealth of data is required to draw upon the generation process.

An Example From the Medical Health Sciences

To illustrate the three-step approach to AIG, an example from the medical health sciences is presented. This example is drawn from the content area of general surgery where the examinee is required to diagnosis problems that could arise from a serious abdominal injury. This example uses a key features cognitive model with systematic distractor generation.

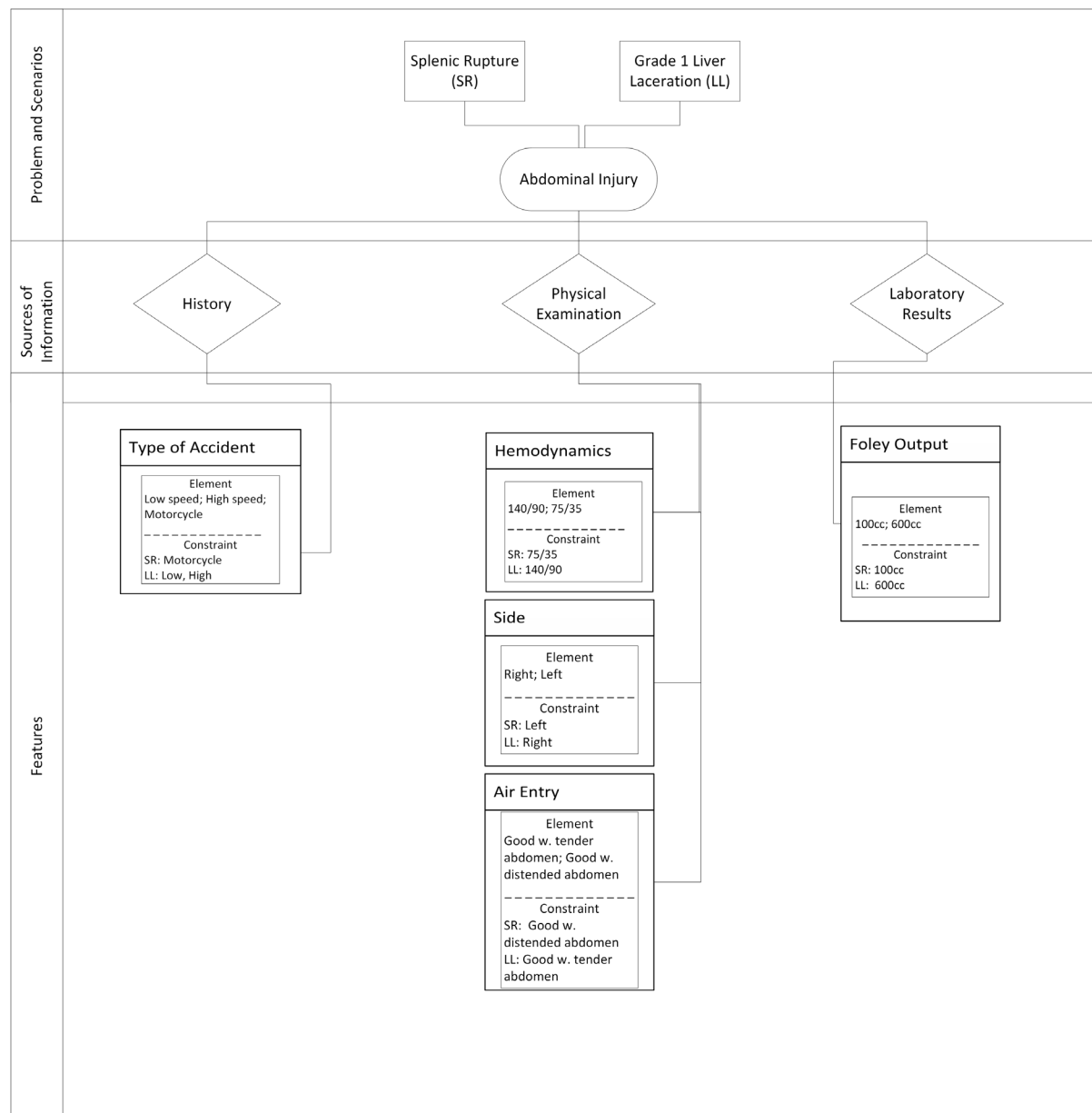
In step 1, a cognitive model for AIG is created. The model in this example was created inductively by asking two 3rd year surgical residents to identify and describe the information that would be used by a surgeon to solve two serious medical problems (i.e., splenic rupture and Grade 1 liver laceration) related to abdominal injury. Three types of information are specified in the cognitive model for AIG. This information is presented as separate panels in Figure 1. The top panel identifies the main concept or problem and its associated scenarios. In this example, the problem is abdominal injury. Two associated scenarios are splenic rupture (SR) and Grade 1 liver laceration (LL). The middle panel specifies the relevant sources of information presented with the problem. In this example, three sources of information were presented: History, physical examination, and laboratory results. The bottom panel highlights the salient features, which includes the elements and constraints. The first component for a feature is the element. Elements contain content specific to each feature that can be manipulated for item generation. The second component for a feature is the constraint. Constraints serve as restrictions that must be applied during the generation process to ensure that content in the elements are combined in a meaningful way so useful items can be generated. For the Figure 1 example, five features (i.e., type of accident, hemodynamics, side, air entry, and Foley output) were identified across the three sources of information. Each feature specifies the elements and constraints. For instance, the type of accident feature has three elements, low speed, high speed, and motorcycle. These elements contain constraints. For example, splenic rupture is only related to the motorcycle accident (i.e., SR: Motorcycle) whereas the low and high speed accidents are related to the Grade 1 liver laceration (i.e., LL: Low, High).

In step 2, the item model is created (see Table 1). The item model contains the template that will be used to generate test items. It also specifies the elements for the features. Five features are included. The Type of Accident feature has three elements. The remaining four features—Hemodynamics, Side, Air Entry, Foley Output—all contain two elements. Taken together Figure 1 and Table 1 describe the content combinations required to produce the correct option in the cognitive model. Splenic rupture is the correct option, for example, when the elements are: motorcycle accident at highway speeds (Type of Accident), blood pressure is 75/35 and heart rate is 140 (Hemodynamics), left side (Side), good air entry and a large distended abdomen with guarding (Air Entry), and 100cc of bloody urine (Foley Output).

The same logic is also used to produce the incorrect options using the systematic distractor generation method. Distractor 3 is diaphragmatic rupture. This diagnosis shares some, but not all, of the elements with splenic rupture. For instance, a diaphragmatic rupture can be associated with the elements motor vehicle accident at highway speeds (Type of Accident), blood pressure is 75/35 and heart rate is

140 (Hemodynamics), and 100cc of bloody urine (Foley Output). But a diaphragmatic rupture is not associated with pain on either the left or the right side (Side) and does not necessarily display physical examination results related to air entry and abdominal pain (Air Entry), as presented in the cognitive or item models. As a result, diaphragmatic rupture is a plausible but erroneous option because it shares some but not all of the features related to splenic rupture. The same logic used to code the elements in diaphragmatic rupture is also used to code pneumothorax, cardiac tamponade, and aortic rupture in order to produce a cognitive model for the incorrect options. Then, an incorrect option is selected from this distractor model for inclusion in the generated item whenever it shares some but not all of the elements with the correct option.

Figure 1. An abdominal injury cognitive model



In step 3, IGOR assembles the content specified in an item model, subject to elements and constraints articulated in the cognitive model for both the correct and incorrect options. Iterations are conducted in IGOR to assemble all possible combinations of elements and options, subject to the constraints. In the current example, IGOR generated 62 abdominal injury items. The model used in this example is comparatively small and is provided for illustrative purposes only in our chapter. Item generation in operational testing programs typically include 5-7 different features per model where each feature has 2-10 different elements thereby producing much larger numbers of items.

Table 1. A item model for generating abdominal injury test items.

<i>Stem</i>	A 25-year-old male is involved in a [Type of Accident]. Emergency Medical Services resuscitates him with 2L crystalloid and transports him to your tertiary centre. When he arrives his [Hemodynamics]. He has a Glasgow Coma Scale score of 14. He is complaining of lower-rib pain on his [Side]. On examination, he has [Air Entry]. [Foley Output] . What is the most likely diagnosis?
<i>Elements</i>	Type of Accident: 1: highway speed roll over 2: bicycle accident where he hits a barricade 3: motorcycle accident at highway speeds Hemodynamics: 1: blood pressure is 75/35 and his heart rate is 140 2: blood pressure is 140/90 and his heart rate is 90 Side: 1: left side 2: right side Air Entry: 1: good air entry and a large distended abdomen with guarding 2: good air entry, mildly tender abdomen, and no guarding Foley Output: 1: A foley catheter emits 100cc of bloody urine 2: A foley catheter emits 600cc of urine
<i>Options</i>	1: Splenic rupture 2: Grade 1 liver laceration 3: Diaphragmatic rupture 4: Pneumothorax 5: Cardiac tamponade 6: Aortic rupture 7: Epidural hematoma
<i>Key</i>	

FUTURE RESEARCH DIRECTIONS

Item generation is currently attracting great interest from a diverse audience beyond the testing development experts. Although efforts are being made across computing science, psychometrics, and other content experts, three directions of research can be expected in the near future: the expansion of the AIG method, the development in different content areas, and the evaluation of the generation process. In expanding the AIG method, an area of research that is widely sought after in item generation is the integration of calibrated item parameters with the generated items. If items can be generated with their statistical properties, then it can mitigate the issue of field testing and quality control. Although statistical models exist on how item parameters can be generated (Lai & Gierl, 2012; Cho et al., 2014; Sinharay & Johnson, 2013; Graf & Fife, 2013), few studies were able robustly deploy a model that can accurately match difficulty estimation to generated items. A challenge in this area often lie with what

information is used to inform parameter estimation. Chen et al., (2019) continued this line of research and was only able to estimate difficulty variations for 5% of their generated items. Efforts on calibrated item generation will likely continue in the future as statistical estimation of generated item properties is information highly desired.

In developing content in different content areas, methods are now being developed for their own context. Mindyarto, Nugroho & Linuwih (2018) using the item modeling method to create physics testlet items. Gunabushanam et al. (2019) was able to follow the item modeling method to create items in the context of radiology. Growth in unsuspecting areas are also bringing the use of new technologies. Von Davier (2018) used a bank of over 3000 items in a personality inventory as basis for generation through a neural network to provide basis. Segments are reassembled based on learned patterns from neural network to assemble into an item. Leo et al. (2019) followed an ontological approach and generated over 3 million items through assembling and querying an existing medical ontology to generate items based on the relationships as defined in the ontology. In sum, as the content areas continue to grow, more attempts will be made in expanding the item generation method integrate natural language processing techniques.

In the evaluation of generative outcomes, studies on its feasibility and practicality are beginning to take place. Embretson and Kingston (2018) evaluated the efficacy in the production of items in the area of mathematics. Their study demonstrated feasibility in the production of items, but highlighted challenges in adopting item generation with either test development practices such as field testing and parameter estimation. One notable advantage of generating test items is the scalability of the approach. However, the efforts required to scale the production of an item model also requires greater investment of cost than written items. To evaluate the return-on-investment of item generation as an approach, Kosh et al. (2018) conducted a cost analysis on item generation and found that the comparatively larger upfront cost of item generation is off-set if there is a demand for greater than 173 items per content area. In this analysis, they have accounted for the up-front cost of generation, survival rate of items in the review process, and time required for model development. Finally, Attali (2018) evaluated a broad deployment of generated items in a low-stake learning companion context. Following closely to the concept of item model, Attali evaluated their deployment of generated items for 6000 students as practice questions. With different use case driving the need for item generation, we suspect evaluation of AIG as a method in its effectiveness and adoption will continue to be needed to convince skeptics in the near future.

CONCLUSION

As the importance of technology continues to increase, countries require skilled workers who can produce new ideas, products, and services. The ability to create these outcomes will be determined by the effectiveness of our educational programs. Education provides students with the knowledge and skills required to think, reason, communicate, and collaborate in a world that is increasingly shaped by knowledge services, information, and communication technologies. Computerized testing will foster the development of this highly skilled workforce by helping students acquire these essential skills. Computers allow educators to administer tests more frequently so students can receive specific continuous feedback as they develop their skills. But when tests are given more frequently, a constant supply of test items is needed. Automatic item generation is a rapidly evolving research area where cognitive and psychometric theories are used to constantly produce tests that contain items that are generated with computer technology. The purpose of this chapter was to describe and illustrate a template-based method for generating

test items to address the challenging problem of rapidly and economically producing large numbers of high-quality, content-specific, test items required to support computerized testing.

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KEY TERMS AND DEFINITIONS

Automatic Item Generation: A process of using item models to generate test items with the aid of computer technology.

Cognitive Model: A representation that highlights the knowledge, skills, problem-solving processes and/or content an examinee requires to answer test items.

Distractor Pool Method with Random Selection: A method for creating distractors when the distractors created from a list and then the list is used to randomly select plausible but erroneous content for each generated item.

Elements: Variables in the item model that can be modified to create new test items.

Item Model: A template that highlights the features in an item that must be manipulated to generate new items.

Key Features Cognitive Model: A model used to guide item generation based on the relationships among the key features specified in the cognitive model, which include the attributes or features of a task are systematically combined to produce meaningful outcomes across the item feature set.

Systematic Distractor Generation: A method for generating distractors where specific information related to errors and misconceptions is used to create plausible but incorrect options.

Systematic Generation with Rationales Method: A method to systematically create distractors when rationales are used to produce a list of incorrect options.

Organizational Knowledge and Administration Lessons From an ICT4D MOOC

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INTRODUCTION

The rapid acceleration of human-centered and technology-oriented advancements in a multitude of industries and fields means that most **organizations** could greatly benefit from an expansion of coverage into all aspects of **organizational** research, allowing for a greater breadth and range of content. In a chapter on transdisciplinary approaches to action research for Information and Communication Technologies for Development (ICT4D), Goosen (2018c, p. 97) further recommended that researchers “ought to try out the theories they propose together with practitioners in real-world situations and with real **organizations**, towards making academic research relevant.”

The purpose of this chapter is therefore to offer insights into key topics, such as **organizational structure, strategic leadership, information technology management, and analytics**, among others, especially as applicable in the emerging areas of ICT4D and Massive(ly) Open Online Courses (MOOCs). This chapter will be comprised of content that highlights authoritative research results, directed at the proposed target audience of this book. “That is why students, professors, and universities” could be interested (Abbakumov, Desmet, & Van den Noortgate, 2019, p. 332), together with e-learners, teachers and managers at e-schools in South Africa (Goosen & Van der Merwe, 2015), as well as researchers, educators, students, professionals, and knowledge seekers from all around the world, as these pertain to all aspects of **organizational growth and development**, specifically discussed in the context of a MOOC entitled ‘Ethical Information and Communication Technologies for Development Solutions’.

“With e-learning technologies evolving and expanding at high rates, organizations and institutions around the world are integrating” MOOCs and other Open Educational Resources (OERs) in order to address problems, especially for “Open Education in the Global South” (Zhang, Bonk, Reeves, & Reynolds, 2019). In their guest editorial on initiating the debate regarding perspectives on teaching, learning and assessment in Open Distance e-Learning (ODEL) contexts, Prinsloo and Coetzee (2013, p. 1355) indicated that there are many **problems** “facing higher education institutions, such as changes in funding regimes, the impact of technologies, changing student profiles and the impact of the economic downturn, to mention but a few.” According to Subotzky and Prinsloo (2011), the **problems** and imperatives related to enhancing student support for retention and success at Higher Education Institutions (HEIs) in particularly South Africa are formidable, where success rates and retention are notoriously poor. Examples of conference papers, which detailed such issues include Goosen (2014), who aimed to investigate effective teaching and meaningful learning to address the **problems** of Information and Communication Technology (ICT) education in an Open and Distance e-Learning context, and Goosen

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(2015c), on assessment to address the **problems** of effective teaching and meaningful learning in an ICT4D MOOC.

The chapter represents significant innovative work by closing gaps regarding research and “sharing of teaching practices that empower educators to benefit from the best ideas of their colleagues” (Cape Town Open Education Declaration, 2007). Further significance of the chapter lies in presenting an original piece of work contributing to academic debate under the theme of scholarship of teaching and learning in higher education (Subotzky & Prinsloo, 2011). Potentially useful content, with interest value for the intended audience, particularly facilitators, include examples of practice relating to the themes of student support in ODeL for increasing retention and success in courses with massive participation at higher institutions of learning (Firmin, Schiorring, Whitmer, Willett, Collins and Sujitparapitaya, 2014; Jona & Naidu, 2014; Subotzky & Prinsloo, 2011), the assessment of students and using Information Communication Technologies (ICTs) to facilitate teaching and learning (Libbrecht & Goosen, 2015).

“In recent years there has been a significant growth in the number of online courses known as MOOCs available” (Liyanagunawardena, Lundqvist, Mitchell, Warburton, & Williams, 2019). According to Bates (2014), the **organization** and management of social learning on such a massive scale, without the loss of potential advantages related to collaborating at such a scale, is still a major **problem** remaining to be adequately addressed. Like that of Fischer (2014), this chapter not only reports on collected data regarding existing practices, but also investigates the advantages and disadvantages of different design choices, in order to help identify the e-learning practices worth preserving.

Although much can be deduced by relying more on student and/or lecturer feelings and perceptions, there is a need to represent “perspectives on MOOCs from outside Western contexts”, based on actual cases (Bates, 2014, p. 147).

Baggaley (2014b) agreed that reporting on North American MOOC practices does not provide any evidence regarding the transferability of these to other regions, where some students are literally studying “in a village in Africa”, as had somewhat contemplatively been expressed by Fischer (2014, p. 151). In a slightly earlier reflection for the Distance Education journal (Baggaley, 2013), regarding the rapid rise of MOOCs, Baggaley (2014a) also indicated that MOOC evaluations, which are now emerging, are finding that claims regarding courses, which are supposed to be appropriate for worldwide adoption, are groundless. Fischer (2014) agreed that the particular **problems** related to courses that reach beyond individual countries’ borders need to be carefully considered.

Although indications are that established constructivist or instructionist approaches to pedagogy are usually adopted in relation to the curriculum development, pedagogy and assessment of MOOCs, questions are also asked to make the underlying assumptions and theory informing the chapter evident (Knox, 2014).

A diversity of educational research methodologies implemented regarding MOOCs included heuristics, data and learning analytics, utilizing a case study (Firmin, et al., 2014), using user statistics and survey data to examine students’ experiences, and reporting on studies investigating co-located MOOC study groups, using quasi-experimental comparisons (Li, et al., 2014).

This chapter discusses analysis results on survey data about the context of this MOOC, to discover lessons learned from the affordances and acceptance of established and emerging technologies when used regarding student support for retention and success (Diver & Martinez, 2015). Also included are results on how OERs made available online were used by educators, with the main aim of the MOOC having been growth in students’ proficiency” in such areas (Abbakumov, et al., 2019, p. 332).

It is important to identify **problems** such as those mentioned previously to the future of MOOCs (Fischer, 2014), faced regarding the scholarship of teaching and learning applied to large cohorts (Bag-

galey, 2014a), as the success of MOOCs depend on how well these are managed. Concluding remarks propose calls considering implications regarding MOOCs, including multimodal approaches to pedagogy and research in the discipline of ICTs (Baggaley, 2013).

Similar to what was done by Jona and Naidu (2014), referring to Bates (2014), this introduction has now described and summarized the general perspective of the chapter, which provides a useful point to start, in order to draw some lessons learned, based on theoretical groundings, as well as qualitative and quantitative data (Fischer, 2014). Towards this end, the objectives of the chapter will be specifically stated as being part of an investigation to establish:

- What **organizational knowledge** can be gained from an ICT4D MOOC in terms of the affordances (opportunities) presented by established and emerging technologies in growing capacities for sustainable ODeL provision?
- To what extent can **administration** lessons learnt from an ICT4D MOOC improve the acceptance by students of established and emerging technologies used for growing capacities for sustainable ODeL provision?

BACKGROUND

This section of the chapter will provide broad definitions and discussions of the topic and incorporate views of others into the discussion (in the form of a literature review), to support, refute and/or demonstrate the author's position on the topic.

Naidu (2016, p. 1) saw “openness as part of a bigger agenda incorporating many other dimensions of learning and teaching as opposed to a rather narrow focus on free and open access to educational resources”. According to Cronin and MacLaren (2018, p. 127), open education is defined “as encompassing resources, tools and practices to improve educational access, effectiveness, and equality worldwide”, while Weller, Jordan, DeVries and Rolfe (2018, p. 109) believe that the “term open education has recently been used to refer to topics such as” OERs and MOOCs. Embodying “the values and visions of openness”, Koseoglu and Bozkurt (2018, p. 455) defined Open Educational Practices (OEPs) as “a broad range of practices ... informed by open education initiatives”. Against the background of growing awareness of new digitally-enabled OEPs, the relationship between these and established educational modes, such as Distance Education (DE), remains unclear (Prinsloo, 2016), especially with the overlapping issues of student empowerment and/or inclusion through open practice (Czerniewicz, 2018; Hodgkinson-Williams & Arinto, 2017).

Theoretical and Conceptual Frameworks

Relating to the context as set out in the introduction to this chapter, Subotzky and Prinsloo (2011, p. 177) presented “a socio-critical model and framework” to understand, predict and enhance student support for retention and success in ODeL and “developed at the University of South Africa”. Jona and Naidu (2014) emphasized the importance of agreeing on a shared vocabulary for discussing and debating questions regarding the theoretical and conceptual frameworks underpinning pedagogical approaches instantiated in MOOCs. In response, Knox (2014) indicated that established **constructivist** or instructionist approaches to pedagogy are usually adopted in relation to the curriculum development and assessment of MOOCs.

In this same context, Kop and Hill (2008), however, asked whether connectivism was a learning theory for the future, or vestige of the past?

Literature Review

The article by Goosen and Van Heerden (2013), according to Prinsloo and Coetzee (2013, p. 1360), shared “findings regarding the impact of the introduction of project-based learning and assessment”, which showed that these “increased not only the effectiveness of the teaching, but also students’ self-confidence”, as it can “be used effectively for assisting in learning academic areas” (Goosen, 2019b, p. 89) for an undergraduate Computer Science course in an ODeL context.

Scholarship of Teaching and Learning

Shulman (2000) asked why there should be a Scholarship of Teaching and Learning (SoTL), while the question from Kreber (2007) was what the scholarship of teaching and learning as an authentic practice was really all about?

According to Prinsloo, Slade and Galpin (2012, p. 133), both the University of South Africa and the Open University encouraged “the scholarship of teaching and learning to increase evidence-based approaches to interventions aimed at improving student retention and success.” In this same milieu, Pintrich and Zusho (2007) provided an evidence-based perspective on student motivation and self-regulated learning in the college classroom, against the background of the scholarship of teaching and learning in higher education.

Prinsloo and Coetzee (2013, p. 1357) added that, against “the changing landscape of higher and distance education, the possible foci in” fields related to ODeL research are diverse, including “the need to expand the scholarship of teaching and learning to provide evidence-informed and value-based foundations from which to shape teaching, learning,” student support and assessment practices. Since the latter authors (Prinsloo & Coetzee, Initiating the debate: Perspectives on teaching, learning and assessment in ODL contexts, 2013, p. 1363) indicated that the different **problems** “inherent in the nexus between the scholarship of teaching, learning and assessment and disciplinary research” need to be considered, Huber and Morreale (2002) explored common ground regarding disciplinary styles in the scholarship of teaching and learning.

While Hatch (2005) looked at taking the development of the scholarship of teaching and learning into the classroom, Richlin and Cox (2004) investigated new directions in terms of developing scholarly teaching and the scholarship of teaching and learning through faculty learning communities. In the same kind of scenarios, in their capacities as faculty luncheon speakers, in Dawson, et al. (2015):

- Dawson examined assessment alignment as a process for program evaluation,
- Ritchie carried out a quantitative investigation into collaborative testing to improve learning,
- Newton used case-based learning in undergraduate Biochemistry education, regarding design, implementation, and pedagogical outcomes,
- Wolstenholme and Aspenlieder studied teaching evaluations and SoTL for continuous improvement,
- Yankulov considered peer review, writing and presenting in undergraduate courses, in terms of how teaching innovation and teaching/learning research can be united,
- Jacobs researched how to collect, analyze, and present qualitative data,
- Graether investigated quantitative and qualitative analysis of courses and students, and finally,

- Bettger explored SoTL opportunities arising from the design of a ‘Biological Concepts of Health’ course.

Learning Analytics

In the proceedings of the first international conference on learning analytics and knowledge, Fournier, Kop and Sitlia (2011) commented on the value of learning analytics to networking in a personal environment.

Prinsloo, Slade and Galpin (2012, p. 131) pointed out that despite all the research on student “retention and success since the first conceptual mappings of” student success, “there have not been equal impacts on the rates of both” student success and retention. To realize “the potential of learning analytics” towards impact, the **problems**, paradoxes and opportunities related to learning analytics for mega ODeL institutions need to be appreciated.

According to Willis, Slade and Prinsloo (2016, p. 881), learning analytics’ growth as a means for improving learning outcomes means that student data is being collected, analyzed “and applied in previously unforeseen ways.” The latter authors therefore derived a typology from a cross-continental, cross-institutional perspective, as Bolton, Goosen and Kritzinger (2016, p. 1) are of the opinion that the influence of such social change needs to be “discussed, highlighting the new requirements” with regard to the ethical oversight of student data in learning analytics.

MASSIVE OPEN ONLINE COURSES

“In the field of education,” MOOCs “have raised remarkable attention throughout the last decade” (Otto, et al., 2019, p. 12). MOOCs represent “an instructional approach that permits hundreds of thousands of students to access online courses anywhere around the world and typically free of charge” (Weinhardt & Sitzmann, 2019, p. 218). “The large numbers that enrolled, coupled with the unprecedented reach through the internet” (Oakley & Sejnowski, 2019, p. 1), also means that MOOCs “allow learning to take place anytime” (Wong, et al., 2019, p. 356).

The fact that MOOCs tend to not be based on instructional principles that are widely accepted was lamented by Baggaley (2014a), and as this same author indicated that studies evaluating early ‘connectivist MOOCs’ have indicated **pedagogical** deficiencies in these, it would be essential to consider this as well.

Similar to what was reported with regard to one of the very first MOOCs, the author is of the opinion that the particular course reported on in this chapter has a solid **pedagogical** approach and includes the use of open educational resources (Baggaley, 2013; Fischer, 2014; Jona & Naidu, 2014).

Although designing MOOCs is undergoing rapid curriculum development with regard to pedagogy and assessment, a lot has already been established about ODeL, which needs careful application and supervision when instructionally designing MOOCs (Bates, 2014)

– one finding in this regard is that e-learners, teachers and managers at e-schools in South Africa (Goosen & Van der Merwe, 2015), as well as students at HEIs, want e-learning as part of their education (Goosen, 2016).

According to Diver and Martinez (2015, p. 5), it is not correct considering MOOCs as wholly different entities, “outside and apart from other types of” distance education and e-learning environments. Baggaley (2013, p. 369) agreed that very little about MOOCs “is actually new, and plenty of lessons are available about how” these can be implemented; Jona and Naidu (2014, p. 142) therefore asked what lessons from existing e-learning “and mainstream distance education research” can contribute, and what

the unique educational technologies for growing innovation are, which support the design, implementation, analysis, delivery and/or evaluation of MOOCs in the 21st century (Goosen, 2015a). One example of such research, on excellence in e-learning course design, was reported on by Goosen (2015b).

The approach followed had a team including individuals “trained in instructional **design**, the learning sciences, educational technology, course design or other educational specialties to help with the design of their courses” (Baggaley, 2013, p. 373, quoting Holden). The online development and curriculum design of the course was informed by a contextual analysis, liaison with industry and/or professional bodies and other relevant stakeholders, and/or relevant market research, including applicable quality assurance criteria in terms of the planning process.

When choosing the ‘best’ elements towards developing a MOOC, as discussed in the previous paragraph (Goosen, Mentz, & Nieuwoudt, 2007), research like that of Van Heerden and Goosen (2012), on using vodcasts to teach in an ODL environment can be born in mind. Such elements were augmented “by innovative technological developments such as delivering content” by using readings, **problems**, assignments and a portfolio, as well as enrichment components, such as peer-to-peer learning support, to provide scalability to large audiences in terms of technology perspectives, including platforms supporting the sizeable number of students being added to these e-learning environments – these also fostered learning through conversations, activities and participatory settings (Fischer, 2014, p. 153). Since Li et al. (2014) suggested that MOOC students prefer studying in groups, social facilitation within such groups could make learning difficult concepts a more pleasant experience. e-Learning discussion forums for affording communication among participants, and supporting the importance of self-directed, **problem**-based and active learning, as well as fostering collaboration amongst students, and interactivity for “providing **feedback** (e.g., with automatic grading)”, were therefore also implemented (Fischer, 2014, p. 153). Students are teaching each other (Baggaley, 2013) and taking responsibility to digest the information being presented to them, to discuss it with other students (Baggaley, 2014b).

Since, however, Baggaley (2013) reported on the huge amount of information available in these discussion forums, this same author (Baggaley, 2014b, referring to Knox) warned that numerous MOOC students are crushed by this peer-to-peer approach. The author agrees with Fischer (2014, p. 152) that the students can be disorientated by the “volume of ideas and comments”, while Knox (2014, p. 169) pointed out that “MOOCs can provoke anxiety about presence and orientation in relation to” these large-scale activities.

According to Baggaley (2013, quoting Carter), lecturers and policy-makers are further facing the increased costs of infrastructure and of teaching an increased number of students using fewer resources (Fischer, 2014). Firmin et al. (2014) pointed out that HEIs therefore increasingly consider the integration of MOOCs into their overall curriculum and course activities by including support services, with enrolment sizes being similar.

“The large audience base of” MOOCs is challenging pedagogical practices (Li, et al., 2014, p. 217). It is impossible for a single lecturer to handle such massive student numbers (Baggaley, 2014a). With regard to curriculum development, pedagogy, assessment, as well as the need for the lecturer “to provide the students with **feedback**” (Baggaley, 2013, p. 369), one “prominent **problem** is the elimination of the traditional **interaction** between” lecturers and students (Li, et al., 2014, p. 217), as “learning **feedback** cannot be obtained directly from the” lecturer. Fischer (2014, p. 153) indicated that “an important question to ask is: Could the technology used in distance education ever become good enough to mimic the ease and richness of **interaction**” seen in face-to-face settings? The figure of the lecturer is “often considered indispensable, calling into question MOOC designs that too quickly assume the” lecturer “to be merely ‘a fellow node’ in the network ..., or even a role that is increasingly obsolete” (Knox, 2014, p. 172).

These **problems** can be addressed through the establishment and support of curator roles for **organizing** the potentially large information spaces, who were called Teaching Assistants (**TAs**) in the course discussed in this chapter. As opposed to the situations described by Baggaley (2014b), which dispensed with teaching support, and in another instance, where courses were unsupervised, lecturers played no role in appointing and monitoring of the teaching assistants, nor provided these lecturers with any training (Baggaley, 2013). Wong et al. (2019, p. 356) also reported a situation “with little external monitoring by” lecturers.

While learning has taken place in both open and distance contexts, MOOCs have increased the size of student enrolments (Baggaley, 2014b) to situations where participation numbers “in the tens of thousands” (Knox, 2014, p. 164) “of students in a single course” (Baggaley, 2013, p. 368). The large enrolment numbers associated with MOOCs underscores the importance of engaging in e-learning student support for retention and success with regard to educational activities (Firmin, et al., 2014), which compelled Diver and Martinez (2015) to investigate **issues** related to MOOC dropout, with high non-completion rates in MOOCs also being reported (Jona & Naidu, 2014).

Marshall (2014, p. 250) indicated that there are significant “research **ethics** concerns arising from” various initiatives around the “analytical and other work being done by academics and” HEIs, regarding specifically MOOCs. According to Jona and Naidu (2014), the latter essay by Marshall (2014) explored the **ethical** considerations relating to this new educational approach and research findings, which “should be used to inform” and must serve to guide the “thoughts and approaches to MOOCs” (Diver & Martinez, 2015, p. 6) in terms of the decision-making of key stakeholders, including students, individual faculty members and/or higher education institutions’ online support services, coordinators, leaders and **administrators**, who consider the implementation of MOOCs in their organizations (Firmin, et al., 2014). Similarly, Jona and Naidu (2014, referring to Baggaley) also raised concerns that many lecturers and distance education researchers share: Baggaley (2014b, p. 162) is of the opinion that “the **ethical** approach taken by Marshall (2014) may ultimately pose the unarguable” **problem** that decision-makers cannot ignore.

According to Goosen (2018b, p. 19), it “is important to indicate whether the researcher has received permission to conduct research from the relevant authorities, where research involves the utilization of space, data and/or facilities at other institutions and/or **organizations**.” Both Baggaley (2014b) and Jona and Naidu (2014, p. 143) therefore encouraged all those HEIs who participate in the development, **administration** and study of “MOOCs to pause and consider the many important implications of this new technology and” the **ethics** of these and associated practices and policies. In this regard, the chapter by Goosen (2018a) discussed ethical information and communication technologies for development solutions in terms of research integrity for MOOCs.

RESEARCH METHODOLOGY

The diversity of research methodologies, which had previously been implemented relating to MOOCs, have included:

- Okada, Scott and Mendonca (2015) using a case study on effective web videoconferencing for proctoring online oral exams at scale in Brazil;
- Greenland and Moore (2014) with a preliminary case study investigating patterns of student enrolment and attrition in Australian open access online education;

- While Firmin, et al. (2014) utilized a case study on using MOOCs for conventional college coursework in a distance education context,
- the chapter by Goosen (2019a) used a case study of a MOOC to provide details on technology-supported teaching and research methods for educators.

Similar to the situation described by Rodriguez (2013, p. 68), the collection of “qualitative and quantitative data through” surveys given to participants towards “the end of the courses” reported on in this chapter also “concentrated on the **design** of the courses, statistics and content”, and were likewise used “to determine general demographic information ... and participant satisfaction with the courses.”

SOLUTIONS AND RECOMMENDATIONS

Unfortunately, the commentary by Bates (2014) did not include any findings. The aim of this section of the chapter will, however, be “to categorize and describe different types” of students in the MOOC by means of some of the quantitative findings from the research mentioned in this chapter (Luna, Fardoun, Padillo, Romero, & Ventura, 2019, p. 1).

Coughlan and Perryman (2015, p. 181) reported on a MOOC called *Physiotherapy Management of Spinal Cord Injuries*. Like the afore-mentioned, the MOOC reported on in this chapter runs in each of two semesters per year and attracted, on average, almost 16,000 registrants per semester for the period referred to in this chapter, and like Goosen (2016) and Wong et al. (2019), will be reporting on characteristically, highly diverse groups of students in the samples from 30 countries.

Fischer (2014, p. 150) also reported that for the course reported on in that paper, “on average only about 50% of those who registered for a course ever viewed the” learning materials. Table 2 shows that up to 84% of students not only viewed the learning materials, but, in fact, used the functions on the institutional learning management system (myUNISA) for this course to download learning materials.

As online courses, MOOCs have notoriously high attrition (Mongkhonvanit, Kanopka, & Lang, 2019). Also reporting on the low completion rates for MOOCs, Fischer (2014, p. 150) indicated that “only about 4% completed the courses”, while Baggaley (2013, p. 372) reported “that only 14% of the participants completed the course”. In sharp contrast, the MOOC reported on in this chapter has shown completion rates (number of students registered at the time of mark sign-off divided by number of students who completed the final portfolio) as high as 89% for the first semester of 2014 (Goosen, 2018a). The percentage of students who pass the course has also been standing at a constant of 84% since the second semester of 2014.

Recommendations

With regard to methodological issues, Boucher and Piderit (2017, p. 161) **recommended** action research as “a commonly used method for the demonstration of the scholarship of teaching and learning”.

According to Fischer (2014, p. 154), the use of human tutoring and/or assignment marking of individual students and teaching assistants to support the discussions towards operating more successfully, and to support students experiencing **problems** “with content and/or technical issues” are **recommended**.

Fischer (2014) additionally **recommended** that **future** research needed to be conducted for exploring a range of **issues** around open questions, such as whether MOOCs are able to enculturate the building of communities and feelings amongst the students taking a course.

Table 1. Countries of residence for sample students

Country of Residence	EUP1501-S1-2014		EUP1501-S2-2014		EUP1501-S1-2015		EUP1501-S2-2015	
South Africa	1,962	96%	1,506	96%	513	95%	411	91%
Zimbabwe	32	1.6%	26	1.7%	4	0.74%	16	3.5%
Namibia	14	0.68%	6	0.38%	3	0.55%	6	1.3%
Botswana	8	0.39%	9	0.57%	5	0.92%		
Swaziland	3	0.15%	8	0.51%	3	0.55%	2	0.44%
Zambia	3	0.15%	3	0.19%	1	0.18%		
Angola	3	0.15%	2	0.13%	2	0.37%	1	0.22%
China	3	0.15%						
United Kingdom	3	0.15%					1	0.22%
Malawi	2	0.10%	3	0.19%				
Lesotho	2	0.10%	2	0.13%	2	0.37%	1	0.22%
United Arab Emirates	2	0.10%	1	0.06%	2	0.37%		
Mauritius	2	0.10%						
Nigeria	2	0.10%						
Kenya	1	0.05%	2	0.13%	1	0.18%		
Bahrain	1	0.05%						
Cyprus	1	0.05%						
Niger	1	0.05%						
Seychelles	1	0.05%						
Singapore	1	0.05%						
South Sudan	1	0.05%						
Tanzania	1	0.05%						
Ethiopia			2	0.13%			1	0.22%
Canada			1	0.06%				
Germany			1	0.06%				
Saudi Arabia			1	0.06%			1	0.22%
Brazil					2	0.37%		
Democratic Republic of the Congo			1	0.18%				
Mozambique					1	0.18%		
Sweden					1	0.18%		

Table 2. I used the functions on myUNISA for this course to download learning materials

EUP1501-S1-2014		EUP1501-S2-2014		EUP1501-S1-2015		EUP1501-S2-2015	
1638	81%	1056	79%	377	81%	346	84%

FUTURE RESEARCH DIRECTIONS

This section of the chapter will discuss **future** and emerging trends and provide insight about the future of the encyclopedia's theme, of **organizational** knowledge, **administration** and technologies, from the perspective of the chapter focus on **organizational knowledge** and **administration lessons** from an ICT4D MOOC. The viability of **paradigms**, models, implementation issues of proposed programs, etc., may also be included in this section. Finally, this section of the chapter will suggest future research opportunities within the domain of the topic.

In the context of information and knowledge management, Thomas (2011) pointed to cloud computing as a potential **paradigm** for practicing the scholarship of teaching and learning. In this regard, Shulman (2001) believed approaches to the scholarship of teaching and learning are opening lines towards inventing the **future**.

Despite Baggaley (2013) warning against the uncritical hype, which often accompanies the use of new educational technologies, supporters of MOOCs have been able to generate enthusiasm and excitement worldwide (Fischer, 2014). As such, MOOCs present potentially exciting possibilities and opportunities to explore innovative, multi-dimensional aspects of the use of technology for openness in the ever-changing and expanding world towards embracing the **future** of ODeL. These also relate to theories, which drive practice (Jona & Naidu, 2014), and empirically investigation of the affordances and acceptance by students of both established and especially emerging technologies in growing capacities for sustainable ODeL provision - especially in South Africa and regarding the first-year experience (Marshall, 2014).

The research team in the article by Firmin, et al. (2014) suggested that **future** investigations should be conducted into the roles, which e-learning and other student support efforts can play in accelerating persistent efforts towards improving outcomes for the different student populations, who are enrolled in MOOCs. The context presented by the confluence of MOOCs, e-learning and distance education, more generally, can represent another important component (Fischer, 2014). Furthermore, according to Bates (2014), one of the more critical areas for **future** research and development is that the MOOC community still lack methods and designs for making progress towards the creation of the best environments, which properly support participants.

Jona and Naidu (2014) called for **future** exploration of promising new insights towards advancing the understanding and practice in terms of fitting the learning and teaching needs of 21st century MOOCs (Goosen, 2015a), included establishing common grounds for a shared understanding of the incorporation of locally relevant issues and needs (Fischer, 2014). Together with addressing pedagogical concerns, both more recent and established in nature, these offers yet another avenue of exploration, which can affect the framing of informed discussions, academic debate, and decisions regarding MOOCs and e-learning course design that are taking place (Diver and Martinez, 2015).

Fischer (2014, p. 151) pointed out the importance of identifying research **problems** to the **future** of MOOCs, with the success of MOOCs depending on how well these are managed regarding common **problems** faced regarding the scholarship of teaching and learning applied to large cohorts (Baggaley, 2014a). These **problems** could include “whether students can learn what they want and when they want it” (Fischer, 2014, p. 151), as well as providing access to individual students “that they would not have otherwise” (Fischer, 2014, p. 155) - Goosen (2018d) provided details around students’ access to an ICT4D MOOC.

According to Diver and Martinez (2015, p. 21), MOOCs generate tremendous amounts of data, which “can be used not only” for improving the MOOCs themselves and their associated e-learning

environments, but can also act as a reference to analyze and reflect on “past, current, and **future** MOOC developments” (Fischer, 2014, p. 149).

Bozkurt, Koseoglu and Singh (2019, p. 78) emphasized that open educational practices “as an emerging area of study” also offer “fertile ground for **future** research.”

CONCLUSION

Since Liyanagunawardena, et al. (2019) indicated that previous results have seen “a marked reduction in the clarity around the different course offerings”, this has created a research gap. This section will provide discussion of the overall coverage of the chapter and concluding remarks, which propose a call with regard to further consideration of MOOCs in terms of moving beyond individualism and self-interest towards achieving **implications** related to MOOC design, especially the **implications** for those practitioners and researchers from HEIs that have previously engaged and/or specialized in the higher education arenas of distance education.

“In order to gauge the significance of education at scale,” like that of Knox (2014, p. 164), this chapter analyzed a specific example “of massive participation derived from” e-learning and distance education, “a MOOC from the University of” South Africa. User statistics and survey data were used to illustrate this, and for the examination of “the experiences and repercussions of engaging” in educational activities “where participants number in the tens of thousands.” This was in response to the call from Baggaley (2014b, p. 162), that the consequences with regard to effectively “learning for the vast majority of participants who took” part in MOOCs need to be established.

The chapter pointed out the organizational knowledge that can be gained from an ICT4D MOOC in terms of the affordances (opportunities) presented by established and emerging technologies in growing capacities for sustainable ODeL provision, as well as administration lessons learned from creating an ICT4D MOOC to improve acceptance by students. The results showed that this MOOC is increasingly popular among students from around the world (Abbakumov, et al., 2019).

As Knox (2014, p. 173) indicated that some students “responded to massive participation in ways that can be interpreted as overload” and/or anxiety, “more work is needed within the open educational movement to consider how to work with a global audience that has significantly different experiences and beliefs about education”.

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KEY TERMS AND DEFINITIONS

Connectivism: A theoretical framework for understanding learning, the latter taking place when knowledge is stimulated through a cyclical process, started when students connect to a socially networked environment to find and share new information.

ICTs for Development (ICT4D): An academic field constructed of building blocks, providing complementary perspectives from information systems, as well as development management.

Information and Communications Technologies (ICTs): Any devices used for creating and/or capturing, storing, processing, managing, as well as any dissemination/transmission/transfer and/or display of data and information by using digital means.

Massive(ly) Open Online Courses (MOOCs): MOOCs are characterized by their massive enrollment figures in terms of number of students, who have open access to the online content of these courses.

Online Learning or E-Learning: Learning that takes place via the internet, using a variety of devices to access the web.

Plagiarism: Failure to acknowledge the work of others.

Sub-Saharan Africa (SSA): Those African countries located towards the south of the Sahara Desert.

Preferences, Utility, Value–Driven Modeling, and Decision Support

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INTRODUCTION

Organizational knowledge is indispensable in the process of modeling complex systems, which describe phenomena with significant human participation. A complex system is a system with the active or decisive involvement of the person in the determination of objective, description, and choice of the final decision as an element of the system itself. In the context of the system analysis, this is a “human-process”-system. This conception is reflected in the decision-making theory at the stage of determination of the system structure in the light of the main objective. At such a basic level, the needed information and knowledge are generally expressed in ordinal scale as human preferences. The chapter focuses attention on complex models and mathematically well-founded methods where the decision-maker (DM) is represented through his preference as a value or utility function, being part of the mathematical modeling process. It is a value-based design, an engineering strategy grounded on system analyses enabling multidisciplinary design optimization (Collopy & Hollingsworth, 2009).

A benefit could be to integrate the human’s preferences with machine learning. The latter focuses on a prediction that builds on known properties derived from training data. Machine learning explores the construction and learning algorithms that can learn from teaching experts and make predictions. According to some opinions, machine learning and pattern recognition can be viewed as two facets of the same problem. As a scientific field, Machine learning is an area of computer science, evolved from pattern recognition and computational learning theory (Aizerman, Braverman, & Rozonoer, 1970; Vapnik, 1998; Mandel, 2018). The decision-making is also an iterative process that includes learning as an essential part of its realization (Keeney & Raiffa, 1999). The combination of the abovementioned theories and approaches enable constructing mathematical value-based models of complex systems like

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“human-process” and building a mathematically well-grounded control solution as a flexible, iterative mutual learning process (Pavlov & Marinov, 2017).

Value focused thinking and value-based modeling imply a mathematical paradigm applicable in diverse areas of activity (Erickson, 2002). The utility theory and the proposed approach offer an appropriate solution. The main goal is to demonstrate this unified mathematical approach, reduced to specific numerical methods, in a broad scope of applications in complex systems. The objective of the chapter is to present such a strict logical mathematical approach for value modeling and estimation of human preferences as machine learning in the process of construction of two examples of complex systems with human participation in two completely different areas of activity. The first model focuses on forestry timber production rendering an account to landscape design, social and ecological biodiversity factors. The second model concerns the classroom teaching and determining the optimal usage of active and passive resources based on information and communication technology (ICT).

BACKGROUND

A reasonable approach to the mathematical description of human beings is an analytical representation of their preferences. Preference representation as value or utility function enables value-based modeling. Value-based decision-making based on human preferences and their inclusion in complex systems is a challenge and a modern research trend simultaneously. It is the first step in the implementation of human-centered value-driven design in a decision-making process (Keeney & Raiffa, 1999). The main objective is to avoid the contradictions in human’s decisions in complex processes and to permit mathematical calculations in these fields.

The complex phenomena and the characteristics of human thinking raise uncertainty in the expressed human preferences. The mathematical approach to modeling such type of thinking and acquired information includes the theory of measurement, utility theory, theory of probability and various aspects of operational researches (Keeney & Raiffa, 1999; Clarke, 1983; Aubin, 2007). Especially promising in this direction is the stochastic approximation theory and the potential functions method. The latter, by its nature, allows machine learning and is used in various fields, including a mathematical description of perceptions (Aizerman et al, 1970; Mandel, 2018).

PREFERENCES, STOCHASTIC APPROXIMATION AND UTILITY REPRESENTATION

When the alternatives are arranged by preferences, it implies the *ordering scale*. In the case of decision-making under certainty, every DM’s choice corresponds to only one outcome (alternative x , $x \in X$). X denotes the set of alternatives, e.g. possible outcomes, provoked by the DM’s actions. Let consider a more general scheme of interaction between DM and the real world. Assuming that for every choice of the DM, there are (i , $i=1 \div n$) possible outcomes (alternatives), each of which occurs with probability p_i , where $\sum_{i=1}^n p_i = 1$. Thus, every decision corresponds to one possibility distribution (p) as an outcome.

Following the Bayesian approach, it is reasonable to maximize mathematical expectation $\sum_{i=1}^n p_i u(x_i)$ (Keeney & Raiffa, 1999; Fishburn, 1970). The function $u(x)$ is a utility function that evaluates the different

final alternatives $x \in X$. The normative (axiomatic) approach regards the conditions for the existence of utility function $u(\cdot)$ (Fishburn, 1970; Pfanzagl, 1971). X is the set of alternatives and P – a convex set of probability distributions over X . By $(\succ)$ DM's preference relation over P ($X \subseteq P$) is denoted. The relation $(p \succ q)$, $(p, q) \in P^2$ expresses the preferences of DM over P including those over X ($X \subseteq P$). The induced indifference relation $(\approx)$ is defined as (Fishburn, 1970):

$$((x \approx y) \Leftrightarrow \neg((x \succ y) \vee (x \prec y)), (x, y) \in X^2).$$

Let $(\int u(\cdot) dp)$ denote integration based on the probability measure p . A utility function $u(\cdot)$ is defined so that the following is fulfilled:

$$(p \succ q, (p, q) \in P^2) \Rightarrow (\int u(\cdot) dp \succ \int u(\cdot) dq).$$

In keeping with Von Neumann's axiomatic and utility theory, interpretation of the above formula provides that the integral of utility function $u(\cdot)$ is a measure for comparison of the probability distributions p and q defined over X . The assumption of the existence of a utility function $u(\cdot)$ leads to the “negatively transitive” $(\neg(p \succ t) \dot{\cup} \neg(t \succ q)) \dot{\supset} \neg(p \succ q)$ and “asymmetric” relation $(\succ)$ (Fishburn, 1970). These properties imply the existence of asymmetry $((x \succ y) \dot{\supset} \neg(y \succ x))$, transitivity $((x \succ y) \dot{\cup} (y \succ z) \dot{\supset} (x \succ z))$ and transitivity of the “indifference” relation $(\approx)$. In practice, the transitivity of the relations $(\succ)$ and $(\approx)$ is violated very often by uncertainty and DM's mistakes. The transitivity violation of the relation $(\succ)$ could be interpreted as a lack of information or a subjective mistake of DM. The transitivity violation of the relation $(\approx)$ is due to natural “uncertainty” of human's preferences and qualitative nature of expressions of the human's subjective notions and evaluations (Pavlov & Andreev, 2013).

There are several empirical methods for utility evaluation and necessarily all of them are based theoretically on the “lottery” (gambling) approach (Keeney & Raiffa, 1999; Fishburn, 1970; Farquhar, 1984). A “lottery” is every discrete finite probability distribution over X . The lottery is denoted as $\langle x, y, \alpha \rangle$, where α is the probability of the appearance of alternative x and $(1 - \alpha)$ – the probability of alternative y . The most widely used evaluation approach is the assessment (Keeney & Raiffa, 1999):

$$z \approx \langle x, y, \alpha \rangle, \text{ where } (x, y, z) \in X^3, (x \succ z \succ y) \text{ and } \alpha \in [0, 1]$$

The bottleneck of this approach is the transitivity violations of the relations and the so-called “certainty effect” and “probability distortion” (Kahneman & Tversky, 1979; Shmeidler, 1989). In complex situations, it is also difficult to determine the alternatives x (the best) and y (the worst) under the condition that $(x \succ z \succ y)$, where z is the analyzed alternative.

The measurement scale of the utility function $u(\cdot)$ originates from the mathematical formulation of the relations $(\succ)$ and $(\approx)$ and on the fact that the set of the probability distributions P , ($X \subseteq P$) is a convex set (Fishburn, 1970):

$$((q, p) \in P^2 \Rightarrow (\alpha q + (1 - \alpha)p) \in P, \text{ for } \forall \alpha \in [0, 1]).$$

These conditions determine the utility function $u(\cdot)$ over X up to an affine transformation, i.e. the interval scale. In the same scale is the measurement of temperature. Theoretically, the utility function $u(\cdot)$ could be build-up/ evaluated by pattern recognition of two sets that represent comparisons between lotteries (Aizerman et al, 1970; Pavlov, 2005):

$$A_u = \{(\alpha, x, y, z) / (\alpha u(x) + (1-\alpha)u(y)) > u(z)\},$$

$$B_u = \{(\alpha, x, y, z) / (\alpha u(x) + (1-\alpha)u(y)) < u(z)\}.$$

The notations x, y, z refer to elements of X and α is a uniformly distributed random value ($\alpha \in [0, 1]$) occurring in the lotteries $\langle x, y, \alpha \rangle$. The study uses a mathematical evaluation approach based on stochastic procedures perceived as machine learning based on DM's preferences. This mathematical approach is stochastic pattern recognition because ($A_u \cap B_u \neq \emptyset$). It means that the utility evaluation is a stochastic approximation with noise (uncertainty) elimination (Aizerman et al, 1970). The following represents the evaluation procedure (Pavlov & Andreev, 2013; Pavlov & Marinov, 2017). Let a sequence of learning points (x, y, z, α) (lottery $\langle x, y, \alpha \rangle$ and simple alternative z) be a set with probability distribution $F(x, y, z, \alpha)$ over $X^3 \times [0, 1]$. It is assumed that the "learning points" (x, y, z, α) are given by the probability distribution $F(x, y, z, \alpha)$ and in each point (x, y, z, α) DM compares the "lottery" $\langle x, y, \alpha \rangle$ with the simple alternative $z, z \in X$ ($\langle x, y, \alpha \rangle$ or $\approx$ or $\langle z \rangle$). Every DM's answer as preference refers to a discrete value, "better $\rightarrow, f(x, y, z, \alpha) = 1$ ", "worse $\leftarrow, f(x, y, z, \alpha) = (-1)$ " or "can't answer or equivalent $\approx, f(x, y, z, \alpha) = 0$ ". The discrete function $f(\cdot)$ denotes the qualitative DM's answer expressed as a preference which determines a learning point-training example $((x, y, z, \alpha), f(x, y, z, \alpha))$ and its affiliation to one of the two sets A_u and B_u . Every learning point refers to A_u ($f(x, y, z, \alpha) = 1$) with subjective probability $D_1(x, y, z, \alpha)$ and to B_u ($f(x, y, z, \alpha) = -1$) with subjective probability $D_2(x, y, z, \alpha)$. The vectors (x, y, z, α) could be got from pseudo-random sequences. By this way is formed a machine-learning training sequence of „learning points" (training examples). As the stochastic recurrent procedure for utility polynomial approximation is mathematical machine learning following the concepts of Aizerman et al, 1970; Pavlov & Andreev, 2013).

This collation is a subjective characteristic, representing the empirical knowledge of the DM or their intuition. The subjective and probability uncertainties and errors in DM's answers are taken into account as additive noise. This noise is denoted by the symbol ζ . The mathematical expectation of the noise ζ is proven zero (Pavlov, Andreev, 2013, 2017):

$$f(x, y, z, \alpha) = D_1(x, y, z, \alpha) + \zeta = 1 \text{ if } (x, y, z, \alpha) \text{ is referred to } A_u \text{ or}$$

$$f(x, y, z, \alpha) = D_2(x, y, z, \alpha) + \zeta = -1 \text{ if } (x, y, z, \alpha) \text{ is referred to } B_u.$$

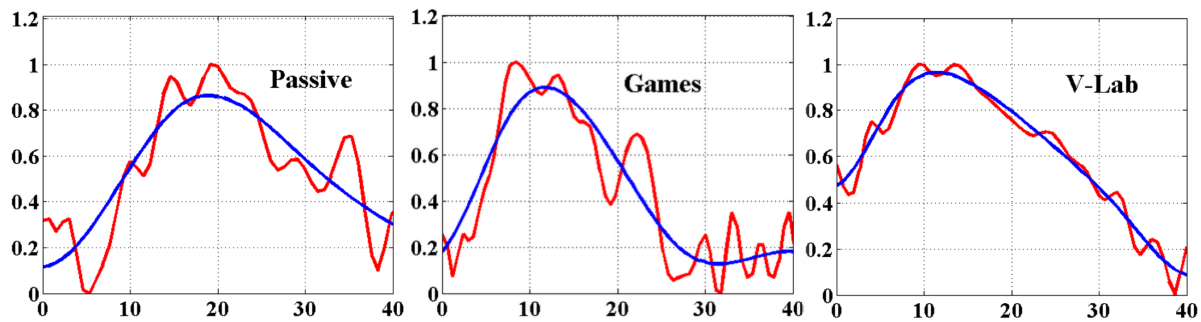
The sets A_u and B_u overlap ($A_u \cap B_u \neq \emptyset$) because of the noise ζ . The probabilities $D_1(x, y, z, \alpha)$ and $D_2(x, y, z, \alpha)$ are exactly conditional mathematical expectations of $f(x, y, z, \alpha)$ over the sets A_u and B_u respectively (Aizerman et al, 1970; Pavlov, Andreev, 2013). In the chosen mathematical approach the probabilities $D_1(x, y, z, \alpha)$ and $D_2(x, y, z, \alpha)$ are stochastically approximated by a function of type:

$$G(x, y, z, \alpha) = (\alpha g(x) + (1-\alpha)g(y) - g(z)).$$

The function $g(x)$ is an approximation of the expert utility function $u(\cdot)$. Figure 1 shows three utility functions evaluated by the mentioned approach and developed mathematical procedures. The seesaw lines are approximations of the functions $g(\cdot)$ which appear in the formula of the function $G(x, y, z, \alpha)$.

A – passive teaching; B – active teaching through educational games; C – active teaching through virtual laboratories

Figure 1. Utility functions (the seesaw line is pattern recognition; the smooth line is utility polynomial approximation):



The function $G(x,y,z,\alpha)$ recognizes stochastically the two sets A_u and B_u (stochastic pattern recognition). The smooth lines are regressions of $g(\cdot)$ and de facto are approximations of the utility functions in the meaning of von Neumann (Pavlov & Andreev, 2013; Pavlov & Marinov, 2017). These functions are used in the process of modeling the *teachers' thinking*.

Value-Driven Decision Making and Control in Forest Ecological Management

In general, the economic evaluation of the forest is limited to the revenue from timber, although the forest offers many different benefits. Ecosystems as a whole could provide public services in different categories: material, energy, climate regulation, etc. The concept of multiple benefits of forests was developed rapidly in the 1980s and received a strong impetus from the United Nations Conference on Environment and Development in Rio de Janeiro in 1992. The economists, authors of the economics of ecosystem services study proved that maximum use of one forest service negatively affected the state of the others and ultimately led to the economic decline in the final product. The focus on forestry has shifted from timber production to a wide range of goods and services such as non-timber products, landscape design, and conservation of biodiversity (Erickson, 2002; Minnitt, 2007).

The concept of multiple forest benefits continues to evolve today. When taking into account the abovementioned, the following case is studied. Suppose a businessman apply to lumber in a particular forest and propose a business plan to the economics ministry. The administration uses an information system for decision support in which the value (utility) based model is constructed by specialists, scientists, ecologists, and economists. The system determines the optimal parameters of the business plan using the quantitative value-based model and the built-in utility function. The government employees make a decision based on the proposed optimal modeling scheme. According to the case study, the main objective of the investigation is:

To develop a value-based model (VBM) for integrated assessment of economic, environmental and social services of forest ecosystems, which could be applied for monitoring and forest ecological management or control of forest areas and allowing the sustainable development of business and natural resources used.

A value-based model was developed and focused on the preferences of an expert in ecological and economic management. This model was integrated into the ForEco system (Lyubenova et al, 2015). It was recognized that expert preferences could play a crucial role in the decision-making process. For the

modeling purposes, the authors accept three forest ecosystem indicators (sub-objectives or factors) that adequately describe the main objective of investigation following the DM's opinion:

- X_1 – timber reserves ($\text{m}^3.\text{ha}^{-1}$) as the representing criterion for the assessment of economic impact or material services;
- X_2 – species richness ($\text{n}.\text{ha}^{-1}$) as the representing criterion for the assessment of environmental impact, or regulatory and support services;
- X_3 – the percentage of the population employed in the forestry sector as the representing criterion for the assessment of social effect or services.

The value model is developed as a multi-attribute utility function with the three factors mentioned above. The carried out expert analysis and organizational structuring led to accepting the following sub-objectives and the appropriate sub-criteria, which adequately describe the main objective and are real, physically measured quantities. The domain of variation of representing criteria is determined in Table 1.

Table 1. Forest ecosystem indicators (factors) and their assignment to the attributes of the utility function

Factor	Denotation	Significance	Measuring units
X_1	material services as a volume of timber per hectare	economic impact	10 to 300 [$\text{m}^3.\text{ha}^{-1}$]
X_2	regulatory and support services	ecological impact	1 to 200 [number of species per hectare]
X_3	the percentage of employed locals in the forestry sector	social effect	1 to 30[%]

In the process of investigation, the DM found independence by utility between the following factors:

- X_2 from X_1 and X_2 from X_3 ;
- X_3 from X_1 and X_3 from X_2 .

The first utility independence means that the preferences of DM between lotteries for x_2 at different values of x_1 and x_3 do not change (Keeney & Raiffa, 1999). That suggests utility independence of x_2 from the changes of the other two factors. Whatever the wood reserves in the forest ecosystem are, the employment of the population in the forestry sector may be different, but in any case, the preferences are directed to the preservation of vast richness of species in the forest.

The preferences of DM between lotteries for x_3 at different values of x_1 and x_2 do not change, suggesting utility independence of x_3 from changes of the other two factors. Thus, despite the reserves of wood and diverse species in the forest ecosystem, the preferences are aimed at increasing the number of workers in the forestry sector. Low timber reserves and scant species composition are motivation for an increase of employment in the forestry sector because of the need of reforestation, regeneration, cultivation of existing forests, optimization of forest-related natural resources, development of alternative use. High timber reserves and richness of species composition are motivation for an increase of employment due to opportunities of multifaceted use of forests and the need for environmental management and balanced utilization of forest resources.

Using the theory for the decomposition of multi-attribute utility to simpler functions given in (Keeney & Raiffa, 1999) the following multi-attribute utility structure is determined:

$$\begin{aligned}
 u(X) &= k_1 u(X_1; X_2^o; X_3^o) + \\
 &+ f_2(X_1) \times [u(X_1^o; X_2; X_3^o)] + \\
 &+ f_3(X_1) \times [u(X_1^o; X_2^o; X_3)] + \\
 &+ f_{23}(X_1) \times [u(X_1^o; X_2; X_3^o)] \times [u(X_1^o; X_2^o; X_3)], \\
 \text{where } &u(X_1^o; X_2^o; X_3^o) = 0 \text{ and } u(X_1^*; X_2^*; X_3^*) = 1.
 \end{aligned}$$

In the formula above $X^o = (X_1^o; X_2^o; X_3^o) = (10, 1, 1)$ and $X^* = (X_1^*; X_2^*; X_3^*) = (300, 200, 30)$. The functions f_2 , f_3 , and f_{23} have the forms:

$$\begin{aligned}
 f_2(X_1) &= u(X_1; X_2^*; X_3^o) - k_1 u(X_1; X_2^o; X_3^o), \\
 f_3(X_1) &= u(X_1; X_2^o; X_3^*) - k_1 u(X_1; X_2^o; X_3^o), \\
 f_{23}(X_1) &= u(X_1; X_2^*; X_3^*) - f_2(X_1) - u(X_1; X_2^o; X_3^*).
 \end{aligned}$$

Each of these functions was evaluated based on the DM's preferences. The described value modeling is a part of the Smart Forest Ecological Management System ForEco, which is based on Open Data and FIWARE (Lyubenova et al, 2015).

Potential users are forest and landscape policymakers in governmental and municipal institutions managing the following activities:

- Planning new forests in an environmentally friendly way with minimal negative influences;
- Guiding forest managers and planners to choose, if possible, suitable native species, to ensure the sustainability of the environment;
- Managing cost-effectively forest resources;
- Evaluating alternative strategies, provision of comparable forecasts, etc.

Other prospective end-users are companies and experts from the Green Economy, Agricultural and Forestry sector, as well as – research and innovation organizations.

The aim is to build a utility (value) based model that can be used for value-based modeling and management, even for value-based optimal control, taking into account the environmental, social, financial impact on the local population. For this purpose, a model developed by Hotelling is used (Hotelling, 1931; Clarke, 1983; Cairns, 2018; Di Vita, 2011). A logging model of forest areas of the following type is chosen.

$$\begin{aligned}
 \dot{y} &= -\min(z, v)r(y), \\
 \dot{z} &= \gamma w, \\
 y(0) &> 0, z(0) > 0, \\
 0 &\leq v, 0 \leq w, (v + w) \leq L(t).
 \end{aligned}$$

In the above formula, $y(t)$ refers to “extracted woods per hectare” [$\text{m}^3.\text{ha}^{-1}$]. This new meaning of X_1 is just a demonstration of the model. The variable (z) indicates the capital invested in the equipment and (v) is the labor as a workforce (one man – one shovel). Both dimensions are in standard units (for example, money in BGN, utils). The variable (w) indicates the portion of labor used in the production of the equipment. As an optimal control criterion, an integral is selected:

$$\int_0^T \exp(-\delta t)(\pi \min(z, v)r(y) - \alpha v - \beta w)dt.$$

This integral has the meaning of net income. With (T) is indicated a period of work, (π) is the price of the timber, (δ) is the devaluation factor over time, (α) and (β) are respectively the value of labor force and capital investments. Regardless of relatively simple description, determination of the optimal solution requires a special technique, namely non-smooth analysis and optimization (Clarke, 1983). The solution includes the following three steps (time intervals):

- first step – the solution is $(v, w) = (z, L(t) - z)$
- second step – the solution is $(v, w) = (z, 0)$
- third step – the solution is $(0, 0)$

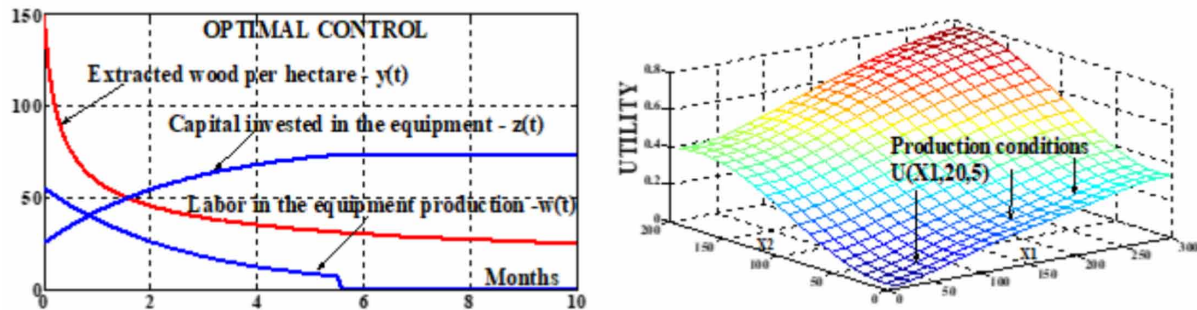
The first and third steps may be missing depending on the parameters and initial conditions. The modeling is performed with the parameters presented in Table 2: The function $r(t)$ is the utility function, or could be the derivative of the utility function in others models, depending on the semantic. The logging is carried out under conditions of 5% social effect (X_3) and the number of tree species/ species richness in the forest ($X_2=20$).

Table 2. Parameters of the model

Value	Quantity	Measuring; Meaning
$y(0)$	150	$\text{m}^3.\text{ha}^{-1}$
T	10	month
L	80000	BGN
α	30	BGN
β	20	BGN
δ	0.3	devaluation factor
$z(0)$	25000	BGN
γ	1.7	coefficient of technology efficiency
$r(t)$	-	utility function
X_3	5	%; social effect
X_2	20	number species per hectare

Figure 2 shows the optimal variations over time of the yield in cubic meters per hectare and the capital invested in equipment, as well as the change over time of the parameter w (labor employed in the production of the equipment).

Figure 2. Utility forest ecological modeling and control: A – optimal control solutions; B – Utility function



The calculation is demonstrative. It illustrates a mathematical description of the problem and takes into account complex social and economic effects with precision in logging management according to DM preferences. The function $r(t)$ could also be a derivative of a utility function, depending on the way that such a utility function is evaluated.

Value Modeling of Active and Passive Technology-Based Resources in Classroom Teaching

Control and management of an education process in schools is a complicated and tough task, even with the help of contemporary technology. There are developed different kinds of decision-support information systems that provide educators and teachers with tools that enable planning, implementing, and controlling the typical activities in teaching practice in terms of providing resources, creating curriculum, lesson planning, and related issues (Passey, Breiter, & Visscher, 2013). Kalay & Chen (2002) examined the effect on students of integrating a decision support system into a school and find a significant improvement in students' achievement. Here is presented a value-based model that concerns the optimal usage of active and passive technology-based resources in classroom teaching. The proper allocation of diverse types of learning resources and the use of various pedagogical methods are vital for the effective teaching process. The methodology enables mathematical modeling and management, even control and prescriptive decision support in such complex processes. The authors apply the evaluation of utility functions for representing the subjective preferences of teachers who have a long-standing practice of using ICT resources in classroom activities. For the current study, three technology-based teaching approaches are chosen because of their frequency of usage and usefulness. In the context of school education presentations, virtual laboratories and educational games are the most appreciated (Terzieva, Todorova, Kademova-Katzarova & Andreev, 2016). These tools sufficiently fulfill the requirements of the essential pedagogical methods – information, phenomenological and cooperative and enable combining passive and active teaching approaches:

- Passive – through a presentation (acquisition of information from e-textbooks, videos, animations);
- Active – through a virtual laboratory (experiment, phenomena observing, results' discussion);
- Active – through learning games (application of acquired knowledge and skills, acquisition of new knowledge through communication, cooperation and negotiation with other participants).

The research founds on the results of an online questionnaire that covers broad topics related to the implementation of ICT in teaching practice. Thus, it is enabled an extensive investigation of factors such as types of used teaching activities and technology-based resources, as well as their frequency of usage (Terzieva et al., 2016). The survey findings representing the opinion of 190 teachers from different regions in Bulgaria serves as input data for current research. Prevail respondents with more than 15 years of professional experience (54%) from primary and secondary schools. As a method for carrying out the survey, a questionnaire distributed through e-mail invitations was selected. They were targeted at teachers attending forums for innovative teaching methods based on ICT, so most answers are from teachers with good technology experience. Although in a sense it is a constraint, this fact contributes to comparatively accurate results, as the global trend in education is the widespread integration of technology. Therefore, the suggestions derived from technology well-skilled teachers for an optimal usage ratio of active and passive technology-based resources in classrooms are indicative of modern teaching process.

Initially, to design a quantitative utility model that describes the tackled problem, its structure consisting of the main objective, sub-objectives and relations between them have to be defined. For the current task, the main objective is to assess and analytically represent the usefulness of ICT-based teaching approaches. The sub-objectives are to detect the subjective preferences of teachers for the correlation of *passive* and *active teaching* approaches and ratio within active teaching (*educational games/virtual laboratories*). Further, in formulae, these approaches are considered as variables denoted as y , x_G and x_L respectively.

Having in mind the described model the multi-attribute utility function is determined as a function of three variables that represent the mentioned teaching approaches. This function is constructed in the frames of the von Neumann axiomatic approach of decision-making theory in conditions of uncertainty with the use of recurrent stochastic procedures for utility approximation (Keeney & Raiffa, 1999).

SOLUTIONS AND RECOMMENDATIONS

Optimal Usage of Active and Passive Technology-Based Teaching

The following section describes the implementation of organizational knowledge in the process of modeling of the educational system at a school level. In particular, it concerns the determining of the proper use of active and passive technology-based teaching approaches through evaluation and analysis of the subjective preferences of teachers.

The authors propose a solution to the issue through the multi-attribute utility function evaluated by decomposition into single variable functions, following the structure of the problem. The separate examination of the usefulness of each teaching method, need the teachers' preferences to be explicitly presented as three single-attribute utility functions $f(\cdot)$, respectively for *presentations* $f_3(y)$, *educational games* $f_1(x_G)$ and *virtual laboratories* $f_2(x_L)$. They are constructed by an implementation of the above-described mathematical approach. These functions represent the usage of passive and active ICT resources in knowledge delivery and classroom training. The measuring unit for the three variables of the

functions is hours. The decomposition is based on the expressed utility independence in the frame of the multi-attribute utility theory. The considered sets $X_G=[0-40]$ h, $X_L=[0-40]$ h, and $Y=[0-40]$ h represent scales related to the above sub-objectives. The authors assume that the school week has a total of 40 hours and the teaching is conducted only through the researched approaches. The mentioned above “lotteries” are discrete finite probability distributions over Cartesian product $X_G \times X_L \times Y$. It is assumed that $z_1 = (x_{G1}, x_{L1}, y_1)$, $z_2 = (x_{G2}, x_{L2}, y_2)$ and $z = (x_G, x_L, y)$. Then a lottery used in the process of evaluation is denoted as $\langle z_1, z_2, \alpha \rangle$, where α is the probability of appearance of the alternative z_1 and $(1 - \alpha)$ is the probability of the alternative z_2 . The approach used for evaluation is described in (Keeney & Raiffa, 1999; Pavlov, 2005):

$$z \approx \langle z_G, z_L, \alpha \rangle, \quad z_G, z_L, z \in X_G \times X_L \times Y, \alpha \in [0, 1].$$

A profound investigation of the problem under consideration implies utility independence among the following factors, determined by decision-makers:

- $X = X_G \times X_L$ from Y and vice versa,
- X_G from X_L and vice versa.

The DM assumes the factors X and Y as mutually utility independent, so the multi-attribute utility function is theoretically presented as follows (Keeney & Raiffa, 1999).

$$U_{12}(x_G, x_L) = k_1 f_1(x_G) + k_2 f_2(x_L) + k_{12} f_1(x_G) f_2(x_L),$$

$$U_{123}(x_G, x_L, y) = b_1 f_3(y) + b_2 U_{12}(x_G, x_L) + b_{12} U_{12}(x_G, x_L) f_3(y)$$

Here $k_1, k_2, k_{12}, b_1, b_2$, and b_{12} are constants whereas $f_1(\cdot), f_2(\cdot), f_3(\cdot)$ are above-mentioned single-attribute functions. These constants and utility functions are evaluated by stochastic approximation procedures of the potential function method in the frames of the discussed above evaluation approach (Keeney & Raiffa, 1999; Pavlov, 2005). For example, the evaluation of $f_1(x_G)$ consists of the following steps:

- DM compares the “lottery” $\langle x, y, \alpha \rangle$ with the simple alternative z , where the variables $x, y, z \in X_G$, $\alpha \in [0, 1]$, x_L and y are fixed at chosen values;
- A „learning point” (training example) $((x, y, z, \alpha), f(x, y, z, \alpha))$ is determined;
- A training sequence of a finite number of “learning points” (training examples) is used in recurrent stochastic procedures for utility polynomial approximation;
- The same steps are used for preference-based utility evaluation of the functions $f_2(\cdot), f_3(\cdot)$ and the appropriate coefficients and by fixing the rest part of variables at chosen values.

Figure 1 shows the constructed single-attribute utility functions that imply the following considerations. Figure 1A presents the utility function of the passive teaching method. When insufficient, it is practically zero. At least 10 hours a week of passive teaching are required to achieve a utility of about 50%. The optimal number of hours spent on this teaching approach is within 15 to 24 (a utility of over 80%). When passive teaching exceeds 30 hours, the utility function drops, but even in using this approach all the time, the utility does not fall below 30%.

Figure 1B shows the utility function of the active learning method through learning games. The optimal use of this approach is between 8 and 16 hours: the utility in this range is over 80%. The utility curve increases steeply at the beginning, which means that even with relatively little use of learning games, a positive effect in learning can be achieved. Usage of a game-based approach over 20 hours per week is not beneficial and not advised.

The utility curve of using a virtual laboratory has a very different shape (Figure 1C). Remarkably, even with very little use of such an instrument, the utility is very high – from 50% upwards. The maximum is between 6 and 20 hours (over 80%), then the utility decreases and the usage of over 30 hours is not efficient for the learning process.

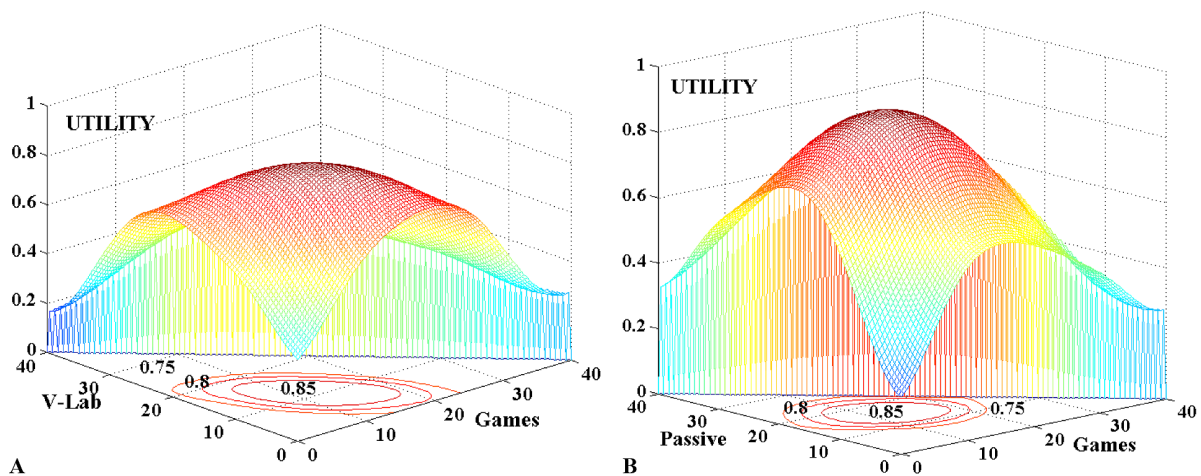
For the three teaching methods, the curves have rounded maxima. It means that there are wide intervals where changes in the use of these methods do not significantly affect their effectiveness. Thus, the teacher can use various combinations of different learning methods and tools within the framework of a specific situation.

The utility functions and the evaluated coefficients obtained for each of the teaching methods examined, allow constructing surfaces that represent their mutual effect in a general multi-attribute utility function. As the authors assume a school week of 40 hours, the variables associated with the applied teaching approach are related by the formula:

$$z_G + z_L + z = 40, \quad z_G, z_L, z \in X_G \times X_L \times Y.$$

Figure 3 shows this correlation between the parameters as a graphical surface of the aggregated multi-attribute utility. Figure 3A presents the utility function of the two active methods considered – educational games and virtual laboratory when the variable of passive teaching is determined as $z = 40 - z_G - z_L$. Figure 3B depicts the utility function for the mutual effect of the active teaching method through educational games and the passive one as $z_L = 40 - z_G - z$. Similar is the surface of the multi-attribute utility function for the mutual effect of the active teaching method through virtual laboratory and the passive one, so it is not presented.

Figure 3. Multi-attribute utility functions representing the mutual effect of: A – active teaching through educational games and virtual laboratory ($z = 40 - z_G - z_L$); B – active teaching through learning games and passive approach ($z_L = 40 - z_G - z$)



Since the accurate reading on the vertical axis is hard in three-dimensional graphics, the projection of the utility function's isohypses (height contours) is used. The perspectives of these graphics are chosen in such a way that these projections are well visible and readable. The desired percentage of the utility function can be selected. Thus the boundaries of an area where can be found possible suboptimal solutions for an effective teaching-learning process by combining different teaching approaches are determined. Teachers can decide in each particular circumstance according to many factors (e.g., school stage, learning subjects, administrative requirements, and students' knowledge) what percentage of the utility function to choose for achieving educational goals. For example, Figure 3 illustrates 75%, 80% and 85% utility that forms a satisfactory area for application of considered pedagogical approaches.

These graphics indicate clearly that even minimal use of a virtual laboratory in teaching has a positive effect, while excessive usage is not relevant. In educational games, both extremes are not recommendable. The passive learning method requires at least about 10 hours a week to have some effect, and its excessive use is not optimal but still reasonable.

The users that can benefit from considered preference-based utility approach are school, administrative and other education-related policymakers that are responsible for ensuring an efficient and contemporary teaching process. The aim is to build a utility (value) based model of teaching that can be used for management and value-based optimal control, taking into account the innovative teaching approaches and their educational and psychological impact on students. In a school context, this model can be a part of an information system that supports the management of the following tasks:

- Evaluating the usefulness of teaching approaches and various teaching resources;
- Guiding and supporting the teachers to choose and blend different teaching approaches and resources for their implementation;
- Supporting decision making based on teachers' preferences to ensure the effectiveness of the teaching process;
- Planning the lessons in a sub-optimal, learner-focused manner with minimal negative influences;
- Managing the efficient achievement of educational objects.

FUTURE RESEARCH DIRECTIONS

There is no doubt that ICT will become increasingly important in education as in all areas of society. It is also indisputable that everything has both a positive and negative impact. Hence, in the decision-making process it is essential to take into account the opinion, experience, and recommendations of experts and those who use in practice new technology resources considering as follows:

- what is particularly useful and should be further developed
- what should be improved
- what is a flaw
- what is inappropriate and has to be discarded

To this end, surveys are being conducted, raising arguments in support of research into the following issues: the usability of ICT products, their degree of usefulness and their application in different contexts of the teaching-learning process. A further concept is to develop an appropriate methodology for using the data from surveys, thus to perform research on the usefulness and benefits of each technology tool

or resource based on the aggregated opinion of many experts, not just of individual expert's knowledge and intuition. The described value-based approach is particularly appropriate for profound investigations of mentioned issues.

The presented methodology and value-driven modeling create an environment that enables optimization by offering a general objective function. The model takes as input the essential attributes of the designed system and gives as outputs a score. Such value or utility functions reflect human knowledge and intuition expressed as preferences within the framework of the system and objective. The human's thinking, notions and preferences have cardinal significance, but the value-based decision and control require quantitative information. The machine learning in mathematical meaning also needs analytical presentations. These are two contradiction issues with their particular requirements. This preference informational level imposes the need for new approaches and algorithms for the inclusion of value-driven management and control in the decision-making process in a harmonious way. The well-grounded and precise mathematical approach to this problem requires the usage of achievements of the measurement theory (scaling), utility theory, decision-making theory (normative and prescriptive approaches), probability and statistics and some results from optimal control theory (Pavlov & Marinov, 2017).

CONCLUSION

A possible solution for value-utility preference-based evaluation and representation is the stochastic approximation used in an environment of a gambling approach to express the human's knowledge as preferences. In that manner, the incomplete information for mathematical modeling and decision making in complex systems is compensated with the measurement of qualitative human preferences. The discussed two models are examples of such modeling of complex processes.

The first value-based model for integrated assessment of economic, ecological and social services of forest ecosystems is a mathematical model of the kind "human-dynamical production" taking into account the complex social and economic characteristics of the timber production process. This model allows optimal control determined in line with the DM's preferences regarding the three factors, logging, social effect and salary and ecology on the forest.

The second value-based model concerns the profound exploration of the use of technology-supported resources that enable efficient teaching process. The implemented mathematical procedure determines the utility functions of considered passive and active teaching approaches. It takes into account the usefulness of employed resources and their frequency of usage in teaching context by recognizing teachers' opinions expressed in an online survey. In practice, the obtained utility functions serve for reasoned suggestions about efficient integration of technology-enhanced teaching approaches. Additionally, these functions allow educators to construct multiple instances of different optimal combinations of technology-supported active and passive resources according to their preferences and specific learning objectives. The applied mathematical approach is flexible and can meet the requirements and particularity of each school subject.

The purpose of this chapter is to demonstrate that the proposed specific mathematical utility approach makes systems engineering value-based strategy practically feasible under different specifications. It is also applicable in different countries depending on the particular parameters of particular tasks and decision maker's preferences represented by the polynomial of the utility function.

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KEY TERMS AND DEFINITIONS

Active Teaching Resource: A resource used in active teaching approach – both the teacher and learner actively participates in the process of knowledge acquiring (e.g., discussion, laboratory experiment, simulation, group project, educational game).

Complexity: A condition of a system or situation integrated with some degree of order but with too many elements and relationships to be understood in a simple analytic or logical way. In the extreme, the complex system or situation is with multiple and diverse connections with dynamic and interdependent relationships, events, and processes.

Machine Learning: A computational methodology for automatic information collection and knowledge descriptions aimed at improving solutions of tasks from real practice and experience.

Model-Driven Decision-Making and Control: An emphasized access to and manipulation of a statistical, financial, optimization, or simulation model. It uses data and parameters provided by users to assist decision process in analyzing a situation.

Passive Teaching Resource: A resource used in passive teaching approach – teacher presents learning matter, the learner only passively receives knowledge (e.g., narrative, presentation, lecture, demonstration, text).

Util: A microeconomics' standard unit of measurement of the utility.

Utility Independence: An attribute A1 is utility-independent of attribute A2, if conditional preferences on lotteries on A1, given at a fixed value of A2, do not depend on that fixed point. The utility independence is not symmetrical.

Utility Theory: A normative approach to the issue of how people should rationally choose in conditions of uncertainty.

Value-Driven Design: A system engineering strategy, which enables multidisciplinary design optimization. It creates an environment for optimization by providing designers with a value function as objective or as part of the mathematical model.

A Nemetic Model for Transmedia Organizational Literacy

2

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INTRODUCTION

The exponential proliferation of information in digital society, and the increasing complexity of processes and interactions in a hybrid world where humans and machines collaborate on an equal footing has resulted in an explosion in the number of “wicked problems (Churchman, 1967)” humanity is faced with.

The increasing diversification of interconnected media platforms, which provide a complementary complex discourse, demands an effective use of the space that is now called “transmedia.” This article provides terms and definitions for transmedia and for the new set of personal skills and abilities required to participate in it, “transliteracy.” It also presents the nemetic system, which facilitates analyzing, tracking and visualizing communication interactions in virtual transmedia environments.

Since humans started to use both gestural and oral codes to communicate, messages have been elaborated and expressed differently when different communication channels were in use. In recent times, with the dawn of radio and television, that fragmentation of content has become of interest to researchers (Steinberg, 2012) and has been identified as a characteristic of mass media (McLuhan, 1994).

With social media, content is fragmented across multiple virtual and physical platforms, with varying degrees of interaction that add complexity to social communication. Interactivity among multiple authors and multiple audiences generates dynamic “cross-media” seriality or “transmedia narrative” that has been studied from educational, entertainment and sociological points of view (Dena, 2009).

Learning to use these media requires skills beyond the traditional listening and reading, to be able to integrate multiple messages in multiple codes, as an essential skill both for personal and professional communication. This transliteracy is a complex ability of intertextual navigation, the strategy for coding and decoding the multi-discourse in the digital ecosystem.

These recursive communication experiences are the subject of recent research that explores cognitive patterns in narrative that can be represented through geometric models, consolidating the use of the term “fractal narrative” in the transmedia context (Duarte, 2014). The aim of this multilevel analysis is to take into account individual discourse (micro level), collective interaction (meso level) and community knowledge building (macro level).

Because so much of personal and professional life is becoming ever more dematerialized, it should not be surprising to learn that organizations can now be defined and understood through the way that

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these flows are expressed and regulated. Nematics offers a simplified sequence and code to express and visualize these interactive communication processes in the transmedia ecosystem to facilitate organizational development (De, 2014).

BASIC CONCEPTS

Transmedia

In an era where artificial intelligence (AI) is driving interactions between humans and machines, the concept of transmedia has evolved from its origins as an extension of media story telling across platforms into a dynamic ecosystem for organizational transformation.

The term “transmedia” is attributed to Marsha Kinder, who in 1991 used it to refer to an emerging entertainment supersystem, involving intertextuality and multiple sources with different levels of interaction (Kinder, 1991). It applied to tools, processes and concepts, and opened the door to media that had not been invented then, such as wearables, implants, or augmented reality devices.

In 2003 Henry Jenkins described a process of “transmedia storytelling” in which “each medium does what it does best, so that a story might be introduced in a film, expanded through television, novels, and comics, and its world might be explored and experienced through game play” (Jenkins, 2003). Later, he defined transmedia storytelling as a process “where integral elements of a fiction get dispersed systematically across multiple delivery channels for the purpose of creating a unified and coordinated entertainment experience” (Jenkins, 2007).

This notion of multiplatform narrative has expanded to encompass every type of human communication, including marketing (Tenderich, 2014), political debates (Costanza-Chock, 2014), or personal learning networks (Richardson & Mancabelli, 2011). Transmedia expands human relationships in virtual spaces, and is starting to enhance communications capabilities through hybrid human-machine interactions.

Hybrid Communication

At the time of this writing, AI technologies such as machine learning, natural language processing, image recognition, and their various applications are pulling transmedia practice into the world, not only of human-machine interaction, but of active human-machine collaboration. Until recently, human-machine interaction has primarily referred to software interfaces. The evolving digital landscape is now producing situations where non-human agents take a role as collaborators in a group or community, creating hybrid communication and collaboration between human and non-human agents (Lorenzo Galés & Gallon, 2018). Transmedia systems are mediated by “intelligent” non-human agents (e.g. personal assistants such as Amazon Echo, Apple Siri, or Google Home); customer experiences are being managed by AI-driven chatbots; human resource managers, medical practitioners, and law enforcement agencies are all interacting with, and depending on, various types of “intelligent” transmedia devices not only for information, but for decision-making.

But these types of interaction are just the beginning. Emerging technologies are adding to the complexity of our informational environment. They are allowing humans to expand their sensorial perception, and forcing organizations to rethink their structures and processes.

A technology like blockchain, which is invisible to the user, none-the-less engenders an upstream reflection about who is trustworthy, and the nature of trust in the context of a given information set that

is revolutionizing the world of e-commerce, electronic contracts, diplomacy, and all types of sensitive transactions.

The artist Aiste Noreikaite has built a helmet that converts brain wave signals into musical sounds that correspond to the user's different brain states (Chung, 2015). This is a new type of interface that provides humans with extra-sensorial information that breaks down the traditional idea of five senses (sight, sound, smell, taste, touch) and recognizes a continuum that still needs to be identified, categorized, and interpreted by human culture. This enhanced, hybrid interaction promises new typologies of messages which, combined with AI, can create new opportunities for feeling, thinking, and doing – individually and collectively.

Transliteracy

The evolution from media to transmedia requires individuals to pass from personal, linear communication skills and abilities (reading, writing, speaking, etc.) to intertextual skills. They include not only analogy, correlation, mental association, context awareness, or synthesis, but also empathy, engagement, and other emotional appreciations, essential to integrate and combine fragments of meaning into the holistic comprehension of a story, concept, or collaborative activity.

The combination of these complex abilities can be understood as a new competency called transliteracy. Transliteracy has been defined as “the ability to read, write and interact across a range of platforms, tools and media from signing and orality through handwriting, print, TV, radio and film, to digital social networks” (Thomas, 2005, Thomas et al. 2007).

In transliteracy, a coherent discourse is perceived through a series of transmedia fragments. It requires participants to move from discrete, perceptive skills to compound, intangible projective skills that can facilitate strategic thinking and collective problem solving. Interactions such as debating, negotiating, conciliating, or collaborating on social platforms are high value-added skills and become the energy for emerging collective creativity.

In an era of growing complexity, the capacity to construct holistically across a series of fragments is becoming an essential competence for leadership in organizations. Transmedia literacy skills are acquired by communication and interaction across different informational ecosystems. Their development requires participation and engagement in different social media, connected to relational capabilities and social abilities. The ultimate aim of this interaction is to collaborate actively in conversations, events, and shared projects in virtual spaces. While transliteracy can be seen as a human adaptation to new communicative environments, it also implies self-management, interpersonal behavior, and social self-regulatory abilities.

In organizations and institutions, emotional intelligence in leadership has become an essential executive strategy for building trust and increasing the ability to convince and engage others in direct action.

The Nematic path (Notice, Engage, Mull, Exchange) recalls the traditional empirical research method, starting with individual observation and progressing toward collective conceptualization, but it also leads directly to action, through sharing ideas, building common meanings, creating mutual understanding, and envisioning collaborative projects.

This proactive nematic design correlates with several emerging design-thinking processes for organizational action, such as Design for Change, an international program based on four steps (Feel, Imagine, Do, Share) to promote and evaluate social participation among students and young citizens (Bapna et al. 2015). Executive leaders can form and join transmedia networks where they work together to design and execute real-world projects through international collaboration.

Both transmedia and transliteracy are changing the way we perceive learning and professional training at all levels, and how we organize professional environments. Hybrid communication skills are now necessary to understand and produce useful knowledge (Lorenzo Galés & Gallon, 2018) and are more and more related to the abilities to create, join and maintain communities of interest, and build personal digital networks (Rajagopal, 2012).

From an individual point of view, users learn multiple literacies by actively harnessing different competences in relationship with each other. From a collective point of view, organizations identify and empower the use of those transliteracies that help the organization to build internal cohesion and integration, and to develop more proaction and openness to the rest of the community and the world. This tends to coincide with the global competencies cited by the Organization for Economic Cooperation and Development (OECD) as essential for the 21st century (OECD, 2017).

Nemetics

Where transmedia is the framework for communication, and transliteracy is the skill for interaction, Nemetics is the analytic tool. Nemetics functions as a fractal meta-language that facilitates communication among researchers in different disciplines to debate about complexity. It is based on strategical models, and is independent of specific content.

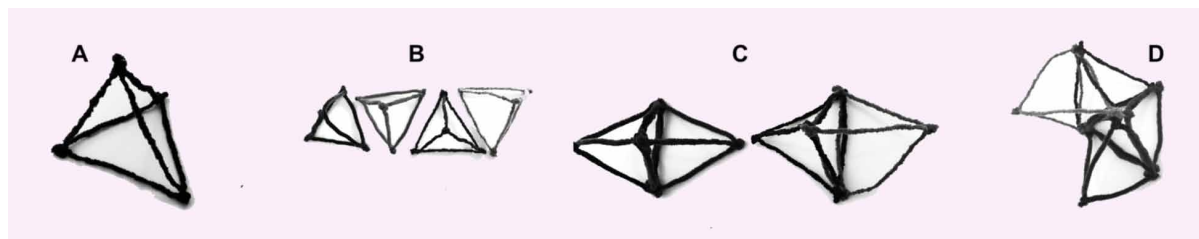
The essentials of Nemetics can be summarized in a simple mnemonic acrostic, which describes learning in any context at any level. At its most effective it is:

- Notice without preconceptions (N).
- Engage without judgment (E).
- Mull before communicating or acting (M).
- Exchange in the appropriate way and time (E)

This basic path (Notice. Engage. Mull. Exchange), recalling the traditional Bloom taxonomy (Anderson et al. 2001), retrieves four action levels that may or may not be performed during interactions (after each verb, add the option, “or not”). With this simple structure, nemetics provides identified sequences, quantifiable interactions, and visualization of results that can be expressed with simple drawings and objects. The whole process is then conceptualized as a single identified process, a NEME that can be seen as a coherent unit, represented visually by the interactions that took place during the debate, as in Figure 1A.

Figure 1. Simple visualization of the fractal nature of nematic sequences

Source: Michael Josefowicz



These basic communicational units are self-similar and can be fractally combined and recombined in a variety of ways to visualize complex exchanges. Figure 1B shows four discrete nemes, but these exchanges can also be connected with larger discussions, and so can be integrated into more complex sets of multi-party exchanges (Figure 1C). The two larger nemes thus produced can also be integrated into a more complex network exchanges (Figure 1D) and this can continue to as high a level of complexity as necessary to define a complex series of patterns and waves of exchange. This model offers extremely rich information (big data) both about the media environment and the participants.

A neme can thus be defined as a bounded network of networks that, at the same time, is the channel and the product of energy transmission. In a nemetic sociogram, conversations would be seen as a result of peoples' interactions, and as a node integrated into a larger network in an expanding conceptual territory. It is both a conversation and a (holistic) topic.

At the individual level, a neme translates as a meta-cognitive routine, the smallest representation of a signal passing from any node to any node in any network in one step. At collective levels, the study of neme patterns can be useful for showing mental models that can serve as universals in further communicative analysis, and in designing debate strategies.

Taken as a unit, a neme routine - that concludes with consensual knowledge - can be the starting point from which new debates can arise. This recursivity had already been studied in The Knowledge Forum, another international Computer Mediated Communication experience (Bereiter & Scardamalia, 2006), and has long been identified as a path into high order thinking (HOT) processes (Rehage, 1994). It is now also applicable to the study of machine learning algorithms, and the AI ecosystem created by their accumulation and interactions. This field is to be developed not only by computer scientists, but by users who are aware of their interactive processes, their learning needs, and their organizational potential.

From routine building to big data analysis, nemetics includes the dimension of self-reflection, professional development, and organizational transformation. The obtained global vision contributes to leadership and resource management, focused on integrated learning - self and collective - and helps expand consciousness and engagement towards complex problem solving.

Nemetics helps express a new way of thinking about human communication that involves co-creation in complex adaptive/creative environments. Nemetic research itself evolves by reproducing experiences of transliteracy in a large variety of transmedia and multi-contextual spaces:

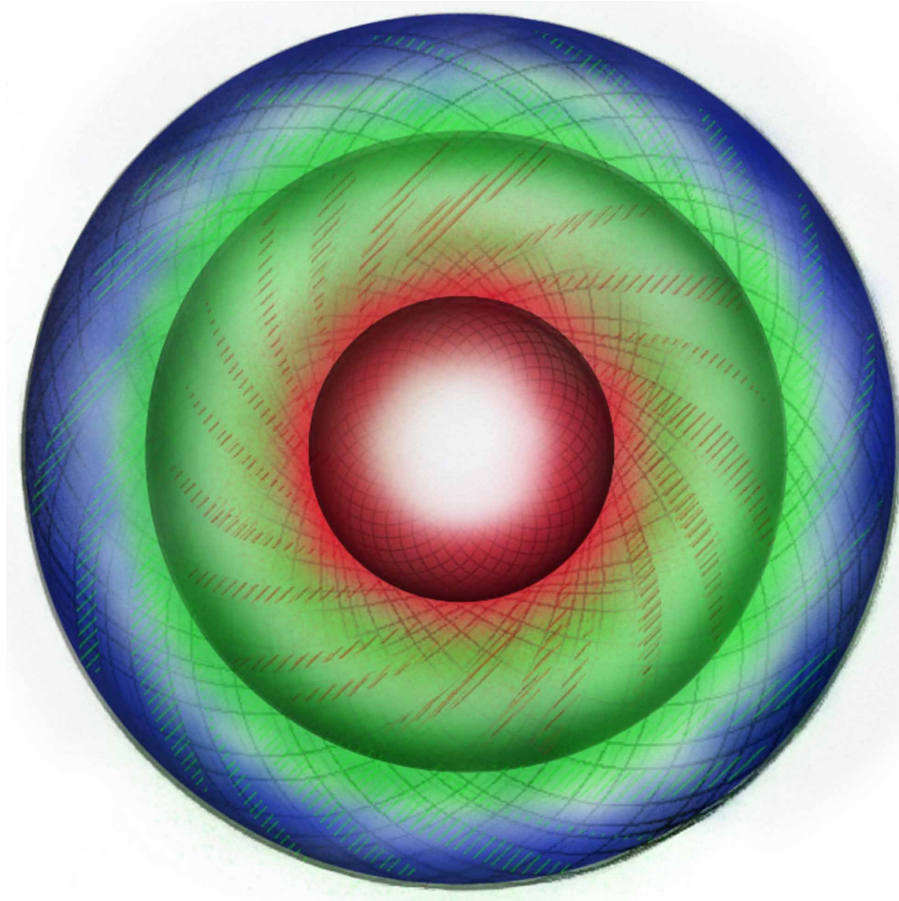
Care is taken not to define the discipline or its boundaries very rigidly. This is because once it is rigidly defined it also rigidly limits the development of the subject, its evolution and expanse it might cover. In short, any rigid definition would limit the discipline's adaptability to future changes in human conceptual understanding and knowledge or application in a different domain than what is envisaged right now" (De, 2012).

Used as the meta-language for recursive analysis, nemetics shows interactive thinking processes, collaborative debates and a collective cognitive resonance, through debate, discussion, negotiation, and compromise. It has allowed networks to research and exchange about innovation, education, history, political economy, design, or art across the fields of different disciplines, specialties and cultures.

This nemetical world is hierarchical, in the sense commonly used in complexity discourse, and it is composed of several nested spheres that represent different levels of interaction. Each sphere nested within a larger sphere is a larger or smaller nemetic structure. It is fractal in the sense that such networks are scaled and context independent. At every level they are self-similar to the levels closer to the center of the sphere and further away from the center of the sphere. Any sphere can be seen as a NEME, where

Figure 2. Spheres of nested complexity

Source: Daniel Durant, used by permission



the proximate inner sphere is the source of energy. The proximate outer sphere is the source of constraints [Figure 2]. In addition, there are flows of energy within and between spheres.

This nematic code can be used as a common language to shape complexity, and the fuzziness of the code is the source of its strength. Applied to organizations, nemes become unit plans for specific projects, and also a macro view of how the projects interact to create the global organizational program. It is also possible to extend this to a wider macro view, at regional or national level, to take into account, for example, institutional initiatives to slow down climate change, and marketing procedures in private enterprises. By quantifying these two initiatives in the same territory, we add relevant social information to the pool of big data. Analysis of their parallel evolution would allow community leaders to discover common goals and possible partnerships.

NEMETICS RESEARCH: USING TRANSMEDIA IN ORGANIZATIONAL DEVELOPMENT

Theoretical Context

The multilayer nemetics system provides a methodology for connectivist action-research and action-reflection in transmedia, including several meta-codes for visualizing procedures and results. In transmedia, users are producers, and the process is the product. It can be seen as flows of data and information through multiple channels. Nemetics provides a sequenced approach for organizations to articulate the structure and mechanisms of those flows:

- Identifying, explaining, and interpreting interactions in various media, to analyze their evolution (notice).
- Promoting organizational learning by exploring new communication spaces, to improve teamwork and community building (engage).
- Reflecting on the different transliteracies needed to apply the nemetic model effectively in different situations, and the results that follow from implementations (mull).
- Creating local and global actions to benefit from the strategies developed, and follow through with other people and organizations implicated in the process (exchange).

In addition to being an acronym for Notice, Engage, Mull, and Exchange a neme is defined as a basic communicative unit, analogous to a neuron in biology. Data is transformed to information in one neme. The information is passed along to another neme which creates richer information. Bundles of interlocked nemes, like bundles of neurons, form networks of nemes, and then networks of networks.

The name “neme” was chosen to sound like gene and meme. The gene is the basic unit of biological reproduction. Richard Dawkins (1989) conceived of the meme as a replicator in the cultural and cognitive context. The neme is a replicator in the context of complex creative systems (Nieto-Gomez, 2016) that are organically evolving, transforming, and reshaping themselves, reproducing the recursive evolution of conversations, debates and concept creation.

An organization is a complex creative system that can be represented as the flow of data which transforms into information. It is this flow of information, not the organization chart, that defines the way an organization works. Now we live in a new world of torrents of data as a result of the Internet of Things (IoT). In fact, information often changes in the time it takes to verify it. As a result, many of our traditional organizational structures are breaking, especially those based on hierarchies. Yaneer Bar-Yam, President and Professor at the New England Complex Systems Institute, has noted,

A group of individuals whose collective behavior is controlled by a single individual cannot behave in a more complex way than the individual who is exercising the control (Bar-Yam, 2002).

This is why traditional command and control organizational structures are failing. The top-down model cannot cope with the level of complexity of the society around us. Nemetics aims to help organizational leaders in the following ways (Gallon, 2015a, slide 13):

- Provide a Leadership decision framework to resolve ‘wicked problems’ and improve performance.

- Act as a discovery tool to make sense of reality and view it in terms of interactions & emergence to help us strategize.
- Be a design tool to improve any particular situation in life. It might be personal, organizational or technical.
- Act as an enabler to observe one's own thinking process enabling possible change in individual and collective consciousness.

The distributed, self-organizing management systems that have been evolving over the last years correspond closely with the fragmented representation found in transmedia structures. Just as material emerges on different platforms and in different media according to the needs of the content and activities represented in transmedia objects, leadership roles and team configurations emerge in times and places according to the needs of the moment in an organizational structure. Nematics provides an ontology that allows us to make the distinctions necessary to organize highly fragmented big data into useful information, and follow the emergences of different self-organizing teams, tasks, and needs. Under this paradigm, a set of fractal analogies can be derived for studying organizational co-creation and collective resonance. Organizations need to become more consciously proactive in developing distributed leadership as the only way to cope with, and manage, complexity. Nematic thinking can help make the kinds of transitions needed, for example, to move hiring practices away from seeking profiles suitable for a given task, toward finding a mix of profiles that bring a variety of competencies and personalities together in a way that will foster teamwork and allow leadership to emerge as naturally as possible. Teamwork built around diversity requires more debate and discussion than ever, and neme sequences are vital in both planning and analyzing exchanges so that they can be as efficient and productive as possible.

Emerging experiences can be identified by studying interaction sequences, exchange paths, and conversational structure in augmented communication situations. Nematic research is the result of users from different fields and communities creating a common code for exchanging explicit information, implicit organizational knowledge, and meta-analysis for common research. Nematic strategies have been used in Barcelona (Catalonia) to explain social media dynamic flow to educators (Lorenzo, 2015, slides 22-23), in Cracow (Poland) to propose solutions for solving some of the wicked problems technical communicators have to face (Gallon, 2015a, 2015b) and in the New Delhi Area (India) for engineering training courses on vibration analysis and condition based maintenance (De, 2017, slides 9-12). From theoretical development to practical application, nematics evolves inside transmedia ecosystems as much as it is used to analyze them.

Case Study

The creation of the International Nematics Institute is itself an interesting example of a nematic process that was the result of collaborative interaction in the transmedia sphere with proactive intentions. A full discussion can be found in (Josefowicz, Gallon, & Lorenzo Galés, 2018).

A more recent example is the case of the Printernet organization. At the time of this writing, Printernet has existed 14 months. It is an informal global network of social enterprises. Using only Facebook, Twitter, and shared Google applications, this network has developed nodes in five African villages: two in Uganda, one in Malawi, one in Burundi, and one in Nigeria. Each is now earning some money on the way to sustainable self-sufficiency. The path to self-funding is publishing a magazine to be printed and distributed in each country, earning its income by selling advertising and attracting sponsors.

The project is using a nemetic strategy that involves moving information from bounded networks in North America and Europe to bounded networks in each village. Money is both energy and information in the sense that it clearly communicates that something can be done. The monetary exchanges used to launch the Printernet also serve to build the trust necessary for smooth information flow.

Nemetic Inward Transformation

The genesis of the Printernet in Africa came by “synchronicity” – the happy confluence of synchronicity and serendipity (Robertson, 2011). A chance encounter on Facebook between Michael Josefowicz (one of the authors of this article) and Jonas Fedweck, who organizes a volunteer group in Malawi, initiated the process. During the ensuing conversation Jonas did not ask for money, he asked for help building his social network.

After a week of conversation Jonas told Michael he planned to do a celebration for his volunteers who had been together for nine years. Michael then started a Facebook fundraiser to raise \$150 for t-shirts for the celebration. Joseph posted a picture of the volunteers wearing the t-shirts with a story of the positive affect on his group of volunteers (Notice phase). That process created the beginnings of a trust-based relationship. Jonas trusted Michael to follow through on caring. Michael began trusting Joseph when he saw the pictures to demonstrate the money had been used as it was said it was going to be used.

Continuing the conversation Michael suggested doing a poster to be distributed in the village to encourage people with AIDS to call people in the village who can help them to live a good life (Engage phase). Joseph and Michael collaborated on a design brief. After the design brief was complete, Michael used Twitter to connect with people in the printing community who gather under the #printchat hashtag. “Does anyone know a designer who would like to design a poster to do some good?” with a link to the design brief (Mull phase).

Within a couple of hours, a designer in Portugal tweeted back “I would love to do this project.” Two days after that a tweet with a link to a Google doc was sent. After discussion and review by the concerned parties, the PDF was emailed to Jonas. In three days, it was printed in Malawi and distributed to the village. They received 22 phone calls. Jonas posted a photo of the poster in the village (Exchange phase). Trust increased.

These processes increase trust with every iteration, and involve new people from other countries thanks to social networks. The demonstrated accomplishments encourage other participants to join the network.

Nemetic Outward Transformation

This same approach was used in what can be said to be the lead example, Uganda, where Joseph Atwongerie started a “Printernet Cafe” in 2018.

A Printernet group existed in New York, interested in finding alternative, less costly and more responsive ways to produce printed books and periodicals in the digital era. Joseph, in Uganda, connected with Michael in New York via Facebook, looking for support for his village tree-planting initiative:

1. The bounded network that is Printernet New York awarded a startup grant to trusted actors in the villages. It was used for WIFI infrastructure, 2 computers, an Internet connected TV and a desktop printer. Once in place it was called a Printernet Cafe. Naming the facility created a boundary around the networks composed of the people who used it. It became possible to say that a person was within that boundary or outside that boundary.

2. The Printernet Café starts earning a profit, selling computer time for 25 cents an hour. In June of 2018 it offers three-week computer skills classes for \$19. Following the principle of money as energy and information, it takes diverse small sums from around the village and transforms it by concentrating it. Once concentrated, it is redeployed to support tree planting, computer skills training, and micro loans to village people. This process is now extended to the other participating villages in Africa.
3. Throughout the growth period, Printernet New York provides daily consulting service via Facebook. The consulting approach was to break information into chunks (sometimes referred to as “molecular information” or “microcontent”). The chunks are communicated in just the right form at just the right time. All the decisions on the ground are made by the villagers. The motto of the consulting is “We advise, you decide.”
4. Printernet partners become paid reporters. They communicate information in the form of words and pictures on a regular schedule. The content is accumulated on a website. Stories from villages in Africa written by villagers in Africa are a unique value proposition for a magazine to be published from New York. The magazine will earn money by selling advertising. The profits earned will be distributed back to the villages.

Results Analysis

Both cases provide examples of nematic organizational sequences that not only function to demonstrate how information is activated but how the nematic sequence can be used for planning.

In one year, the Uganda Printernet cafe has a steady profit of \$500 a month after salaries and rent. It has seven computers and its income has been stable for 6 months. Sixty percent of the profit is used to support a program of planting the next 730,000 trees towards a goal of 1,000,000 fruit trees planted in the village. Thirty percent of the profit is used to give micro loans to villagers.

The Malawi group is transforming energy by pulling together volunteer labor. They have been transforming information resident in the volunteers to create more energy. The first intervention of the t-shirts gave them a sense of belonging to a team, not just a group. As the boundary became clearer, the energy within the boundary was augmented in the form of team spirit and the pride of being on the team.

Similarly, the Uganda group is a bounded network of volunteers who were organized to work to plant trees before Printernet became involved. Once the Printernet Café was in place, the boundary became more clearly defined. People used the cafe or did not. The cafe offers the immediate value of computers and internet access.

The term “boundary” or “bounded network” should not be seen as exclusionary. The boundary serves to identify a defined network, which members can join or leave freely. Their joining or leaving is largely defined by their participation in the various exchanges that take place inside and between networks.

The various Printernet partners also exchange amongst themselves, creating a network of bounded networks, in which best practices and problems can be explored. The global process produces a self-sustaining positive feedback loop that will grow organically.

Current Hypothesis

The Printernet case shows us how leveraging a small amount of energy (in the form of money) and information within a series of bounded transmedia networks can trigger a process of self-organization and organic growth. The project calls upon a multiplicity of platforms (Facebook, Twitter, Google apps)

and media (social networks, real-time and time-shifted messaging, printing, telephone, t-shirts) in an organic way. This is to say, the intention was not to use transmedia or to develop transliteracy skills, but rather to organize groups in the service of capacity building in poor countries, and social justice in rich countries. Doing this required a transmedia approach.

The same nemetic mindset and process can be applied to any organization, from businesses to government to education, social organisms, associations, and beyond. Each organization has its own aggregate of bounded networks. In the customer (or user) facing bounded networks members have the power to make fast decisions based on immediate context and conditions. The overwhelming majority of problems can be solved within the customer facing group. In addition to solving problems quickly, they can be solved while they are still small. It simply requires a maximum of decision-making power to be at the level of customer service work groups.

By extension, each level of management has the same power to solve problems at their level. Using the power of transmedia they can build a space where they act as internal consultants - give advice, be sensitive to risk, discuss the best ways to mitigate risk. All while having enough time in the day to:

- Notice the situation
- Engage (only) when necessary
- Mull the granular details of the situation at hand
- Exchange in the form of doing just the right thing at just the right time in just the right form.

FUTURE RESEARCH DIRECTIONS

In organizations, Nemetic Analysis of transmedia spaces helps detect strengths and weaknesses of internal teams and external networks. The two Printernet examples in the case study show clearly how nemetic structures can be used both to drill down deeper into an organization or community, and to expand connections out to include new partners. Where human-to-human and machine-mediated interaction take place, future researchers will need to develop adequate transmedia literacies and skills to explore these new relational situations, both in personal and professional environments.

New research focused on information flow in institutions and administrations can help professionals understand the emerging communication systems in complex environments, and to design formal and informal transliteracy learning for individuals and teams. Several action-reflection itineraries can be developed, in formal and informal training, for improved efficiency in identifying leadership, team dynamics, and coordination applied to transmedia communication.

Future benefits will come from applying results to personal and professional fields that are now emerging in the hybrid physical-digital environment:

- Interacting with wicked problems (favoring useful and valuable emergences from inherently chaotic systems)
- Designing and planning organizational action (using big data to adapt social behavior)
- Integrating gamification into professional fields (creating new transmedia spaces)
- Aggregating expanded connections and Internet of Things (new kinds of transliteracies)
- Relating personally and professionally to wearables and bionic implants (facing ethical and moral issues in collective debates)

- Developing lifelong learning environments (activating and moderating MOOCs, eLearning platforms and mLearning communities)

These lines of research tend naturally towards the creation of a transformation society, where new global competencies for leadership and organizational development are deployed to produce self-emerging collaborative initiatives that include transmedia learning environments. Examples such as the creation of the Printernet are useful to tell the story of transliteracy emergence and transmedia evolution and develop an academic corpus for integrating both transmedia and transliteracy into the communicative disciplines.

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KEY TERMS AND DEFINITIONS

Complex Creative Systems: A subset of complex adaptive systems, which are systems in which a perfect understanding of the individual parts does not automatically convey a perfect understanding of the whole system's behavior. In a complex creative system, such as the rapidly evolving landscape of technological innovation, neither creative nor adoptive paths can be rigorously predicted, due to the high number of interlocked interactions among its components. It results from the non-linear interaction of the creative agent with users (intellect), objects (components), and contextual rules (regulation, social convention, human nature, etc.).

Intertext: A coherent text that shows a relationship to one or more other texts, where "text" is understood to mean any type of communicative content, typically forming a connected piece of work (includes images, sounds, video, etc.).

NEME: Mnemonic acronym for the fractal learning process of complex creative systems: Notice, Engage, Mull, Exchange.

Nemetics: A fractal code, evolved into a meta-language to facilitate communication among researchers in different disciplines in order to debate about complexity.

Synchrodipity: The compound interaction of synchronicity and serendipity, to produce a sense of discovery, delight or well-being, and a sense of connectedness between people, ideas and actions, derived from the flow and the interconnectivity of all things.

Transliteracy: The ability to read, write, and interact across a variety of communication tools, media, and platforms, from text, orality, signing or drawing, through handwriting, print, TV, radio and films to electronic networks and social media on digital platforms. It is a necessary complex skill for receiving, interiorizing or producing Transmedia.

Transmedia: Complex communication interaction based on multimedia, multimodal, multiplatform, intertextual human communication, in which each medium or platform has a distinct role to play in communicating the complete content. This interaction acquires meaning with each participating element by rebuilding the fragmented discourse.

Wicked Problem: A problem that is difficult or impossible to solve, because of incomplete, contradictory, and changing requirements that are difficult to define, identify, or recognize. It often involves stakeholders who have radically different worldviews. In addition, complex interdependencies make it so that the effort to solve one aspect of a wicked problem may reveal or create new problems.

The Organizational Culture in the Days Post 9/11: A Critical Insight

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INTRODUCTION

Doubtless, terrorism has posed as a major threat as well as a great challenge for the US and Europe (Dershowitz 2002; Sloan 2006). As Jean Baudrillard puts it, terrorism not only signified more than a humiliation for the West but also “the mother of all events” (Baudrillard 2013). If terrorism probed something, it was that the urban spaces exhibit fertile grounds for potential attacks. People are more vulnerable in the urban cities or when they travel to work while the mass means of transport are often weaponized against civilian targets. In his book, *The Clash of Barbarism*, Gilbert Achcar says that terrorism opens the doors for a “narcissist commiseration” which means a sentiment of empathy for the first world victims. The global periphery, which was historically exploited by the center has the opportunity to feel closer to its oppressors (Achcar 2015). What is particularly clear is that victims have no same worth. While the victims of 9/11 were enthralled as “martyrs” thousands of others, located in the Global South, die or agonize day by day without any type of attention (Zizek 2008). Korstanje & Tarlow (2012) studied more than a dozen of plots in horror movies. They hold the thesis that English speaking travelers are marked as “special agents of civilization” who are targeted by evil-doers, monsters even terrorists who hate them. This is particularly interesting since the plots continue a much deeper narrative which was based on the sentiment of exceptionalism that historically characterized by the US. The American ethnocentrism toys with the belief that English speaking nations situate as more educated, more tolerant or even efficient than other cultures. Terrorism reminds not only this (the Anglo supremacy), but why the world, which becomes a dangerous place, should be pacified.

To date, a prolific number of books, studies and work-papers emphasize on the economic effects of terrorism in a macro-level of analysis (Chen & Siems, 2004; Abadie 2006; Benmelech, Berrebi, & Klor, 2010; Abadie & Gardeazabal, 2008; Giroux 2015), whereas less attention is paid to the micro-sociological changes introduced by terrorism in the working conditions. This chapter gathers two different ethnographies conducted in two Argentine companies. Centered on the previous studies of Luke Howie in Melbourne, we find interesting and contrasting outcomes which merit to be discussed. While interviewees acknowledge that terrorism is a major threat, they –instead- believe Argentina is far from what specialists dubbed as “The War on Terror”. In this respect, the different interviewed persons held that terrorism is not a problem for them, even he said “this is a problem of the Gringos!”. Lastly, we examine some of the published works that focus on the interplay of terrorism and working conditions to be contrasted to empirical validation. In the global South, i.e. Argentina, workers seem not to be affected by terrorism. Even, they forget that terrorism whipped Buenos Aires city on two occasions. One of the major problems faced by the applied research was the multiplication of quantitative-led publications

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and information which obscures more than it clarifies. For that reason, we convene to make a qualitative study which straddles “the informational database or multi-variable analysis. In view of this, outcome cannot be universalized and only be strictly comprehended into the fields of the studied organization. It is our intention to provide new insights and methodological discussions revolving around the effects of terrorism in Latin America. In so doing, the theory of emotions and organizational culture occupies a central position. Because of time and space, the chapter does not cover all published works while it focuses on the Marxian tradition and the theories of Luke Howie.

BACKGROUND

Emotions are vital factors in the labor organizational culture. Arlie Hochschild (2002) writes that the founding parents of sociology have focused on emotions in different ways. From Durkheim to Weber, without mentioning Marx or Tonnies, emotions occupied a central position in the theoretical conception of solidarity. From its onset, sociology concerned about the social fact, as well as finding a credible answer that explains how society keeps united. For some reason, the evolution of the discipline through the twentieth century witnessed how “emotions” passed to play a marginal role in the sociological theory. In the threshold of time, as Hochschild observes, emotions set the pace to the advance of “rationality”.

In his book, *Politics and Emotions* Adrian Scribano (2018) lays the foundations towards a new fresh insight that helps understanding how liberalism manipulates emotions to protect the interests of the ruling elite. Through the articulation of different ideological artefacts, the global capital not only domesticates emotions –in the name of productivity and efficiency- but also the bodies according to an external stimulus. To some extent, sensibilities and politics are inevitably entwined. As Scribano puts it, the emotional factor is rechanneled and packaged to stimulate consumerism as well as the pleasure-maximization. In a hyper-competitive climate, each agent is in quest of its own happiness paving the ways to the rise of hedonism and individualism. In this respect, Machado Araoz & Pedro Lisdero (2018) explain that neoliberalism as a mega economic and cultural project arrived in Latin America to stay. Per their viewpoints, neoliberalism combined a set of negotiable with non-negotiable policies, which correspond to the needs of creating a space of stable governance. The dogma of precautionary principle, stability and progress act as a catalyst to avoid the social conflict which derives from decades of economic dependency and oppression. Based on the Marxian legacy, authors argue convincingly that neoliberalism –as a residual form of liberalism- mutates and evolves in different directions and shapes, but what remains in its ideological core is the “progressive reasoning” which means the instrumentalization and subordination of social relations in favor of the sense of efficacy. A Stolz (2009) focused on the elements that historically framed the liberal discourse. She found that the liberal reasoning shows how the loyalties of citizens are not given to the foreign policies of their states but citizens, rather, are systematically educated to believe they are “good boys” if taxes are paid, they vote or even leave their children in the school. This suggests that democracy does not consist in creating a climate of egalitarianism as the exegetes of liberalism think, but a spirit of conformity among citizens for the status quo to protect its interests. The Hobbesian conception of politics played a leading role to configure the doctrine of the state that redeemed individual liberty by the consensus of the majority. Of course, since the fear never disappears but it is enrooted in the core of politics, the legitimacy is commonly subordinated to the needs of securitization. The question of whether torture is accepted or neglected by electorship was widely discussed in the academic circles. While some scholars speak us of the “doctrine of lesser evil”, which suggests that legal torture can enhance democracy in the War on Terror (Ignatieff 2013), other

scholars believe that torture is only the peak of the iceberg of a much deeper repressive culture (Chomsky 2000; Altheide 2017; Korstanje 2018). The doctrine of the precautionary principle orients the present courses of action to protect homeland security but in so doing other unseen risks emerge. In retrospect, many of the resulted policies are based on misjudgments and biased diagnosis which obscure more than they clarify (Sunstein, 2005).

This begs a more than interesting question, whether our conception of risks may not be adjusted to reality, how can we cope with terrorism?

In his book, *The Challenges of Democracy in the War on Terror*, Korstanje (2018) affirms that emulating the tactics of conquest of the United Kingdom, which combined an internal climate of freedom with oppression and violence at the periphery, the US historically developed an imperial system orchestrated under the lemma, divide to rule. The different American governments not only adopted a negative viewpoint of the non-western “Other” but also feared the advance of non-democratic regimes (Korstanje 2018). Hence, Americans were certainly entrapped in an atmosphere of narcissism presented them as special, different, invested by the divine mandate to export democracy and capitalism as the best of feasible worlds. The American expansionism, doubtless, was historically associated with the idea that there is “rogue states”, or “failed states” which some day will compromise the security of the US. This was what experts dubbed as “American exceptionalism” (Tyrell 1991; Skoll & Korstanje 2013).

Last but not least, Donald Pease (1987) deciphers the tension between patriots and their concerns once the US liberated from the British Empire. Centered on a hot debate between liberty and the tyranny of Great Britain, the founding parents devote their efforts to avoid to repeat the example of Britons. While the US did the best to forget its troubled past, the idea of a manifest destiny gave Americans a reason to continue as well as a sentiment of exemplarity which marked their culture from its inception. The sense of manifest destiny not only resolved the long-simmering conflict of a new-born nation with its empire, but also posed the hopes that democracy should be imported and emulated to the rest of nations. As a result of this, the United States coined a new paternalism which accompanied their ethnocentrism up to date. In this vein, S. Coleman (2013) held the thesis that American fundamentalism orchestrated the essence of religion with politics, alerting that the world is always a dangerous place. These new orders seem to be charged with the needs of reforming the world, expiating their sins by means of sacrifice and a renovated atmosphere where fear and grace converges. Americans and other Anglophones, especially those in Britain and the settler countries, Australia and Canada, have produced a culture of terror. That culture induces a generalized fear among the populations of those countries. With a focus on the United States, the ruling class has constructed a culture of fear that has evolved from the kind of fear associated with the anticommunist hysteria in the years following the Second World War and its predecessor Red scares to its current incarnation of the terrorism obsession (Skoll 2016; Altheide 2017).

In a seminal book, which entitles *Memory and the Wars on Terror*, Jessica Gildersleeve & Richard Gehrmann (2017) explore the different constellations revolving around terrorism in the United Kingdom and Australia. The 21st century has seen the rise of a new climate of geopolitical relations, where, following 9/11, terrorism became the highest priority for most established democracies in the West. In parallel, academics of all stripes devoted their efforts to expanding knowledge on terrorism, and over recent years the US has monopolized this knowledge production in terrorism fields. Hence, a book that considers the perspectives of other English speaking nations (specifically the UK and Australia) deserves attention. Continuing with the previous observations done by Samuel Huntington about the “clash of civilizations, Gildersleeve & Gerhmann agree that a long-rivaled sentiment of hostility between East and West can be traced to collective memory. The US-led invasions to Iraq and Afghanistan accelerated dormant violence which finally resulted in the formation of a more radicalized cell, the Islamic State.

Per authors, terrorism is nourished by a set of different distinguishable narratives which are encapsulated into the collective memory. In this token, Kevin Foster, examines the relationship between the mass media and military forces. Employing the example of the Vietnam War, Foster demonstrates how journalists echoed the reports of leaders, published fake news or simply gathered contradictory information. Foster argues convincingly that the role played by US journalists during the Vietnam War was mirrored in Australian reporting of the War on Terror, who often consulted top-ranking commanders in Afghanistan before going on air. Lastly, Kezia Whiting (2017) and Belinda McKay (2017) respectively deal with the influence of the Iliad in the Western conception of the war, and the instability of memory in Janette Turner Hospital's fiction. With a focus on children's trauma, McKay contends that the post 9/11 landscape contains a combination of an apocalyptic climate, where the end is near, and the possibility of empowerment of historically marginalized peoples. Metaphorically linked to the fall of Troy, we are reminded not only that one day the empire will burn, but that the psychological fear instilled by terrorism enables the rise of radicalized discourses that place democracy in jeopardy. McKay argues that, at least for some, 9/11 was an "unprovoked attack", which activated a just response to the enemies of democracy. The false memory is conducive to the needs of repetition in order for the trauma to be anthropomorphized. McKay calls false memory to those historical facts which are politically manipulated or tergiversated to rememorize an idealized landscape of the past. Society keeps united through the articulation of these false memories. The problem lies in the fact when the lesson of history is not correctly learnt the disaster recurs.

Terrorism and the Emotional Effects on Culture Organization

In a seminal book, which entitles *Terrorism, the Worker and the City*, Luke Howie (2018) explores the meaning of security, as well as the effects of terrorism on working conditions in the urban landscapes. In this respect, if the 9/11 probes something, it is that terrorists look to target workers to instill an extreme fear in society. Echoing Jenkins, Howie said that terrorists do not want a lot of people dying, they rather want a lot of people watching! Howie coins the term *Terror-work* to denote the interplay between the needs of witnessing and the substantial changes forced by terrorism in the organizational culture.

"I explore the meaning of human security, precariousness and vulnerability in organizational, managerial, city-dwelling and workplace settings. Working people, particularly those in major cities, have been preferred targets for contemporary terrorism. Life in the city has perhaps always been risky, but the post 9/11, post-Madrid, post 7/7 city is filled with witnesses and victims of terrorism going about their work and lives in routine, mundane and everyday ways – I argue that is the essence of terror-work" (p. 14)

Although 9/11 happened exclusively on 11 September of 2001, its durable effects not only persisted but also subordinated other similar events. As a "mother of all events" (citing Baudrillard), Howie agrees that 9/11 –and the successive attacks in London and Madrid- opened the doors towards a "spectacle of terrorism" which imposed an ideological message to workers. In a hyper-mediated society, as Howie adds, the psychological fear experienced in urban cities does not correspond with the real danger terrorism poses. In Melbourne (Australia), days after the 9/11, higher levels of anxiety and uncertainty surfaced. Although the 9/11 involved directly New Yorkers, Australians believed that it was extremely probable a new attack takes places in Australia. Howie explains this writing that witnessing is stronger in distant places which have never been targeted by terrorism. Terrorism divides the world in two, victims which are the targeted workers and witnesses. While the former has been killed to cause political instability, the latter reinforces a much deeper logic of fear which voluntarily or not achieves the terrorist's goals. This point leads Howie to hold the thesis that in the name of the process of securitization, some material

asymmetries which are proper of capitalist system not only are far to be resolved but also are accentuated. While the status quo claims that security is the touchstone of the private sector, private security guards are left to low-paid salaries, extreme working conditions and excessive working hours. Paradoxically, those affect cities which were directly targeted by terrorism experience positive effects as an enhancement of social cohesion, but those which are geographically distant face higher levels of anxiety and angst. Among the perceived consequence of terrorism in working contexts we have the competence among workers, the rise of international conflicts, and the impositions of liberal economies policies otherwise would be rejected. The idea that the terrorist attack is imminent here and now ushers workers in an atmosphere of hyper-competition and mistrust where the man is the wolf of the man. Howie presents the compilation of seven stories of lay-workers in Melbourne, Australia. Their findings are at the best for us illustrative. A whole portion of interviewees agree what terrorism is but they are hand-tied to define it. Instead, they systematically evoke images and discourses circulating the public opinion just after 9/11. Besides, the possibility of an imminent blow in the Australian soil was a second stable element in all answers. This activates a witch-hunter against Muslim communities in the different Australian cities. Nonetheless, the fact that the masses turned duped once subject to the action of media sounds absurd to Howie. Instead of the classic Marxist studies which focus on the ideological power of terrorism, he said “the audience is the real expert of terrorism” because they feel its effects under their skins. Howie goes on to write:

“People in organizations can become paralyzed by fear and an obsession with eliminating all risks, dangers and threats. These obsessions are leaving visible and social traces. Suspicion, hostility, and angst have become commonplace in the world’s cities and organizations in times of terror. The Twin Towers were once a symbol of power, prosperity and corporate affluence. Their destruction has forced a new view of the proud and tall city-building –they represent impotence and fear” (Howie 2018: 168).

His point is very illustrative here. The city, as a social construal, exhibits not only a type of protection for city-dwellers but a cage, in view of the fact that workers follow standardized behaviour; and of course, stereotyped behaviour terrorists know very well. The city is not only a laboratory for terrorists but a fertile ground to target workers.

In the opposite, Geoffrey Skoll (2016) offers a contrasting explanation about the same issue. Terrorism validates, packages and disseminates an ideological message oriented to affirm the exploitation of lay-workers in favor of the ruling elite. Based on the idea that administrations govern through the creation of external and internal risks, Skoll alerts on the fact that fear is not caused by terrorism. The psychological fear, as well as the climate of insecurity, rest as the touchstone of Western capitalism. Following the Hobbesian dilemma, he toys with the belief that once capitalism expanded to the world its internal fear was disseminated in other non-western cultures with the same intensity. The global empire the US created cannot be sustained without the manipulation of the fear. Far from changing the working conditions, terrorism seems to be an ideological artefact to accelerate work-force exploitation. We do not need to find the causes of global fear in the microsociology, but in the material forces created and unfolded by the capitalist system. While the American capital adventured to colonize new worlds a much deeper sentiment of fear was successfully internalized by the natives. The success of the message consists of making the native believe they will live in the best of feasible worlds. For the American cosmology the World is an insecure place, fraught of despotic governments which are the cradle of evil-doers, terrorists and other enemies of democracy. Since America was a success cultural project which merits to be exported to the uncivilized world, local natives are interrogated to know in what side of the history they want to be. The world is divided into two: developed and under-developed nations, democratic or undemocratic cultures. The non-Western “Other” is often depicted as a person who is in the incorrect side of the river, while fear allows capital reproduction. As Skoll puts it, the rul-

ing elite keeps its privileged position in view of two combined elements: repression and ideology. The 9/11 established a mechanism of total control where individual rights were systematically subordinated to the idea of collective well-being. Not only obtrusive methods of surveillance were imposed but also on behalf of security the democratic institutions were seriously harmed. The allegories and discourses revolving around terrorism and 9/11 impede the concrete steps in changing the financial conditions that led the capitalist world to bankruptcy in 2008. In this point, Skoll and Howie converge. Terrorism in general and 9/11 in particular generated a type of new spectacle that places democracy in jeopardy. The divergence, doubtless, rests on the fact while Howie considers terrorism recreates the universal conditions of operation through the media even in the global South, Skoll adheres to the thesis that the culture of fear is enrooted into English speaking countries.

Having said this, terrorism activates a sentiment of exemplarity and exemption which was culturally enrooted in America since its early life. Over the recent years, some voices have questioned the role of the US as the watchdog of democracy in the world. The dilemma seems to be that while the US protects democracy in the four continents, human rights violations repeatedly occur in the Supermax prisons and other terrorist detention camps (O'Brien, 2004; Roth 2006; Skoll 2016; Korstanje 2018).

Argentines and 9/11: This is a Problem of the Gringos!

Argentina has suffered in its soil two major terrorist attacks in 1992 and 1994. The first event happened on 17 March of 1992 in Buenos Aires city. 292 civilians were hurt and 29 died when a bomb blasted before the Israel Embassy. Two years later, a new attack involved AMIA (Argentine Israelite Mutual Association) killing 85 persons and injuring more than one hundred civilians. Despite the virulence of the attacks, less is known respecting the responsible of the two successive attacks. Though some voices alert that The Republic of Iran was involved in the events, to date there is no domestic connection that reveals further information.

This section is based on my own ethnographies conducted during 2005 and 2013 in two companies. Because of confidentiality, the real names of companies, as well as interviewees remain covert. Company A is fully dedicated to the organization of tours and inbound tourism while Company B associates to computer security. I took an appearance in Company A on the morning of July and presented myself to the CEO (Charles 59 years old). Charles shortly introduced me in his role as organizer of the culture, as well as the protocols and main activities of his firm. Charles doubts that 9/11 would be a major threat for Argentina though he confirms the country went through two terrorist attacks in the pastime. Instead, he holds “este es un problema de gringos- this is a problem of the Gringos!” denoting some indifference for the sad events of 2001. He said that the US has historically served as a watchdog imposing restrictive policies and meddling in the autonomy of other nations. 9/11 was for him a “blow-back” for the intromissions in the Middle East. Charles finally shows some critical thinking about the foreign relations of the US. As he said “after Hiroshima and Nagasaki we saw how the world was divided in two poles. For this the US has never asked for pardon. They never recognized this was a horrendous crime. Do you believe this was on behalf of democracy?... (just after a silence of second he replied) “9/11 the US faced a great shock but most probably this is part of the costs of being a super-power”.

Charles introduces me to Sandra, one of his secretaries. Sandra (35 years old) is married and has two children. Instead of Charles, Sandra feels extreme empathy with the victims of 9/11. She even understands that the radicalized mind of terrorism appears to be “irreversible” and invariably it leads towards the formation of a hatred sentiment against Americans. Sandra recognizes terrorism is a major threat for the world, but to some extent not for Argentina. Her country was historically relegated from the World

and remains immune to terrorism. When I asked for the possibilities of a terrorist attack takes place in Argentine soil she responds

“no.. I believe that terrorism is not targeting nations in the Third World. We have other problems such as local crime, lack of political stability, poverty and higher rates of unemployment. I sincerely feel that the third world is not involved in the terrorist agenda. This is a problem of the established democracies since terrorists experienced psychological frustrations in their homelands. Terrorists hate western tourists because they hate democracy, in fact terrorism comes from the lack of political stability which is proper of undemocratic nations!”

Argentina has combined elected and de facto governments in its history. Sandra emphasizes this instability impeded the formation of firm democratic institutions towards a developed and sustainable economy. She is reluctant to the active role of the US and the different military interventions in the world. Sandra believes that the US involuntarily created the conditions of chaos and decontrol that today characterizes Middle East. At the time she is interrogated on the potential solutions to fight terrorism, she says that technology allows a rapid prevention of terrorist attacks as well as an efficient psychological profile investigation. After years of isolation, Argentina needs to be reinserted economically to the world, but in so doing, terrorism would target the country. The unconditional support of former president Carlos Saul Menem to George Bush in the Gulf War prompted the attacks on Israel Embassy and AMIA in Buenos Aires city. As a form of retaliation, these events showed the importance to keep the neutrality in this global conflict.

Different is the case of Fabian who works as a tour leader (travel agent). He loves traveling to New York and Chicago, as well as other American cities. He fascinates the American way and the prosperity of the global North. When he travels, further concerns on the fact of being targeted by terrorism surfaces. Instead, he answers that Argentina is far from being a real target for international jihadism. Fabian is fluent in English and feel empathy for Americans. This sentiment of empathy led him to experience a vicarious trauma just after 9/11. This ideological position accompanied him over months. As he replies, “tourism reconnects the world placing divergent culture in the same sphere of existence. Travelling is a great experience, a point where you learn from others. The act of killing tourists not only is horrendous but a sign of barbarism”. Terrorists are cowards who vulnerate lay-people who want to know other cultures. Doubtless, we need to fight against the intolerance of terrorism. Tourism is an activity of peace which prospers in democratic backgrounds.

In company B, I suspected, the results would be different but I got wrong. I did not have the opportunity to interview the CEO but I met with two executive directors: Robert (32 years old) and Benedict (59 year old). Surprisingly, both agree Argentina is not inserted in the battleground in the War on Terror. Hence, we are immune to terrorist attacks. Robert overtly said

“I work for a company of information security but learnt in my experience that security is a buzzword which depends on many factors. Much security we claim for, more insecure we feel. Argentina wont’s never been targeted by terrorism but also what happened in Israel Embassy is not our problem. This was not an attack against Argentina, this comes from an old problem for Palestine in the Middle East. I am sad for the innocent victims but strongly believe that this is a problem between Arabs and Jews”.

Rather, Benedict laments the Argentine government did not remind properly the events of 1992 and 1994. The attacks to Israel Embassy and AMIA have not left any lesson for Argentinians who remained indifferent. While the US government thematized the 9/11 as well as the struggle against terrorism as their most significant hallmarks, in Argentina the government coordinated efforts to hide “Jew com-

munity” relocating the embassy and AMIA. Beyond the suspicions, today authorities have no trace on the responsible minds managing the attacks.

FUTURE RESEARCH DIRECTIONS

The present chapter evinced some preliminary remarks on how argentine workers perceive terrorism. Although paraphrasing Baudrillard, 9/11 was “the mother of all events”, for interviewees do not feel terrorism is a major threat for Argentina. These findings contrast to what Howie presents in his study-case. Far from being concerned about terrorism, Argentinians strongly believe “this is a problem of the Others”, or at the best, “this is a problem of gringos!”. Secondly, terrorism is wholly perceived as a problem derived from psychological resentment. The third world, in this vein, would be a fertile ground for the process of radicalization terrorism needs. The hate against foreign tourists epitomizes a much deeper resentment against democracy. Those who work in tour organizations or serve as travel agents feel ideologically closer to the US and its War on Terror than other interviewees.

CONCLUSION

After further review, the interviewees consider uniformly that the two attacks in 1992 and 1994 were not directed to Argentina but to the State of Israel. Moved by the ongoing conflict in the Middle East, these attacks were the results of durable disputes between Jews and Muslims. Though the sample was not statistically representative, the obtained outcome reveals interestingly two important things. On one hand, terrorism created a mythical allegory revolving around 9/11, which subordinated the interpretations and meanings of other similar events. The attacks to Israel Embassy and AMIA were not only hidden, relocating the vulnerable “Other” in another geographical area of Buenos Aires, but they were understood through the lens of American exceptionalism. On another, terrorism shows concrete effects and consequences on the organizational culture, which can be deciphered using qualitative methods. Since the information gathered in these micro-units is not enough to be extrapolated to all Argentina, further research should be done. Our intention aimed at describing the position of some argentine workers –not the entire universe- before terrorism and other global risks. The chapter follows a descriptive dynamic which escapes to the monopoly and rationality of “quantitative-related methods”.

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KEY TERMS AND DEFINITIONS

Conflict: A situation of dispute between two or more parts where each side follows different interests.

Labor Relations: A field of study which connotes the social ties and relations of workers and capital owners in the productive stage.

Terrorism: The illegal use of force or coercive violence to create terror or political instability.

War on Terror: An international military campaign that was started by the US and its allies just after 9/11.

Witnessing: A process accelerated by terrorism where the audience become trapped in the culture of terror.

The Diversity Paradox

2

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INTRODUCTION

The diversity paradox is an organizational emphasis placed upon one potential understanding of diversity which, paradoxically, deemphasizes alternative expressions of individual difference. An organizational focus on representations of gender, for instance, synchronously moves the focus away from sexual orientation; an organizational focus on representations of sexual orientation synchronously moves the focus away from age; and so on. This article explores *the diversity paradox* in more detail, including its background and six primary tenants: fractionated understanding, visible hierarchy, false attainment, neglected representation, diminished alternatives, and potential tokenism. The article concludes with recommendations for both researchers and lay leaders alike whom hope to cultivate healthier organizational milieu.

The diversity paradox is an especially significant phenomenon in today's increasingly diversified society. Perhaps nowhere is this phenomenon more salient than within the United States. The percentage of Americans who self-identify as white has been in steep decline for decades, and this diversification is only projected to continue in the coming decades. Today, approximately 60% of those living in the United States identify as white, 17% as Latinx, 12% as black/African American, 5% Asian, and 1% American Indian/Alaskan Native. Yet by the year 2055, the percentage white Americans is predicted to decrease by nearly 15 percentage points, resulting in the United States no longer having a single racial/ethnic majority (Pew Research Center, 2016). This trend in increased diversification is mirrored elsewhere as well – fueled by political alliances in the European Union, immigration policies in South America, international trade agreements in North America, and so on (Rice, 2010).

Despite the increased diversity in countries like the United States – or perhaps because of it – issues of racial/ethnic inequality continue to plague our world. This reality is evident whether measured by income inequality (Glazer, 2005), health disparities (Dillon, Roscoe, & Jenkins, 2012), education levels (Closson, 2010), or incarceration rates (Ward, Farrell, & Rousseau, 2009). For these reasons, it is more important than ever for contemporary organizational leaders and scholars to learn how to engage with culturally diverse voices, perceptions, and taken for granted assumptions. The diversity paradox contributes to this need for increased understanding by revealing specific ways that diverse members manage tensions and limitations, thus, holding promise for improved racial/ethnic relations within intercultural contexts, organizations, and society writ large.

BACKGROUND

The diversity paradox first emerged as a theoretical framework during Jenkins' (2013, 2014a, 2014b, 2014c) four-year ethnography of Central Community Church (pseudonym) – an intercultural congregation located in Tampa Bay's urban corridor. In reference to Christian Scriptures that depict a culturally

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diverse body of believers (see Matthew 28:9; Acts 17:26-27; Revelation 7:9, New International Version), Central Community strove to “reflect and impact the specific realities of [its] surrounding community” (Jenkins, 2014a, p. 7). Thus, Central Community actively promoted diversity via church literature, congregational events, and communal outreach efforts. A majority of sermon topics addressed the need for organizational diversity, and the church’s website described itself as “a multi-ethnic community... transforming the world through Jesus Christ” (Central Community, 2015, par. 3).

After 48 months of fieldwork, which yielded over 300 hours of observations, 140 pages of notes, and 30 semi-structured interviews with organizational leaders and members, Jenkins (2014) found Central Community’s organizational emphasis on diversity to have several unintended consequences. Although admirable on the surface, the church’s limited view of diversity as physical representations of racial/ethnic difference was found to paradoxically diminish the opportunity for alternative expressions of individual difference (see Jenkins & Dillon, 2014). Minority members’ attempts to conform to Central Community’s white normative practices unintendedly resulted in forced assimilation and self-disciplining; consequently, the church’s emphasis on cultivating a diverse congregation actually served to limit possibilities of organizational life – a phenomenon hereto referred to as *the diversity paradox*.

The diversity paradox has since been observed in additional contexts across the United States, including both religious and secular organizations. A study by Santis, Graham, and Jenkins (2019) of Central Faith Church in the greater Los Angeles area, for instance, revealed a similar tension surrounding the notion of organizational diversity. Such additional studies not only evidence the diversity paradox’s prevalence, but also its potential to help inform a wide range of religiously and geographically diffuse settings.

PRIMARY TENANTS

The diversity paradox is shown to manifest itself via six interrelated tenants: (1) fractionated understanding, (2) visible hierarchy, (3) false attainment, (4) neglected representation, (5) diminished alternatives, and (6) potential tokenism. First, organizational discourses promote a *fractionated understanding* of what it means to be a diverse organization, resulting in a *visible hierarchy* of difference and the sense of *false attainment* among its leadership. Among organizational members, this false attainment results in *neglected representation* for certain minorities, as well as *diminished alternatives* for organizational life and an increased level of *potential tokenism*. The present section further outlines each of these six tenants in turn.

Fractionated Understanding

The notion of diversity has become a normative reference for many organizational leaders and members when discussing racial, ethnic, and cultural equality. Diversity is exalted by nonprofit and for-profit organizations alike as being a central priority (Bunn & LaCour, 2009), key source of strength (Richard, 2000), and present-future goal (Unzueta & Binning, 2010). As a result, many organizations go out of their way to publicize the value they place upon creating and maintaining diversity via advertisements, job calls, promotional materials, and formal mission statements (Kidder et al., 2004; Kochan et al., 2003). In 2001, the United Nations Educational, Scientific and Cultural Organization (UNESCO) went as far as to declare that “cultural diversity is as necessary for humankind as biodiversity is for the nature” (par. 12).

Despite an increased value and emphasis on diversity, however, its meaning is still not clearly defined among the general public (Bell & Hartmann, 2007; Unzueta & Binning, 2009). Such ambiguity affords

a broad understanding of diversity's potential role and definition: variations in age, gender, religion, nationality, marital status, economic income, education level, able-bodiedness, sexual orientation, political affiliation, or linguistic disposition, to name but a few (see Coalition for Cultural Diversity, 2010). Because of this broad range of possibilities, organizational leaders commonly focus on one potential expression of the term. Rather than embracing diversity's broad range of possibilities, they choose to extol one fractionated understanding (Mill, Pinnegar & Polunin, 2007).

Originating in the field of chemistry, the term *fractionation* initially referred to the separation of an isotope into smaller quantities (O'Neil, Clayton, & Mayeda, 1969). Fractionation has since been used as a theoretical framework to describe the subdivision of large, complex concepts within social science into smaller, more palatable ideas. Thus, by subdividing an issue like diversity into smaller parts and focusing upon only one potential understanding, organizations are able to make sense of a potentially overwhelming topic. This process has also shown to alleviate the emotional load associated with resolving controversial issues, and to facilitate a better working relationship between organizational members.

Although useful in many instances, such a fractionated approach to diversity is problematic because it inherently neglects opposing perspectives. Jenkins' (2014a, 2014b, 2014c) and Sabrina, Graham, and Jenkins' (2019) aforementioned studies of Central Community and Central Faith respectively found organizational leaders to value difference; yet as a result of their fractionated understanding, they each expressed this value exclusively through differences in race/ethnicity. This reality was evidenced via racially/ethnically diverse band members, promotional materials featuring stereotypical phenotypes, and even frequent challenges by the lead pastor of Central Community for congregational members to interact with others who "looked different" than themselves. Thus, organizational leaders within both Central Community and Central Faith came to overlook alternative conceptions of diversity. Such a fractionated understanding also discounted the way differing expressions of personal identity intersect with one another (i.e., intersectionality), while simultaneously creating a visible hierarchy of difference.

Visible Hierarchy

A fractionated understanding of diversity commonly results in the valuation and devaluation of particular types of difference. In the same way that organizational metaphor inherently emphasizes one insight while simultaneously deemphasizing others, an emphasis placed upon one aspect of diversity simultaneously deemphasizes alternative aspects. As Hamburger and Itzhayek (1998) write: "Metaphor... determines the way people perceive, remember, and analyze information they receive. However, any single metaphor limits people's perception by blocking and distorting the information encountered... They are like people speaking in different languages" (p. 383). Hence, by focusing solely upon one understanding of diversity, organizational leaders can come to view this form of difference as being more valuable than other potential forms.

This visible hierarchy created by *the diversity paradox* typically serves to elevate visible manifestations of difference within a given organizational context. Said differently: organizational hierarchies of difference are usually based on physical and visual representations of racial/ethnic diversity (a.k.a., *marked bodies*). This emphasis on visible representations of race/ethnicity seems due, in part, to external differences being the easiest forms of diversity to observe and quantify. Phenotypical markers such as skin color and hair texture can be confirmed at a distance, in a matter of moments, and without the need for personal interaction. Alternative expressions of difference, such as nationality or linguistic disposition, are much more difficult to detect and require a greater investment of both time and energy. As a

result, these unseen markers of diversity are commonly devalued within organizational discourses – or else overlooked entirely – resulting in a false sense of attainment among its leadership.

False Attainment

By communicating a fractionated and hierarchal view of diversity, organizational leaders not only tend to perpetuate a limited conception of this term, but also decrease their ability to recognize ways in which this understanding actually renders their own organization less diverse. Although a relatively equal number of men and women attended Central Community, for example, its leadership was entirely male (Jenkins, 2014a). This reality was echoed in the later study Central Faith outside Los Angeles (Santis, Graham, & Jenkins, 2019). Despite such lack of diversity, the leadership staff of both congregations remained convinced of their organizations were in fact diverse. Thus, the inability for Central Community or Central Faith to fully recognize or value alternative expressions of diversity resulted in a false sense of attainment among its organizational leaders.

Taken one step further, Jenkins (2014b, 2014c) and his colleagues (Santis, Graham, & Jenkins, 2019) observed that the diversity paradox allowed leaders to celebrate and promote their organization's one-dimensional view of diversity through promotional materials highlighting race/ethnicity. Ultimately, such a false attainment of diversity can lead to several consequences commonly faced by minority members within organizational contexts – namely that of neglected representation, diminished alternatives, and potential tokenism – each of which serve as the diversity paradox's final three tenants.

Neglected Representation

As a result of fractionated understanding, visible hierarchy, and false attainment, *the diversity paradox* can also result in neglected representation for certain minority members. Such individuals might be allowed to fully take part in the organization outwardly; however, they are often not considered part of the organization's diversity quotient. As a result, they are not valued or celebrated in the same way as visually diverse members.

Although several minority participants in Jenkins' (2014a, 2014b, 2014c) longitudinal study of Central Community desired to hear more gospel music, for instance, music choice was not an organizational discourse used to measure diversity. DeYmaz (2007), a prominent leader in the Multi-ethnic Church Movement, characterizes variations in musical style as a "hallmark" of healthy intercultural congregations. Yet according to Central Community's leadership, changes in musical rhythm, tempo, song selection, or instrument choice would not affect its level of diversity; thus, grievances against such a "minor" detail as music were neglected by leaders and other members as merely personal preference. At other times, these grievances were seen as something worse: grumbles of discontent, and an affront to the organization's superordinate goal of creating a diverse organization (see Driskill & Jenkins, 2019).

Santis, Graham, and Jenkins' (2019) observations within Central Faith found similar instances of neglected representation, as leaders overlooked calls for alternative approaches to time management by adhering to a strictly monochronic understanding. Rooted in Western society and stemming from the Industrial Revolution, a *monochronic* view of time is defined by precise and regimented scheduling. By dividing time into precise units, it becomes a tangible commodity that can be "spent" or even "wasted," hence, the adage "time is money." In contrast, a *polychronic* view of time is less rigid and more fluid. It focuses on relationships over scheduling, and is largely associated with Asian, Arabic, African, and Latin American cultures (Cohen, 2004).

Because of Central Faith's adherence to a monochronic view of time, Santis, Graham, and Jenkins (2019) found congregational members were pressured to arrive on time for church related events – especially Sunday morning services. This expectation was evidenced by a digital countdown in the sanctuary used to mark the start of each service, the repeated suggestion by organizational leaders to arrive on time, and even the strategic use of musical guests to encourage punctuality. In the end, such a narrow focus on their monochronic view of time management inhibited congregational leaders from recognizing alternative possibilities of neglected representation – namely, alternative approaches to time management.

Diminished Alternatives

Because of *the diversity paradox*'s tendency to devalue and neglect unseen markers of difference, certain minority members are often unable to express their diverse views and approaches to organizational life. Hence, the organizational emphasis Central Community and Central Faith placing on visual and physical representations of race/ethnicity not only devalued alternative understandings of difference, but also devalued alternative ways of *being* (Jenkins, 2014a). Specifically, the value these organizational leaders placed upon visual representations of race/ethnicity devalued representations of female leadership, sexual orientation, able-bodiedness, nationality and linguistic disposition, as well as age, marital status, economic income, education level, and political affiliation.

On an organizational level, other potential examples of diminished alternatives include white normative approaches to service structure and choice of sermon topics. African American and Hispanic/Latino church services, for example, are usually longer in length than white church services, lasting as long as four hours (Nelson, 2005). In contrast, church services with predominately white members average a mere 65 minutes in length. In addition, African American and Hispanic/Latino church services typically focus the majority of its time on communal singing and dancing; white church services typically reserve a majority of Sunday morning for the pastor's sermon (Thumma, 2007). The choice of sermon topics also differs between predominately African American and predominately white churches. Stemming from the African slave trade and rooted in the Biblical account of Moses leading his people from bondage, African American congregations generally view salvation as the deliverance from present-day hardships and oppression: racism, financial inequality, institutional oppression, etc. Due to its emphasis on social and religious collectivism, Hispanic/Latino churches share a similar focus on the here and now. Conversely, white congregations generally view salvation as the deliverance from eternal damnation, focusing upon its spiritual and enduring dimensions in the afterlife, rather than its physical and temporal implications (Pinn, 2006).

Despite each of these potential alternatives, Jenkins (2014a, 2014b) and his colleagues (Santis, Graham, & Jenkins, 2019) found congregational discourses to be decidedly white in their approach to church processes and practices. Each service rarely lasted longer than 60 minutes. Services were also organized around the lead pastor's weekly sermon, and although the churches routinely focused on present day hardships and oppression within their local communities, organizational discourses still framed conceptions of salvation in strictly spiritual terms.

Potential Tokenism

Finally, via neglected representation and diminished alternatives, *the diversity paradox* reveals a potential danger for intercultural organizations to consign minority members to that of token status. First defined by Kanter (1977) during her study of gender representation in the workplace, *tokenism* is a perfunctory

gesture toward the inclusion of minorities within an otherwise majority group or organization. Such inclusion is typically used to create an artificial façade of diversity, while averting any potential accusations of discrimination (see also Kelly, 2007).

Kanter (1993) divides the process of tokenism into three categories: *heightened visibility*, *assimilation*, and *exclusion*. Token individuals are often appointed to highly visible roles within an organization, yet are granted limited influence or capacity for organizational change. Due to such heightened visibility, tokens commonly experience an increased level of pressure and expectation placed upon their personal performance. Meanwhile, the uniqueness of token individuals is often overlooked by those within the dominant group, resulting in their assimilation into one collectively inferior grouping, characterized by erroneous and exaggerated stereotypes. Tokens often accept these flawed stereotypes for fear of exclusion, yet feelings of isolation and segregation are still commonplace among token individuals.

Consistent with Kanter's (1977, 1993) characterization, *the diversity paradox* reveals a risk for tokenism within intercultural contexts because of the possibility for organizational discourses to become focused upon one specific (and visibly apparent) view of diversity. For this reason, the mere presence of organizational members whom fulfill that view could be interpreted as enough to "satisfy" an organization's diversity quotient. Furthermore, these members run the risk of being made highly visible within the organization, while simultaneously granting those same members limited influence or capacity for organizational change.

Understood in yet another way, *the diversity paradox* also reveals the potential for the phenomenon of *attributional tokenism*. That is, a garish emphasis placed upon one particular trait of an organization's culture, norms or practices that promotes a desired image or appearance, while overlooking cultural norms and practices to the contrary. As a theoretical extension of tokenism, attributional tokenism does not grant any particular person or persons that of token status, but rather a particular organizational feature or characteristic.

Attributional tokenism is not limited to the notion of diversity, nor is it limited to intercultural contexts. Rather, this concept can be recontextualized to any number of organizational settings. It can pertain to any organizational quality or idiosyncrasy of an ambiguous and indefinite nature. If an organization seeks to appear "innovative," for instance, leaders and members might emphasize one inventive feature of the organization (e.g., its dynamic office design), while deemphasizing a multitude of other organizational features that remain utterly conventional (e.g., its dress code, salary schedule, hiring process, promotion procedures, management structure, advertising and growth strategies, etc.). Similarly, if an organization seeks to be perceived as "desirable," it might emphasize its high number of employee applicants, while deemphasizing its exorbitant rate of employee complaints or turnover; if an organization seeks to be perceived as "youthful," it might emphasize the young age of its CEO, while deemphasizing the elevated age of its managers and employees; and so on.

The act of attributional tokenism is not inherently negative. It could be argued that *branding*, which has become a buzzword in personal and organizational development, is a form of attributional tokenism (see Lair, Sullivan, & Cheney, 2005). Howard Schultz, for instance, highlights the specific value of *brand awareness* (i.e., the ability for a consumer to recognize a brand under differing conditions) and *attitude branding* (i.e., the ability for a brand to evoke a particular emotion or sentiment). His observations also stress the ubiquitous nature of branding in contemporary society, as well as its ability to influence everything from fitness to coffee (Daye, 2006, par. 1). During Jenkins' (2013, 2014a, 2014b, 2014c; see also Jenkins & Dillon, 2012) and his colleagues' (Santis, Graham, & Jenkins, 2019) longitudinal studies of intercultural congregations in Florida and California, however, the organizations sought to be perceived (a.k.a., branded) as "diverse." As a result, organizational leaders were able to emphasize the

racial/ethnic composition of their congregations, while deemphasizing their organizations' absence of female leadership, as well as its complete lack of LGBT, disabled, international, and non-English speaking congregational members. Such a discursive move served to create a façade of increased diversity via attributional tokenism.

SOLUTIONS AND RECOMMENDATIONS

The diversity paradox highlights a need for intercultural leaders and members to recognize alternative expressions of difference. A broadened view of diversity would positively correlate with organizational leaders' and members' ability to express their unique views, perspectives, and approaches. Through a broadened understanding of diversity's potential meaning, additional alternatives for organizational life would also emerge, decreasing the probability of personal or attributional tokenism. A broadened understanding of diversity alone is not enough for lasting change, however, as the socially constructed categories of difference are ever-changing. For that reason, organizational leaders and members must also remain continuously receptive to understandings of diversity beyond those presently held by the organization and society at large. Rather than merely adopting a broadened view of diverse communities, intercultural organizations must employ an *ever-broadening* definition. In other words, an organizational view of what it means to be diverse must be viewed as ephemeral: fluid and ever-changing. Any formal or informal classification of terms like "diversity" must remain living documents, open to perpetual change.

In order to actualize such ever-broadening definitions, it is essential that organizational leaders and members adopt reflexive mechanisms of change (see Senge, 2006). *Reflexivity* is defined as the recursive turning-back of personal experience upon itself. Soros (1994) further characterizes the concept of reflexivity as a two-way feedback mechanism that helps shape the participants' thinking; in turn, the participants' thinking helps shape reality in a recurring loop (p. 2). Such a view of reflexivity draws obvious comparisons to the *observer effect* (Furuta, 2012) and *uncertainty principle* (Heisenberg, 1930), which illustrate the way certain measurements cannot be made without affecting the very object in question. As a theoretical physicist, however, Heisenberg dealt with external observations of complementary variables, while reflexivity deals with the role of cognition as a generative tool for observable phenomena.

Reflexivity is also embedded within – while drawing upon – our current perceptions of reality. In this sense, reflexivity is both a result and limitation of our communicative encounters with others: "Reflective understanding is an integrating process that draws upon understandings gained from the body's interaction with the world and from the accumulated wisdom of the culture" (Polkinghorne, 2004, p. 151). A researcher can only be understood in terms of those whom s/he seeks to research; those s/he seeks to research can only be understood in terms of the researcher. It is only together that we mutually specify our own conditions of existence, hence, reflexivity is "relational-in-a-context" (Steier, 1995, p. 64).

Due to its pensive and recursive nature, reflexivity is often illustrated as a set of mirrors doubling back on themselves. Like the Place of Versailles' great Hall of Mirrors, this recursive aspect of reflexivity can be visualized as an infinite set of loops that fail to reflect or generate anything beyond itself. Such recursivity has prompted certain scholars to disparage reflexivity for its narcissistic nature (e.g., Steier, 1995). Other scholars, however, have venerated reflexivity for its ability to challenge patriarchal knowledge production (Haraway, 1991) and its promise for social change (McLafferty, 1995). Pels (2000) further addresses this issue by offering a potential solution for contemporary scholars: "I...defend a view of reflexivity which I call 'one step up.' ... It ties just one loop, adds one level of self-exemplification, in order to bend the rectilinear story into a curvilinear or elliptical one" (p. 3).

By nurturing this reflexive, “one step up” culture among its leaders and members, intercultural organizations can learn to reflect-in-action upon organizational practices and structures. In the end, rather than merely addressing the organizational issues highlighted by *the diversity paradox*, such reflexive mechanisms of change will ultimately provide organizational leaders and members the ability to address their own faulty assumptions about the organization’s current level of diversity – or lack thereof.

FUTURE RESEARCH DIRECTIONS

Continued research on intercultural organizations is severely needed – particularly within racially/ethnically diverse congregations. The need for such research will only increase in places like the United States as its racial composition continues to diversify (US Census Bureau, 2008). Suggestions for future research include ethnographic studies of other racially/ethnically diverse congregations beyond Florida and California in order to identify additional manifestations of *the diversity paradox* – added ways in which an organizational emphasis on one potential understanding of diversity (e.g., age, gender, nationality, sexual-orientation, etc.) serves to deemphasize alternative expressions of difference.

Given that less than 8% of American congregations are intercultural (Emerson, 2008), future research should also extend this study’s focus to monocultural congregations. Rather than focusing on a racial/ethnic outliers like Central Community and Central Faith, organizational communication studies are needed to examine how religious leaders and members constitute community within homogenous populations. Similarly, future organizational studies should explore faith traditions beyond Christianity alone. Indeed, nearly two-thirds of the world do not identify with the Christian religion. An estimated 21% of the world’s population self-identify with Islam, 16% self-identify as “nonreligious,” 14% Hinduism, 6% Buddhism, and 6% Taoism or Confucianism (Central Intelligence Agency, 2013). In light of these numbers, and fact that Islam is also the world’s fastest growing religion (Zein, 2007), it is becoming increasingly vital for organizational communication researchers to examine the organizational complexities surrounding race/ethnicity within other religions as well.

Additional areas for research involve the intersection of community and race/ethnicity within secular contexts. Even though the majority of Americans attend church at least once per year and more than one hundred million Americans are involved in church to some degree (Emerson, 2008), these numbers indicate that approximately two hundred million Americans are *not* involved in a religious or faith-based organization. Consequently, it is vital to explore the way community is co-constructed and maintained by racially/ethnically diverse populations within nonreligious milieu: health settings, educational institutions, governmental organizations, etc. Research within these organizations is needed to identify manifestations of *the diversity paradox* within secular contexts as well.

CONCLUSION

The diversity paradox reveals the propensity for intercultural organizations to promote one potential understanding of diversity in a way that diminishes alternative possibilities of organizational life for certain minority members. This paradox has been shown to occur in six interrelated ways. *Fractionated understanding* refers to the way organizational leaders make sense of a potentially overwhelming topic by subdividing the notion of diversity it into smaller parts and focusing upon only one potential understanding. *Visible hierarchy* refers to the increased value organizational leaders routinely place upon

certain subdivisions of diversity, namely physical and visible representations of racial/ethnic difference. *False attainment* refers to the way in which leaders can become self-convinced of their organization's diversity – because of the increased value they place upon their own subdivided understanding – without ever considering the multitude of ways in which it is not. *Neglected representation* refers to the way certain minority members can be overlooked in regard to an intercultural organization's diversity quotient. *Diminished alternatives* refers to the way these members often feel unable to express their diverse views and approaches to organizational life, and *potential tokenism* refers to the risk of appointing minority members to highly visible roles within an intercultural organization in effort to create an artificial façade of diversity.

In light of the racial/ethnic inequalities that continue plague our world, it is vital that organizational leaders and members continue in their pursuit of building culturally diverse communities. Considering the ambiguous nature of diversity, however, it is equally imperative for leaders and members to remain mindful of the ways in which they seek to build those communities. Thus, *the diversity paradox* offers a theoretical understanding for how organizations can serve to stem racial/ethnic inequality in our world writ large.

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KEY TERMS AND DEFINITIONS

Attributional Tokenism: A garish emphasis upon one particular trait of an organization's culture, norms, or practices that promotes a desired image or appearance, while overlooking cultural norms and practices to the contrary; a theoretical extension of *tokenism*.

Fractionation: The separation of isotopes into smaller quantities.

Marked Bodies: Physical and/or visually apparent representations of difference.

Reflexivity: The recursive turning-back of personal experience upon itself; the process of thinking about thinking.

Tokenism: A perfunctory gesture toward the inclusion of minorities in a group or organization.

White Normativity: A view of whiteness as the default culture in society; the unspoken norm.

Fab Labs: A Place for Innovation, Collaboration, and Creation?

2

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INTRODUCTION

In recent decades, innovation has become a central issue in the survival of public and private organizations. To meet this challenge, most of them are exploring new ways of organizing work, including seeking to build on the creativity of their employees. These explorations result in the invention of new forms of coordination and cooperation.

At the same time, job tasks and employment relationships have become more complex and diversified over time and need to be redefined (Paris and Lê, 2016). Organizations are also looking for ways to increase the innovative spirit of their employees and to develop organizational innovation (autonomy, versatility, development of collective actions, team work for example). This context contributes to the creation of new forms of employment and activities. To ensure these restructurings and these new expectations, new ways of organizing work are unfolding, which has helped to make it possible to implement fab labs.

BACKGROUND

Fab Labs are proliferating around the world and are presented as new places of collaboration and exchange open to all and in which anything is possible, but these places are more specifically oriented towards the fabrication of products with 3D printers in many cases, or other types of productions. In doing so, the place does allow for the creation of many innovations and facilitates meetings between creatives and designers. However, they can also create certain risks that are not yet necessarily documented.

In this chapter, the authors propose to draw up a synthetic and nuanced inventory of the benefits and risks created by fab labs. This assessment is therefore original, given the lack of research on the negative aspects of these places and the lack of contrasting studies on the subject in particular.

FOCUS OF THE ARTICLE

The Contributions Of Fab Labs: Between Knowledge Democracy And Sharing Of Tools

Fab Labs, Places Of Digital Democratization

Fab lab is the contraction of “fabrication laboratory”. Fab labs have been created within the MIT Center for Bits and Atoms to enable everyone to become the main players in technology manufacturing rather than just spectators (Gershenfeld, 2005). The first ever fab lab was established at the Massachusetts Institute of Technology (MIT) in the CBA (Center for Bits and Atom), a research laboratory founded in 2001 by the NSF (National Science Foundation). Thus, in the same way that the Internet has enabled the collaborative web and in fact the development of sharing tools, the CBA wishes to make fab labs the logical consequence of the digital revolution, by giving everyone the opportunity to manufacture digital tools, as Neil Gershenfeld, director of CBA attached to MIT (Scaillerez and Tremblay, 2017a and b) wishes. After participating in the digital revolution, MIT wants to democratize digital manufacturing. The Fab lab network, also initiated by MIT, has listed nearly 1,000 so far (Deskmag, 2017).

Fab Labs, Places Favorable To Open Innovation

The fab lab activity is part of the dynamics that can result from open innovation (Chesbrough, 2003 and Chesbrough, Vanhaverbeke, and West, 2006). This theoretical framework includes two main streams, the first dealing with the relationship of the concept with the use of internal skills of the company, the second dealing with external partners. Fab Labs can register their activity in this second stream of thought.

Open innovation refers to the idea that companies do not have all the skills needed to innovate internally. On the contrary, external resources, external research and development (R & D) can foster innovation in an organization. This theory of open innovation refers in a way to the work of Nonaka (1991), which also indicated that companies do not always have the best talents at their jobs, so they must seek to benefit from expertise and skills externally, including the tacit knowledge put forward by Nonaka and Takeuchi (1995). This does not mean that we must forget internal knowledge, but simply that we must also acquire intellectual property and ideas developed by others (Trott and Hartmann, 2009). It is also necessary to integrate into networks to access external knowledge, and this is where fab labs can be useful. In this respect, fab labs can then as much meet the needs of companies, as those of entrepreneurs and even anyone wishing to manufacture a material or immaterial object.

Trott and Hartmann (2009) point out that this idea of external knowledge is not entirely new but has been put forward less than internal talent as a source of creativity and innovation. Open innovation actions can contribute to the development or enhancement of a product or reflection through the use of external sources, such as the various actors associated with it (Chesbrough, 2003; Laursen and Salter, 2006). This is what we can find in a fab lab where users will take advantage of the community tools to build a prototype together. Everyone brings his skills. It is a sharing of knowledge and tools between creator and creative. In this case, open innovation relies on the intervention of external resources, but also of intermediaries (Chesbrough, 2006) with the ultimate aim of organizing the meeting between various users through the development of an innovative process. By following this reasoning, a fab lab can then be considered as an open space of innovation, drawing strength from the collaboration between its members.

Fab Labs, Places Of Sharing (Tools And Knowledge)

The existence of a collaborative environment is an important factor at the beginning of the innovation process whether you're in a small business or you're an entrepreneur, or a craftsman, because success or failure depends on their ability to acquire external resources and knowledge complementary to those available internally (such as their own knowledge or their own material). To justify its existence, a fab lab therefore requires the help of intermediaries, individuals or organizations serving as an interface between two or more parties throughout each stage of the innovation process (Howells, 2006; Fleischmann, Hielscher, and Merritt, 2016). Their role is then to try to develop a relationship of trust between the actors solicited, acting as matchmakers to encourage meetings and the sharing of tools and knowledge.

This can be done by:

- the use of resources in its possession (Chesbrough 2003; Leroux, Muller, Plottu, and Widehem, 2014), such as the pooling of 3D printers for example. In Montreal, in the area of innovation, Échofab is a fab lab that provides all (entrepreneurs, craftsmen, students ...) four 3D printers, a laser cutting machine or a digital milling machine. Amateur or expert creations are possible;
- the development of an environment designed to facilitate exchanges between members of the group, such as creating within the fab lab open working spaces, places of conviviality to take lunch together or coffee ...). In Quebec City, Chambre Blanche is a fab lab that welcomes artists from around the world and from multiple domains (dancers, sculptors, painters ...). To facilitate meetings between artists, or between manufacturers and creatives, Chambre Blanche organizes events such as Design Fiction nights. The fab lab also hosts artists who live on site and who have the equipment and workshop to provide an environment conducive to their creativity. It can also facilitate the flow of knowledge and meetings (Leroux and al., 2014; Fabbri and Charue-Duboc, 2016), by organizing workshops, discovery workshops, or all types of meetings between its users. In the city of Sherbrooke in Quebec (Canada), La Fabrique is a fab lab that sets up workshops to also allow its users to learn how to make many products.

A fab lab then seems to be a place where this intermediation is possible through a variety of factors facilitating the culture of collaboration within it and thus, allowing contacts to achieve the expected result, such as business opportunities or product or service innovations. These manufacturing spaces make available to all people (for free or at a lower cost) their machines and tools in order to lead to the manufacture of an object or digital innovations. They facilitate learning by doing and sharing skills (Bosqué, 2015). In short, in a fab lab, anyone with an idea can benefit from a place to test (prototyping), then create a physical or digital object freely and quickly, because the place provides the necessary means (Troxler and Wolf, 2011). In a fab lab, the cooperation can allow for example the creation of products with numerically controlled machines, such as a 3 D printer or a laser cutting machine (Fastermann, 2014; Allen, 2016; Fleischmann and al., 2016).

In short, fab labs are community laboratories that are conducive to exchanging knowledge and resources between various people in different professional fields such as the web, information and communication technology (ICT), as well as those of health, arts and sciences for example (Bosqué, 2015), or simply production of artefacts with a 3D printer.

Fab Labs, Places Conducive To The Collaborative Economy

Fab Labs are devices designed to facilitate exchanges, sharing and collaboration. Their action can then be considered as part of the new economy, particularly the collaborative economy, which relies on the sharing and production of common values and new forms of work organization (Botsman and Rogers, 2010). The collaborative economy indeed promotes collaborative lifestyles or collaborative consumption (Felson and Spaeth, 1978), as well as contributive production (digital tool manufacturing or 3D printer: Vak and al., 2015; Devendorf, De Kosnik, Mattingly, Ryokai 2016; Fleischmann and al., 2016) that can be found within fab labs. These new economic theories promote collaboration, pooling and sharing, which then serves as fertile ground for the establishment of third places. These contribute to the sharing of a space (co-working), a reflection (the living lab), but also tools (fab labs).

Within these systems, the collaborative economy can take various forms such as the sharing economy, the circular economy (Le Moigne, 2014) or the economy of functionality (Van Niel, 2015). These approaches and collaborative practices can then be seen as participating in this economy of frugality (Radjou and Prabhu, 2015), or even happy sobriety (also called voluntary simplicity, Boisvert, 2005).

In sum, in agreement with certain values of the new economy (McDonough and Braungart, 2011), fab labs are part of a broader desire to decrease (Sempels and Hoffmann, 2012), to combat planned obsolescence (Geldron, 2013) and challenge traditional neoliberal dogmas (Rifkin, 2014), given the need to reduce the impact of hyper-consumption on the environment. This new collaborative economy also supports the sale of the use of the good and not the good in itself in an ecological perspective and sustainable development (Gaglio and Lauriol, 2011).

At first glance, fab labs seem to bring a lot of benefits and are part of a modern trend to restore a certain sharing and democratization of knowledge. However, these places also include risks of deviance that must not be ignored.

RISKS INCURRED BY FAB LABS: BETWEEN DESKILLING OF KNOWLEDGE AND NEW OCCUPATIONAL RISKS

Fab Labs, A Risk Of Skills Disqualification

Fab labs are part of the do-it-yourself (DIY) movement (Kuznetsov and Paulos, 2010; Rognoli, Bianchini, Maffei, and Karana, 2015; Tanenbaum, Williams, Desjardins, and Tanenbaum, 2013). This DIY is often celebrated for the potential it holds for the democratization of knowledge, for the development of citizen-made manufacturing, for the empowerment of ordinary people and for its educational, economic and socio-cultural value (Wolinsky, 2009).

In addition to apologizing for a new way of “doing”, fab labs also develop ways to communicate, domesticate, “trivialize”, that is to say to make more accessible and democratic “do it yourself” movement. The DIY then embodies the sharing of data and knowledge, as well as the opening of knowledge gates hitherto reserved exclusively for technological institutions. The DIY also advocates the entrepreneurial spirit, the community spirit but also an underlying form of rebellion, individualism and mistrust of bureaucracy (Delfanti, 2010). Fab labs can indeed cause some risks. Thus, by facilitating Do It Yourself and Make almost anything (Gershenfeld, 2012), these places could eventually contribute to the uberisation of knowledge (Scaillerez and Tremblay, 2017a). It would then be a negation of skills acquired by some in favor of a pseudo-universal knowledge.

Previously, it was almost unthinkable that individuals could manufacture a multitude of products by themselves because the purchase of technological equipment was expensive, difficult, rare, if not impossible. However, the affordability and availability of scientific equipment has increased significantly in recent years. There are now various ways in which the cost of setting up a community manufacturing workshop becomes more affordable through the purchase of used equipment in particular. The possibility offered by these fab labs to construct or build by yourself such goods (3D printer, DIY tools, mechanics, carpentry objects ...: Devendorf and al., 2016) could then contribute to a loss of levels of technical expertise (advanced technical and craft skills) and real skills of professionals to the benefit of a generalization of amateur creations. Fab labs can then raise some concerns, since it can be dangerous to tinker with technology outside scientific institutions and this can lead to potential risks for people and the environment. One could then fear a deskilling effect of the actors who use these places and their devices, but also risks of injury or health with non-standardized instruments. It may be necessary to frame these new forms of activity emanating from digital, or at least the resulting products.

Fab Labs, a Risk of Deterioration of Work and Health

Practices that are explored in fab labs carry a culture of “doing”, rapid experimentation and sharing, to a degree that depends on the forms considered (Lallement, 2015). Promoting autonomy and collaboration, these practices have also triggered a shift in working relationships. One of the aims is to undo the hierarchical relationships of previous systems to install more horizontal, participatory and open modes of cooperation.

By bringing the Make almost anything into private garages the boundaries between amateurs and experts, between scientists and citizens, between universities and homes are potentially reconfigured. Other limitations become particularly salient and problematic through these changes: between responsible and criminal uses, between safe handling and dangerous experiences, between the garage and the outside world. Indeed, various health devices or dangerous arms could be easily created, and this surely needs to be controlled.

SOLUTIONS AND RECOMMENDATIONS

This new economy, driven by technological advances and the increase in the number of fab labs around the world, could also lead to certain deviances such as increasing, or even creating new occupational risks, or degrading working conditions, by facilitating the penetration of work in all spheres of life of the user of these places. These excesses would go against the primary reasons why fab labs were created. It would be necessary to establish a regulatory framework. For the moment, all the writings on this theme, whether it be the ministerial reports, the jurisprudence, or the texts of law on the international scale, do not really address any of these issues (Scaillerez and Tremblay, 2016 and 2017a).

FUTURE RESEARCH DIRECTIONS

With regard to fab labs, there is a lack of dissemination of information that could partly explain why these places are still very little known and used mainly by certain categories of the population (analysts, programmers, designers ...). However, fab labs could serve everyone (artisans, traders ...) and participate

in the revitalization of several forms of very diverse territories (rural areas, small towns, remote areas), although they are for the moment rather concentrated in large cities (Tremblay & Scaillerez, 2020)

In addition, most writings dealing with the notion of fab labs are essentially composed of studies and field surveys of concrete achievements, but there is little analysis, let alone confrontation with a precise framework of analysis. Above all, there are a large number of descriptive studies written by technology professionals. Research on fab labs is for the moment composed of very technical studies on high technology or hard sciences like biochemistry, but the studies in human sciences and those intended for the popularization of the subject are few.

One can even add that most publications tend to be very favorable to third places, and rather uncritical. On the other hand, the possible limits, risks of deviance, malaise and other dysfunctions that one could meet in this type of place tend to be neglected.

Finally, studies on the relationship between fab labs on the one hand, and innovation and entrepreneurship on the other are emerging, but research on the subject is still in emergence, so for the moment it is impossible to conclude on their results, as well as on significant impact in these two areas.

CONCLUSION

Fab labs could be of greater importance in the coming years, given the proliferation of fab labs around the world. This new craze testifies that these laboratories deserve special attention because they can provide precise answers to certain societal and economic issues. However, the implementation of these new forms of work and collaborative sharing can lead to a number of risks and raises new questions that have not yet found their solutions. If some of the people behind these labs see them as a more democratic mode of access to various technologies, exchanges of knowledge and workplaces, tensions and risks can sometimes appear between users and call into question the associated advantages to their democratization.

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KEY TERMS AND DEFINITIONS

Collaboration: Behavior resulting from exchanges, mutual aid and sharing of skills between manufacturers, as well as the provision and sharing of materials (tools and materials) present in the fab lab to create a manufactured object in common by the users of the place.

Exchanges: Sharing of knowledge and experiences between manufacturers in order to develop forms of manufacturing in the best conditions.

Manufacturer-e-s: All persons (experts or amateurs) who use the fab lab and who wish to manufacture a material or immaterial object.

Manufacturing: In a fab lab, manufacturing corresponds to a material object (3D printer ...) or intangible (software ...) developed by the manufacturers present in the place.

Manufacturing Laboratory: A place that welcomes all types of manufacturers by providing all of its tools and materials, while creating a climate conducive to exchanges and collaboration.

Mutualisation: Pooling of all skills, all tools (cutting machine ...) and all materials (wood board, paper ...) in order to encourage collaboration and manufacture between manufacturers.

Skills: All the knowledge, experiences, know-how and mutual expertise held by users of a fab lab in order to create a collective manufacturing.

The Role of Networks in Local Governance

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INTRODUCTION

In this historical phase in various European countries, we are assisting to a redefinition of the competencies among different level of governments; this decentralization involves a redistribution of power, authority and monetary resources towards lower level of government implying so new arrangements in the relationship between these different authority structures (Haveri 2006). This process defines a framework characterized by a high dispersion of authority and competencies which are fragmented among these various levels around which the governance issues are organized, determining so that arrangements of power, competencies and relationships that is called multilevel governance (Hooghe and Marks 2003; van Popering-Verkerk and van Buuren 2016).

The devolution of powers, authority and resources which is at the base of the multilevel model, feed the amplification of fragmentation that is a distinctive feature of new governance systems; an unavoidable produced by the need to foster and improve specialization and bring services production/supply as close as possible to citizens (Peters 1998; Hooghe and Marks 2003; van Popering-Verkerk and van Buuren 2016).

As a result of this state of affairs, the great challenge that local governance is facing at the moment is the quest for coordination and cooperation between and within governance levels and among different actors (Peters 1998), otherwise every effort to realize a more efficient and effective governance model could be useless (van Popering-Verkerk and van Buuren 2016).

If we take in consideration, for example, the production of public services at the local level, we can appreciate that inter-municipal co-operation and interaction networks are becoming more relevant (Haveri 2006; Klok et al. 2018; Previtali and Salvati 2018), requesting the effort to foster new organizational models and instruments for coordination.

These networks which can represent different levels of government and/or different actors within the same territory, may be characterized by the simultaneous presence of different interests, power asymmetries, conditions of interdependence and organizational differences. Such a concept defines an organizational innovation that implies for public (local governments, public administration) and private actors (citizens, associations, profit and non-profit organizations) both challenges and opportunities.

The broader aim of the chapter is to identify some of the main features that characterize these networks, which are their goals in the framework of the occurring changes to local governance, trying to sketch which is their role and the opportunities connected to this organizational innovation for public administration and the implications for the connection between p.a. and social actors, as it is well represented by a particular experience of governance network like the one of the inter-municipal cooperation.

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BACKGROUND

The Governance Concept: a Useful Tool to Understand Networks' Functioning?

The scientific debate on network cannot be totally disconnected from the one on governance, a field of research that has become extremely popular in the last decades, in particular in its stream of research connected to the New Public Management's approach that, briefly said, was based on the strong assumption of a reduction of the Government and public sector's role in services provision (Klijn and Koppenjan 2000; Klijn 2008; Klijn and Koppenjan 2012).

The most known definition of governance is the one provided by Rhodes (1996) that defines it as a system of self-organizing and inter-organizational networks which has changed the old hierarchical bureaucratic model of power and authority centralization typical of the modern state. The adoption of informal practices and organizational provisions by the private sector is characterizing the new governance model that stresses the role of multiple relationships between public and private actors. Such an organizational perspective allows to understand the changing process in governing and policy making, with new arenas in which policies are defined/implemented and multiple actors within them that can contribute to their definition and implementation (Montin 2000). Relevant is the emphasis posed on processes rather than on structure and on the diffusion and fragmentation of power and authority.

Following the literature review on governance made by Klijn (2008, 507-508) four strands characterize this field of studies:

1. governance as corporate governance which refers to the function of public administration;
2. governance as new public management or market governance, which is focused on the analysis of performances and implementation;
3. governance as multilevel governance pertaining the study of networks across various levels;
4. governance as network governance that focus on the interaction between different organizations within a complex pattern of (multitier) relationships.

Considering the main features of governance like the presence of both informal and formal relationships, involvement of both public and private actors, multiple connections between actors, seems difficult to consider it not strictly related to the network model, which is the direct product of dynamic processes and continuative interactions among actors (Klijn 1996; Klijn and Koppenja 2000; Verveij et al. 2013).

As wisely pointed out by Klijn (2000; Klijn and Koppenjan 2012) it is not necessary to create a distinction between governance and governance networks because the first is an ongoing process that happen within the "boundaries" created by the governance networks. In fact they are both defined as the "public policy making and implementation through a web of relationships between government, business and civil society" (Klijn 2000, 511). What emerges from the connection between the concepts of governance and networks is the fact that networks are a specific arrangement of interdependencies and relationships between actors that allows governance to deploy its self-steering and self-organizing capacity (Klijn and Koppenjan 2012).

Network as a Theoretical Framework

During the last years network has become, like governance, a catch all term implied in a variety of ways and for different purposes, not always in a correct and pertinent mode: a situation that has contributed to feeding confusion and lack of clarity about the role of this concept and its heuristic and analytical potential.

According to scholarly literature we can identify two approaches concerning the explanation of what a policy network is (Börzel 1998): the first one is referred to the “interest intermediation school” and conceives policy network as an arena for interests intermediation, the second one is related to the “governance school” and defines network as a governance arena in which independent organizations co-ordinate themselves, pool their resources and define precise mechanisms in order to define and/or implement policies.

As stated by Börzel the two models are not mutually exclusive and frequently in the empirical reality they can be complementary, due to the fact that policy making is obviously influenced by governance arrangements (Lewis 2011). This connection is underlined also by Sørensen and Torfing (2007) which define governance network as a relatively stable horizontal articulation of interdependent actors which interact by the means of negotiation that take place in self-regulating framework. Furthermore Börzel sketched a minimum definition that conceives a policy network as a “set of relatively stable relationships which are of non-hierarchical and interdependent nature, linking a variety of actors who share common interests regarding a policy and who exchange resources to pursue these shared interests acknowledging that co-operation is the best way to achieve common goals” (1998, 254).

Linking together the character of governance relationships that are informal and non- hierarchical and of policy making as the result of the interaction process between multiple actors, Börzel pointed out two peculiar elements of a network arrangement: the fact that it is a relational concept (it needs at least two actors to take place) and that it is intrinsically dynamic in its nature. This dynamism underlines that the network is first of all a process, determined by actors’ interactions which are steered by interests and power asymmetries (Klijn 1996; Haveri 2006). The stability of these interactions within the network is what defines its structure that is so the product of the cumulative effect of the ongoing relationships between partners (Klijn 1996).

Under this point of view network exists because (Klijn 1996): a) actors pool their resources, b) these actors become so mutually dependent from these resources (and of their sharing modality), c) it defines a model of collaboration and a common management of resources that contribute to institutionalize the network via the constitution of stable patterns of collaboration (i.e. the creation of institutions).

Klijn analysis perfectly shows the central role exerted by resources in defining network existence. Resources and their sharing are essential in order to allow to pursue collective outcomes and to guarantee to reach converging interests (Börzel 1998). Despite the fact that the final goal is improving cooperation, it is possible that the network could be characterized by an unbalanced distribution of these resources, so leading to the creation of power asymmetries. The fact that interdependency is the main character of a network means that the actors need one another, but it does not preclude differences and unbalance. The degree of dependency and the number of relationships can vary according to various elements like the actors’ goals, the willingness to use their resources, the level of mutual trust etc. (Scharpf 1978; Klijn 1996; Börzel 1998; Haveri 2006).

Under this point of view, collaboration between actors within a complex model of networks can be primary conceived in terms of structures and processes which create the environment within which actors can allocate resources in order to reach the defined goals and to better coordinate their activities (Vangen et al. 2015). Consequently the capacity to have a steady and continuous flow of information between

actors, which guarantees a channel of information and avoids huge asymmetry among partners, it is a crucial element to understand how a network is managed and how effective its leadership is – especially in more complex systems - (Vangen et al. 2015; Cristofoli et al. 2017).

The degree according to which this condition of interdependency may vary can be defined as the gap in the strategic power of the actors (Stoppino 2001). The more one (or more) actor has a dominant position in terms of owned resources and willingness to imply them and the more another actor(s) has scarcity of disposable resources and difficulty to fully imply them, the easiest is that the network can move towards a condition of domination and dependency instead of coordination and interdependency.

The type of gap in the strategic power also influences the strategic interactions among the actors and so the output of these games, making the uncertainty a characterizing feature of the functioning of the networks (Klijn 1996; Haveri 2006). Uncertainty will be higher: a) the more complex the tasks and goals of the network are, b) the less institutionalized the pattern of strategic interaction among the actors is.

Properly for the risk to incur in a series of uncertainties, it is necessary for the network to move towards institutionalization in order to reduce the opportunities for defection, free riding and exit, and guarantee conformity and cooperation for all the involved actors.

Networks' Tasks

The main goal of network arrangement is to (try to) reduce complexity and make the interactions among various actors easier (Hovik and Hanssen 2015). This 'umbrella task' gathers different goals that can be achieved through the network's actions: these goals can be all simultaneously pursued and achieved or they can only be partially reached, what is characterizing is that all of them can be pursued only by cooperation.

Governance network is so the result of the various strategic interactions between partners and of the agreement among them in order to define rules, common settings, tasks and instruments useful to assure a shared enjoyment of the pooled resources (Klijn 1998). There is a bidirectional relationship between network and organizations because they mutually influence one another. As stated before, the interactions between membership organizations – cooperation, conflict, strategies - define the borders of the network, and the network provides an arena with ties and opportunities within which the actors cooperate and strategically act (Thelen and Steinmo 1992). This is the connection that we can find between structure and agency in the terms carried on by, for example, the historical institutionalist approach. According to this stream of research actors are strategic in the sense that they want to realize certain goals or gain certain rewards and they do so in context – the institutions - that make the use of certain strategies compared to others more effective (Hay and Wincott 1998).

Following this premise, the first task is the creation of stable patterns of action between the members of the network in order to pursue the reduction of uncertainty and transaction costs as much as possible (Borzel 1998; Turrini et al. 2010). This can be reached by the definition of a common framework of stabilized rules, behaviours, procedures etc. as the institutionalized product of the strategic interactions among partners (Klijn 1996). These interactions gather not only the interests of the single actors but also the connections defined by mutual trust, the formal/informal communication and the sharing of resources. All these elements are useful to enforce the institutionalized rules and make more predictable individual behaviours.

The second task is the effort to reduce the level of fragmentation by stimulating coordination among actors (Kazepov and Barberis 2013; Hovik and Hanssen 2015). Coordination does not necessarily imply

a homogenization of interests and goals but is more related to the need to reach a new way to organize the governance structure and to plan and supply services.

The third element is the ability to produce collective outcomes which are both the product of a conciliation of different interests and the capacity to achieve better results by improving policy's effectiveness (Börzel 1998). The institutionalization of networks allows to solve cooperation dilemmas and guarantee the conformity of actors to collective decisions.

A final element concerns the stabilization of a constant flow of resources and the definition of common rules (Turrini et al. 2010). For the survival of a network it is fundamental to guarantee a stable exchange of resources among the involved actors (Klijn 1996); an exchange that determines the degree of interdependence within the network. Furthermore it needs rules which are generalizable procedures that provide actors with ties and opportunities within the network. Formal and informal rules are the elements that stabilize conformity, regulate the interactions among actors and assure a proficient cooperation to actors because they provide stability to the environment in which network members operate.

Beside rules and stabilized patterns of cooperation, it is fundamental the role of the leadership and network management to guarantee coordination, even despite differences in interests and difficulties in cooperation (Cristofoli et al. 2017). It is the leadership that can decisively contribute to create new models of cooperation within a governance network, in particular by fostering trust among the partners and stimulating cooperation (Ansell and Gash 2012; Hartley et al. 2013) due to the relevant impact that managerial strategies have on trust and its enforcement (Klijn et al. 2010) and on uncertainty reduction.

Leadership/management has the duty to steer the network dynamism and to guide the process of cooperation by supporting the policy making process, activating resources and reorienting networks' tasks according to the different needs and the mutate external conditions (Turrini et al. 2010).

The Transformation of Local Governance: Between Fragmentation and Coordination

One of the main aspects concerning the transformation that is occurring to local governance and to public services production (especially in sensitive sectors like social and healthcare policies) is the enforcing process of territorialisation which has as its main feature the task to bring public services as close as possible to citizens, enforcing the effectiveness and the personalization of the services, but also transparency and participation for citizens and associations (Bifulco and Centemeri 2008; Andreotti et al. 2012; Previtali and Salvati 2017).

Local governance is a phenomenon that is undergoing several and continues paths of change that necessary pertain to the relationship that occur with society and territorial actors; an extremely relevant issue if we consider that (local) governance implies also the joint self-steering capacity of a given territory (Peters 1998; Bouckaert et al. 2002).

Undoubtedly transformation in local governance is the product of the changes occurring to contemporary societies (Bouckaert et al. 2002) but it is also the result both of the changes occurring to the local government model and of the competencies attributed to local actors (public and private) (Rhodes 1997; Peters 1998). As pinpointed by Haveri (2006, 33) local governance is a concept which defines 'the many changes that can be seen in the way municipalities and other local-level actors solve problems and respond to societal challenges at local level'. What is more important – at least for the purpose of our focus - is the fact that at the core of the new model of governance relies the need for actors to seek, feed and guarantee new strict and effective instruments of cooperation which by pass the traditional hierarchal organization of authority (Haveri 2006; Verweij et al. 2013).

Under this point of view the public actor is becoming more and more involved in building cooperation and partnerships with social actors, Third Sector and other local authorities in order to produce new services, employing a course of action that can be defined as the effort to build governance networks (Haveri 2006; McGuire and Agranoff 2011; Previtali and Salvati 2018).

This model perfectly resembles what, generally speaking, means Rhodes when he wrote about governance (1996), in particular because this concept allows us to understand how services production and delivery is now characterized by the active presence of the private and voluntary sectors (1996, 658) and by new inter-organizational linkages which, as outlined by the network theory, stimulate the opportunity to build new organizational instruments for coordination and resources' management.

This framework is characterized by a high dispersion of authority which is fragmented among different actors involved in decision making and in policy implementation (van Popering-Verkerk and van Buuren 2016; Previtali and Salvati 2018), and various levels around which the governance issues are organized and managed (Hooghe and Marks 2003; van Popering-Verkerk and van Buuren 2016). For these reasons the structure of local governance is gradually moving towards a major coordination among actors, creating governance arenas based on mutual trust, cooperation and pooling of resources, as explained by the network theoretical framework.

Over the last years different realms of service production have steadily shifted towards this organizational model. For this reason the network concept is useful to capture the shift occurred in local governance organization in the last decades: a movement from the classical bureaucratic and hierarchical structure of authority to a more informal net of actors – public and private – which at different level participate to policy formation and implementation (Lecy et al. 2014), and that encompasses both formal and informal rules and procedure (Klijn 1996; McGuire and Agranoff 2011; Lecy et al. 2014; Hovik and Hanssen 2015). The governance model produced by these arrangements is based on a complex system of multiple interactions between different actors – municipalities, public agencies, associations, Third Sector etc. – which are not able to reach their policy/interest goals alone. Aware of this limit, they improve coordination by the means of several interdependency nodes with the general task to realize common and shared goals. This improvement of coordination created by this arrangement is contributing to strengthen effectiveness in the throughput and the output phase (Schmidt 2013), which means to enforce both the processual and the implementation phases of decision making.

As stated before, in order to be effective, these networks are necessarily based on common and shared rules that guarantee the cooperation and the conformity of all the actors, reducing the risk of defection and/or exit. All these features make the network an institutionalized framework for co-ordination among multiple actors, in particular for what concerns the sharing of resources and interests (Börzel 1998): network partners are mutually dependent for the planning and realization of policies/actions and for producing and delivering services. As enlightened by Rhodes (1996, 658), “these networks are made up of organizations which need to exchange resources (for example, money, information, expertise) to achieve their objectives, to maximize their influence over outcomes, and to avoid becoming dependent on other players in the game”.

How these arenas are composed, influences the level of complexity within a certain network: the complexity tends to rise according to the level of interdependence among the actors, and the differences between them can be the product of different ideas about collective problems and/or solutions to these problems and also to the type of connections that link actors (Verweij et al. 2013; Hovik and Hanssen 2015). Following these premises, the best way to determine how the network is organized imply to know if the network: a) arranges horizontal instruments of coordination to improve cooperation (Scharpf 1978; Verweij et al. 2013), b) tries to imply some forms of centralized control (McGuire 2006), c) involves a

multilevel structure (which is not in contradiction with a horizontal logic of functioning) (Hooghe and Marks 2003).

Considering these issues at stake, we can affirm that network management is focused on the institutional and organizational arrangements implied to facilitate interactions, produce shared decisions and manage different interests and point of views from the various actors. These organizational instruments are more and more needed because a network model of governance requires an open approach towards the involvement of new stakeholders within the governance arena (Verweij et al. 2013), according to a horizontal model of cooperation in which it is difficult to detect a hierarchy between organizations.

The degree of openness within a governance network, especially at a territorial level, may vary according to two elements (Provan and Lemaire 2012): the first is the need not to open up the network with a mere logic of selective integration, that means the involvement of all those organizations which are linked together simply by broad interests (geographic, sectorial, political etc.), the second is the major or minor necessity to build strong or soft ties among the network members (i.e. if you need to provide some essential services, it is probable that you need to have strong ties in order to improve homogeneity and efficiency). Both these elements can be related to the governance structure which, according to its minor or major openness, can impinge on features like authority, influence, power, effectiveness, accountability and so on (Vangen et al. 2015).

One point worthily to underline is: the more the governance structure is open to different actors which can “come and go” according to their interests about the agenda, the more complex it will be to construct efficient instruments of coordination and to detect responsibility and keep the various actors accountable (Vangen et al. 2015). Conversely, for new actors entering in an established network it can be costly in the short-medium period because it implies an investment in terms of learning (about rules, norms, behaviour etc.) and relationships to be established (Klijn 1996).

These issues are at the core of the transformation now occurring to local governance: providing a solution for these organizational problems giving territorial actors the opportunity to effectively act in a coordinate way and so improving their effectiveness in services provision. This is the way the network model is becoming a prominent feature in local governance arrangements.

SOLUTIONS

It is easily understandable that governance networks fulfil numerous tasks of extremely relevant nature. One of the most prominent example of organization via networks is represented by inter-municipal cooperation which represents a rather important example of network coordination at local governance level. These arrangements are thought to tackle with inefficiency, allocation difficulties, problems in designing and implementing policies and fragmentation in resources, knowledge and services connected with conditions of elevated municipal fragmentation, in particular in situations characterized by a high number of small municipalities.

In such a framework the institutionalization of cooperation involves for municipalities some transaction costs like the necessity to monitoring the evolution of the agreement. Nonetheless it guarantees important outputs like the enhancement of municipal ability to produce and deliver services and so solve problems of effectiveness (Klok et al. 2018). The more these cooperation agreements are the result of a voluntary self-organization in creating a new system of inter-municipal collaboration and not an imposition from a higher level of government, the more it seems to be a valuable way to provide a valuable solution for fragmentation (Kwon and Feiock 2010).

For municipalities the creation of a governance network can be the collective answer to numerous individual problems, in particular thanks to a new scale level which allows to plan and implement innovative services in a more efficient way. Furthermore when we talk about inter-municipal cooperation we refer not only to the creation of an agreement between public actors but also to the direct involvement of private actors (profit and non-profit organizations, Third Sector etc.) which thanks to this new structure have the opportunity to directly cooperate with municipalities both in the planning and implementation phase of local policies (Bifulco and Centemeri 2008; Previtali and Salvati 2018).

The analytical framework provided by the network governance approach, allows us to understand the more recent deployment of public-public and public-private relationships in the context of local governance; a context in which there is not a simple externalization of competencies and duties to the private sector with the public actor relegated to a regulative function, but a permeation (a sort of fusion) between the two actors in order to better pool resources, produce a more efficient knowledge of the social context in which the network operates and plans more effective policies and actions.

Under this point of view the network governance arrangement provides an extremely interesting and valuable solution to collective action problems and services' provision. Network creates an environment in which different actors can share resources and produce policy decisions based on the mutual trust that is guaranteed by the formal and informal rules defined by the network. Furthermore it provides a new arena in which to plan and implement policies with the aim to supply new and more effective services: this is particularly important in fragmented contexts like in the local governance arena – a condition that mainly pertains to the administrative organization based on several municipalities - in which we have a proliferation of actors and a dispersion of resources.

In a framework defined by municipal fragmentation and dispersion of resources and knowledge, the high level of adaptive capacity proper of the network makes it a valuable instrument in order to reach collective goals, thanks to a deeper and better involvement of actors (Verveij et al. 2013).

Furthermore the network provides an extra competence for organizations to “stretch and leverage limited resources, enhanced learning, which leads to greater innovation and better service quality; (...) the ability to achieve economies of scale (...), the capacity to be far more flexible than a tradition bureaucracy” (Provan and Lemaire 2012).

Network seems to be a valid analytical framework by which to explain how different actors try to resolve both problems of fragmentation and goal seeking by institutionalizing a new model of governance based on the strengthening of the coordination phase. Coordination is the core topic in order to overcome the many problems produced by the inter and intra institutional fragmentation (Barberis and Kazepov 2013), in particular by providing arenas in which it is possible to produce cooperation mechanisms which have been severely undermined in the field of policy making during the last decades. The reconstruction of these mechanisms can allow to realize collective gains, improve effectiveness in policy making and also maximize utilities of the partners involved in the network.

The effectiveness can be measured by the network capacity to achieve the planned goals and provide solutions to collective problems (McGuire and Agranoff 2011). Certainly this is not a proficient way to measure network capabilities and potentials because there is, for example, the occasion that a valuable and good network pursues weak and poor tasks, so we formally have a good effectiveness but an under efficient use of network potential.

The main risk in which this process of change may incur is connected to the governance of the governance issue (Kazepov and Barberis 2013), a condition that in a context of multi-level governance “*can create perverse stakeholder engagement by creating rent-seeking practices*” (Milio 2014), and that can damage innovative forms of governance. In this situation, as stated by Previtali and Salvati (2018), gov-

ernance network could become an element of complexity, or even a crucial problem, more than a good premise for the functioning of cooperation. In our case we can say that the planning and policymaking process may be a victim of a joint – decision traps in which efficiency and innovation are subordinated to veto powers expressed by a different level/actors of governance (Scharpf 1988), in particular in a model in which horizontal co-ordination can create perverse mechanism by which is not possible to solve decisional issues (Börzel 1998), in particular in the absence of a leadership's role with a network.

A valuable solution for the “governance of the governance” problem is a specific and consolidated path of readjustment for local institutions, administrations and societal actors, of their goals, their organizational model defining a real process of institutional adaptation in order to better cope with the new social needs. This path can work only through institutional adaptability, that means the opportunity to combine the organizational continuity with the flexibility required to integrate and interpret the new inputs/demands/needs that come from the society and from the network partners (Previtali and Salvati 2018), finding an equilibrium between bargaining and decisions, between process and structure.

FUTURE RESEARCH DIRECTION

The article has attempted to show the evaluability of the network governance concept as an analytical tool useful to understand the changing patterns in local governance. A tool that seems extremely useful in order to observe and analyse the relevant topic of service provision at local level. Citizens' needs and social answers are changing and becoming more and more complex and for this reason it is necessary to have a new model of policy design which can boost coordination and reduce fragmentation.

Properly for what concerns these two aspects – fragmentation and coordination - the literature on network governance is inquiring the emerging trends that are characterizing the new historical phase of local government and governance. What is important to stress is that in no way a network can be conceived as an instrument to replace local government or government agencies but, as network literature underlines, this peculiar organizational arrangement can have positive effects on policy effectiveness determining a new role for public actors as positive leading partners (Skelcher 2004; Turrini et al. 2010; McGuire and Agranoff 2011; Previtali and Salvati 2018). A new role that can overcome the marginalization of the public sector theorized by New Public Management and repair the negative externalities produced by its hegemonic approach (Klijn and Koppenjan 2012).

Under this point of view we have numerous examples of successful network organizations that helped improving coordination among actors and the effectiveness of their action. Among many we can quote: the Italian experience of the Piani di Zona as inter-municipal arenas with the task to jointly plan and deliver services in the social field (Bifulco and Centemeri 2008; Previtali and Salvati 2018); the inter-municipal cooperation among Aragon small town municipalities for what concerns the delivery costs of urban solid waste services (Bel and Mur 2009); the case of multilevel network coordination for the management of the climate change effects in Norway (Hanssen et al. 2013).

The merging trend that probably should be studied with more attention is properly the role of government (at every level) and public actors within the network. How is it evolving and changing? Is it still moving towards a role of facilitator and co-operating partner? Is there a new centrality of public actor after the era of the New Public Management?

So, what is central and fundamental in every study – both theoretical and empirical – concerning networks is the inquiry of the model of intergovernmental and inter-organizational collaboration (also in a multilevel facet). One of the main research question should be how different networks build models

of coordination in the presence of scarce network own authority (ie no possibility of imposition from a central actor) and power asymmetries. Or even a reflection about the presence of possible hybrid governance structure composed by different arrangements (Klijn and Koppenjan 2012). From a certain point of view this stream can be reconnected and partially encompassed to one of the research clusters about network identified by Leczy et al. (2014) concerning the governance, which is sided by the ones about policy formation and policy implementation. Keeping in consideration that our focus is mainly on governance structures, it is unavoidable that it intersects both with policy formation and implementation, two phases that are influenced by the way in which the network is conceived.

Furthermore it could also be extremely interesting to reflect about the relationship that occurs between network organizational arrangements and outcomes/performance effectiveness (Klijn et al. 2010; Turrini et al. 2010). Which structural (rules, resources distribution, trust etc.) and/or processual elements (relationships, policy implementation etc.) contribute to the success/failure of a network? Is it, for example, possible to connect level of trust and leadership/management styles with network type of outputs?

From a methodological point of view is worthy as stated by Lewis (2011) to combine different approaches (from organizational studies to political science, sociology, anthropology, economics etc.) and methods (both qualitative and quantitative) in order to better capture a phenomenon that is in continuous evolution.

In a nutshell we can say that the research on network still has a great space for inquiry and this is probably connected to its dynamic nature and the fact that it is an arena open to different type of contributions but that can easily be fostered according to the various context and to the different needs expressed by the involved actors.

CONCLUSION

We have seen that the network concept is useful to analyse and understand for which reason and by which organizational arrangements, independent organizations (both public and private) decided to pool in common their own resources, coordinate their actions and institutionalize their cooperation by the creation of linkages, rules and routinized behaviour (Klijn 1996, 2008; Börzel 1998; Klijn and Koppenjan 2000).

For this reason networks can be considered as an organizational form of governance useful to respond to societal specialization, fragmentation and differentiation: a state of affairs that in the complexity of modern times can lead to grid lock in the absence of effective coordination mechanisms. Functional and territorial differentiation, the fragmentation of competencies and authority/resources, the growth in the number of relevant actors which take part to the decision making process, are all issues that contribute to create subsystem of sectorial specialization with limited competencies which limited the problem solving capacity. The unavoidable output is the interdependence of actors and resources and the need to create coordination mechanism in order to solve collective problems. The need of coordination, mobilization of social resources and a more effective model of decision and implementation has led to the enforcement of networks.

Networks allow to pool and mobilize dispersed social resources, through coordination they guarantee the conformity and cooperation of involved partners and enforce the relationship between public and private actors with a non-hierarchical and interdependent model of governance (that can be both horizontal and/or multilevel).

So networking can be interpreted as a solution for a collective action to problems in a peculiar context like the local governance, where in presence of extreme level of municipalities fragmentation, disper-

sion of resources and multiplicity of actors represent a striking issue when we look at, for example, to cogent social policies like the fight against poverty, social exclusion and social housing (Barberis and Kazepov 2013). Policy issues in which the size of municipalities, their ability to reconnect actors and mobilize resources are all strategic themes in order to effectively plan and supply services. This problem enlightens the urgent need to provide new institutional instruments of governance, that allow those actors to act in a more effective way, overcoming the institutional deficiency produced by a fragmentation, that in a certain context can be defined as pathological.

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KEY TERMS AND DEFINITIONS

Coordination: The activity to organize according to a task, a role and/or a duty different actors/organizations involved in a cooperative action.

Fragmentation: The division of actors/resources/knowledge and services in different streams that make complicated the cooperative action.

Institutionalization: The creation of stable patterns of action and behaviour, based on routinized formal and informal rules.

Network: A model of cooperation between different actors based on the pooling of resources and the definition of common tasks.

Power Asymmetry: The unbalance of resources and authority among the actors which operate in the same network.

Process: The sum of dynamic interactions that occur among actors.

Structure: The stable framework within which actors operate. It defines ties and opportunities for agents' actions.

Territorialisation: The shift of resources, authority, and competences towards the lowest levels of government.

The Relationship Between Performance Measures and Overall Performance in the Manufacturing Environment

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INTRODUCTION

Globalization and liberalization of today's markets economy have posed new challenges to all manufacturing organizations to examine and improve their capabilities. Performance measurement systems are expressed as the overall set of factor used to quantify both the efficiency and accomplishment of the act. Performance evaluation and enhancement is a challenge for small scale manufacturing organizations in the competitive globalized world. Performance measurement represents the effectiveness and progress of activities involved in a manufacturing system. Performance measurement ameliorates the flow of information which avails in enhancing market position of the organization and may likewise fetch new customer (Li et al., 2006). Performance measurement helps in identifying both frail and solid key territory of the system and transmute should be possible in like manner. The overall performance of a manufacturing organization can be enhanced by thoroughly examine and monitor the activities of all departments such as production, inventory, maintenance, etc. involved in the manufacturing system (Gomes et al., 2006). The block diagram of manufacturing system is shown in Figure 1.

Important Performance Measures in Manufacturing System

The output of manufacturing system can be characterized by the final product, reputation and profit etc. The activities involved in the manufacturing system should have an influence on output and performance of the system. Researchers have explored the various factors influencing the performance measure of manufacturing system. The performance measures of manufacturing system are linked to the overall performance of the system. The flow chart of present work is shown in Figure 2. In the present work, only four performance measures are selected by brainstorming and expert's opinion while keeping in view the setup of small scale agricultural equipment manufacturing organizations.

Delivery Performance

Delivery performance is characterized as a height up to which customer demands are fulfilled by the organization within the expected time period. The continuous change in the operational environment, inventory level of raw material must be taken into account and the functional areas such as marketing and operation are having a significant effect on time delivery performance (Nakandala et al., 2013; Marques

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Figure 1.

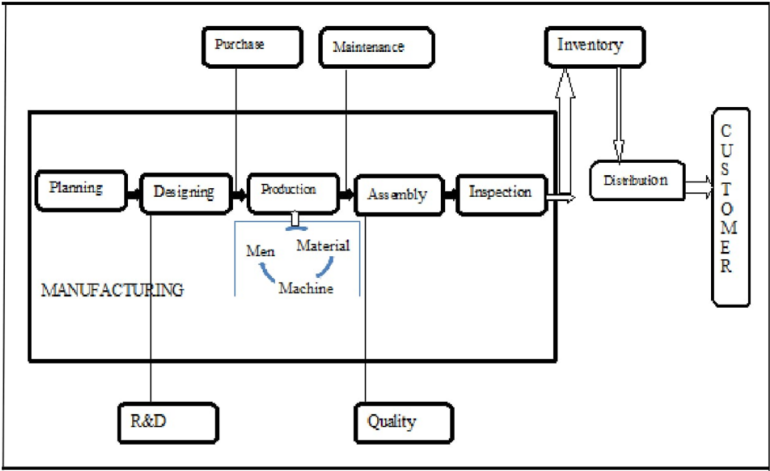
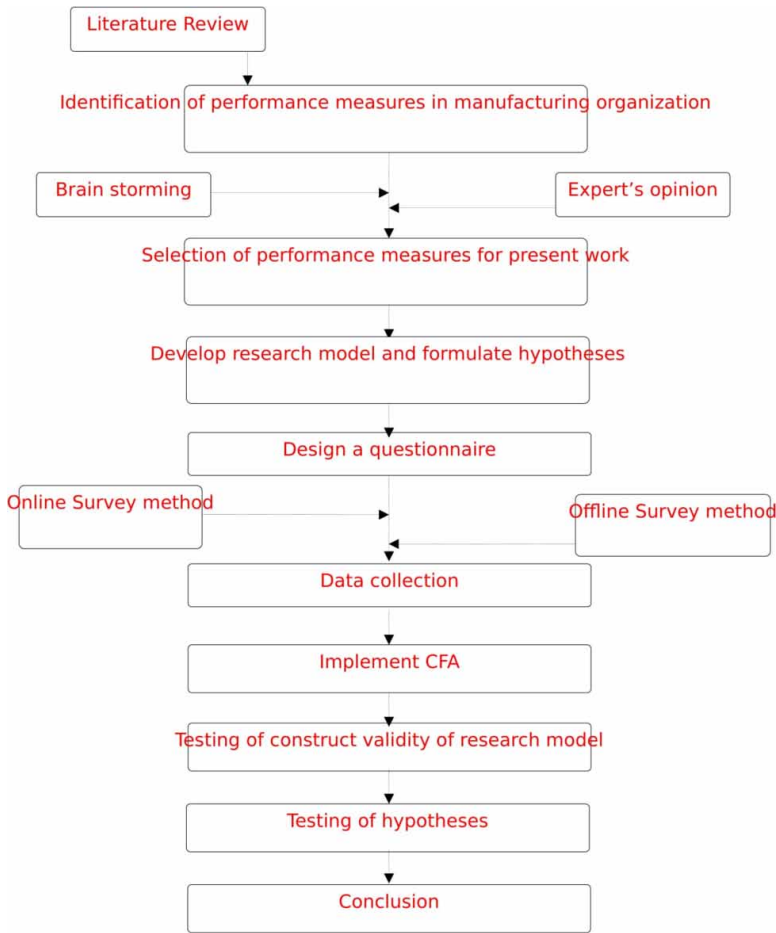


Figure 2.



et al., 2014). The delivery performance helps in diminishing the organizational costs and improves the customer satisfaction levels. The higher uncertainty in delivery time raises the inventory level and makes distinctive consequences on the working performance of the organization (Chen et al., 2006).

Operational Performance

A questionnaire based study of SMEs ensures the impact of innovation capabilities on operational performance (Minna, 2014). A strategy has been proposed to gauge and enhance the operational performance of an organization (Padavano, 2004). The involvement of supplier and customer are critical for upgrading the operating performance of manufacturing organization (Feng et al., 2013). The questionnaire study of Taiwan's manufacturers revealed that the certification of ISO 4001 help in achieving excellence in operational performance (Chung et al., 2005).

Employee's Performance

The effective training of workers improves the skill proficiency as well as employee's performance. The up gradation of employee talent helps in propelling productivity and enhances overall performance of the organization (Jehanzeb and Bashir, 2013). The lack of ability and lack of motivation are two key inhibitors in employee performance and exert ought to be made as needs be to enhance. The employee's performance can exceed expectation by developing creative and supportive working environment (Lee, 2006; Newman et al., 2011).

Customer Relationship Performance

It has been evident that fetching of the customer through a decent service quality help in keeping up the competitive position in the market (Izquierdo et al., 2005). Human resource management has a significant impact on customer satisfaction and organizational performance (Gómez-Cedeño 2015). The customer loyalty can be improved by customer satisfaction and decidedly identified to benefit (Helgesen 2006). It has been shown that there is a direct relationship between customer satisfaction and organizational performance (Wiele et al., 2002). It has been stated that market turbulence has a negative effect on the relationship between CRM practices and organizational performance (Mohamad et al., 2014). According to Zigan and Zeglat (2010), customer satisfaction and faithfulness are critical parameters for measuring non-financial performance of an organization.

The environment of manufacturing organizations is characterized by unpredictable market change due to the customer response. In the competitive globalization era, the manufacturing environment becomes turbulent and uncertain to meet the market expectation. Although, existing works show the relationships between parameters and output/performance of manufacturing system using statistical analysis. Researchers have successfully shown the relationship between success factors/parameters and different performance measures in various sectors such as banking, service, trading etc. However, the relationship between different performance measure and overall performance of manufacturing system has stayed unfamiliar. Therefore, an attempt has been made to explore the relationship between different kind of performance and overall performance of manufacturing system. An attempt has been made to explore the different performance dimensions of manufacturing system. The next chapter presents the extensive relevant review of reputed journal research papers and scientific information available in database.

LITERATURE REVIEW

A little work has been accounted for to demonstrate the linkage between different performance measure and overall performance. Gomes et al., (2006) explored the dimension related to organizational performance of manufacturing industry. The result showed that high performance manufacturing organizations are emphasis on performance aspects related to employees, customers and market share. Berrah et al., (2016) introduced an improvement contribution concept in the field of performance measurement. The presented framework helps in the decision making process in order to improve overall performance of manufacturing system. Elinger et al., (2000) examined the effect of interdepartmental integration in order to achieve better service quality. The result showed that effective relationship between marketing and logistics department improves the delivery performance of the organization. Gomes et al., (2004) concentrated on both financial and non financial measures in the context of performance measurement. It has been inferred that weight age of non financial measure should be more on the assessments of manufacturing performance. Valsamakis and Sprague (2001) presented the role of customer relationship in the performance of small and medium manufacturing organization. Quesada et al., (2012) examined the relationship between success parameters and performance of supply chain management. A survey based research on US pallet industry was performed to validate the proposed framework. Gunasekaran et al., (2004) and Rao et al., (2011) stated that delivery performance is a key metric in supply chain per-

Table 1.Relevant Literature Review

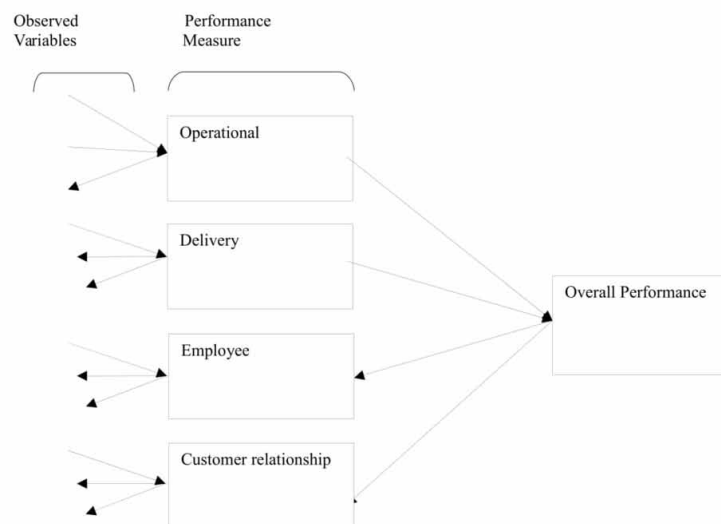
S. No	Author(s)	Year	Descriptions
1	Rezaei and Ortt	2018	· Explored the relationship between functional performance and overall performance. · SEM was used to test the hypotheses. · R& D and Production performance has positive relationship with overall performance.
2	Buli	2017	· Performed a survey research work consist of opinions of 171 SME managers. · Applied multiple and linear multiple regression were applied to test the hypotheses. · Integration of entrepreneurial and market orientations directly linked with performance improvement of small business.
3	Chen and Wu	2016	· Investigated the relationship between customer relationship management (CRM) and business performance. · CRM is directly effect on financial and non-financial performance in supply chain management.
4	Mamun et al.	2018	· Data collected from 360 manufacturing SMEs · Consumer engagement has positively effects on performance of manufacturing SMEs.
5	Ibrahim et al.	2017	· Data collected from 810 employees of nine private companies · Regression analysis was performed to test the hypotheses · Training methodology has significant effect on employee performance which turn in to overall performance of business,
6	Imran et al.	2018	· Data collected from 197 employee's working in services sector · Multiple regression analyses was used to find empirical findings. · Employee creativity has mediating effect on business performance through knowledge process.\
7	Rua el al.	2018	· Data collected from 247 SMEs · Explored various indicators of export performance in SMEs · Competitive strategy has no significant relation in small firms

formance measure and effective delivery performance help in achieving excellence in business. Minna, (2014) performed survey based research to explore the relationship between innovation capability and performance. The results showed that innovation capability has more impact on financial performance than operational performance. Coltman et al., (2011) examined the relationship between customer relation management (CRM) and firm performance. The result showed the direct relationship between CRM and performance. Pereira and Osburn (2007) made an attempt to find the impact of quality circle on employee attitude and performance. The finding revealed that quality management has more impact on job performance which results in improving the productivity of organization. The rest of relevant literature is presented in Table 1. The next chapter deals with the design of the study, which includes development of research model and formulated hypotheses.

MAIN FOCUS OF ARTICLE

Literature revealed that researchers have made successful efforts to examine the relationship between different performance measures and success factors. In this work, an attempt has been made to examine the relationship between four important performance measures (viz. operational performance, delivery performance, employee's performance, and customer relationship performance) and overall performance. The efforts of small scale agricultural equipment manufacturing organizations are mainly focusing on core activities i.e. production of products. The small agricultural firms has mainly the 5-7 shops viz. Welding shop, Sheet metal, Machining, Painting, assembly, inspection, where the workers have to perform tasks. Only few firms are using or recently purchased automatic machines in the sheet metal shop and desire to impart training to the workers on these machines during manufacturing weak days. The small scale

Figure 3.



agricultural equipment manufacturing organizations are involved in manufacturing of low or medium duty equipments such as cultivator, disc harrow, grass and stub cutter, etc. The overall performance of manufacturing is characterized by quality of the final product, financial output, reputation in the market etc. A path model consists of 12 observed variables, and four performance measures (latent variables) was developed and tested using SPSS software package and AMOS 21. The delivery performance (DPP) is linked with three observed variables viz. delivery correctness (DCR), delivery completeness (DCM), delivery precision (DP); the operational performance (OP) is linked with three observed variables viz. technological capabilities (TC), process efficiency (PE), flexibility (FL); employee's performance (EP) is linked with three observed variables viz. employee skill (ES), competitive strategy of worker (CS), ability to work in teamwork (TW) and customer relationship performance (CRP) is linked with three observed variables viz. marketing strategy (MS), service after sale (SS), customer satisfaction (CSS). The research path model is shown in Figure 3. The SPSS software package and AMOS 21 was used to measure reliability and confirmatory factor analysis (CFA) respectively.

Hypotheses Development

Hypothesis H_1 : Operational performance has a direct relationship with overall performance

Hypothesis H_2 : Employee performance has a direct relationship with overall performance

Hypothesis H_3 : Delivery performance has a direct relationship with overall performance

Hypothesis H_4 : Customer relationship performance has a direct relationship with overall performance

In next section, the research methodology is presented which includes data collection; data analysis and hypotheses of present work are tested.

DATA ANALYSIS

The objective of present methodology is to explore the relationship between four performance measure and overall performance measures. The four performance measures (viz. operational performance, delivery performance, employee's performance, and customer relationship performance) considered as latent variables. Data was collected through well designed questionnaire as shown in Appendix I. The questionnaire was thoroughly checked by professional before let it out individuals who are occupied with agriculture tool manufacturing firms situated in the northern region of India industrial. The most prevalent, likert scale (five-point) was used to get the importance of sub parameters on the overall performance of manufacturing organizations. . The outcome of the present work is reflected by the respondent of 105 valid questionnaires who are occupied with agriculture tool manufacturing firms situated in the northern region of India. The SPSS software package and AMOS 21 was used to measure reliability and confirmatory factor analysis (CFA) respectively.

Validation of Path Model

During survey based research, researchers should rely more on the AVE and composite reliability than cronbach alpha. Firstly, the research path model was judged for construct validity by examine the convergent and discriminant validity. The convergent validity was assessed by Composite Reliability (CR)

and Average Variance Extracted (AVE). Hair et al., (2010) suggested the acceptable range of composite reliability (CR) > 0.7 for reliability and average variance extracted (AVE) > 0.5 for convergent validity. The discriminant validity was assessed by comparing AVE and squared correlation between two constructs. The threshold value for discriminant validity is AVE > maximum shared variance (MSV); AVE > Average Shared Variance (ASV) and square root of AVE must be greater than bivariate correlation with the other constructs. The values of AVE, ASV, CR and MSV are shown in Table 2. The results of discriminant validity showed that square root of AVE are greater than bivariate correlation.

Table 2. Convergent and discriminant validity

	CR	AVE	MSV	ASV	CRP	EP	DPP	OP
CRP	0.783	0.549	0.167	0.109	0.741			
EP	0.864	0.685	0.211	0.109	0.324	0.828		
DPP	0.921	0.795	0.085	0.049	0.231	0.101	0.892	
OP	0.770	0.533	0.211	0.154	0.409	0.459	0.291	0.730

Goodness Of Fit For First Order Constructs

Lee et al., (2010) suggested the acceptance range of statics variables such as relative chi-square {chi-square value (CMIN) / degree of freedom (df)} < 2, comparative fit index (CFI) > 0.90; root mean square error of approximation (RMSEA) £ 0.10 and root mean residual (RMR) < 0.05. It was suggested to follow above mentioned range for an acceptable fit statics model. The values of CMIN, df, CFI, RMR and RMSEA have been calculated for first order CFA model. The results showed that values of goodness of fit for first order constructs are falling in the acceptable range as presented in Table 3.

Table 3. Goodness of fit

	Chi-square	Degrees of freedom	CMIN/DF	CFI	RMR	RMSEA
First order CFA	59.038	48	1.230	0.982	0.049	0.047
Second order CFA	60.688	50	1.214	0.982	0.054	0.045

Confirmatory Factor Analysis For Second Order Constructs

Step 1 Goodness of fit for second order construct

The values of CMIN, df, CFI, RMR and RMSEA have been calculated for second order CFA models and result showed that all values are falling in the acceptable range as shown in Table 3.

Step 2 Testing of Hypotheses

The second order CFA models have been analyzed to test all the hypotheses developed in present study. The results of second order CFA model 1 showed that all hypotheses viz. H_1 , H_2 , H_3 , H_4 are supported

Figure 4.

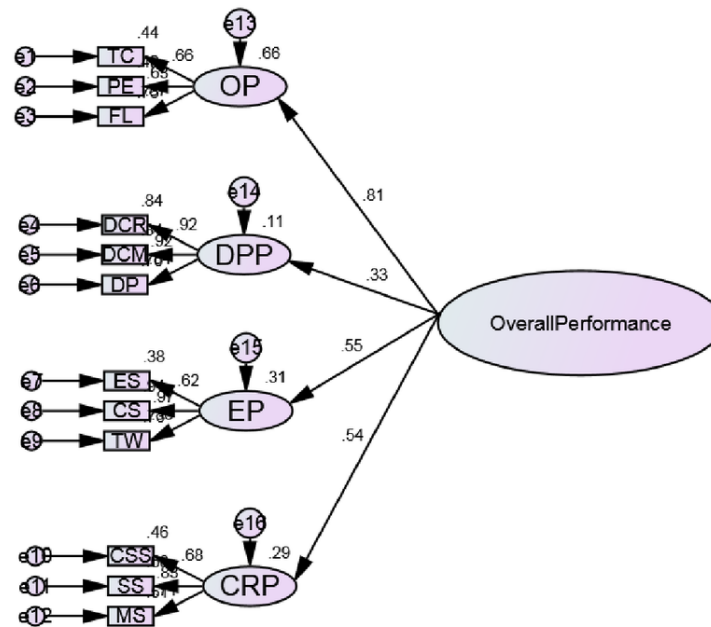


Table 4. Results of Second order CFA model

Performance measure	Regression Weights	Standardized Regression Weights	SE	CR	p-Value
OP	1.000	0.813			
DPP	0.659	0.330	0.286	2.304	0.021*
EP	1.169	0.553	0.391	2.921	0.003**
CRP	0.574	0.542	0.202	2.850	0.004**

Notes: * Indicates significance at the $p < 0.05$ level; * * Indicates significance at the $p < 0.01$ level; * * * Indicates significance at the $p < 0.001$ level

in present work. The values of path coefficient are summarized in Table 4 and path diagram results of second order CFA models are shown in Figure 4.

The result of second order confirmatory showed that each of the four performance measure (viz. operational performance, delivery performance, employee's performance, and customer relationship performance) are significantly related to overall performance. The result showed that overall performance explains about 66% of the variance in operational performance, 31% of the variance in employee's performance, 29% of the variance in customer relationship performance and 11% of the variance in delivery performance as shown in Figure 4. The operational performance has 0.813, employee's performance has 0.553, customer relationship performance has 0.542 and delivery performance has 0.330 value of path coefficient with respect to overall performance. The employee's performance and customer relationship performance are found statistically significant with p value < 0.01 and delivery performance is found statistically significant with p value < 0.05 . The last section concludes the research work as well as recommendations for further research.

CONCLUSION

The present study highlights the relationships between different performance measure and overall performance from the perspective of the agricultural tool manufacturing industry. The outcome of first order confirmatory factor analysis attested the significance of observed parameters in respective performance measure. The competitive strategy of worker, delivery completeness, service after sale and flexibility has higher path coefficient in their respective latent construct. This finding apprised that manager should give more accentuation on parameters which are having higher path coefficient in order to improve the performance of organization. The results of second order confirmatory factor analysis ascertain the significance of considered four performance measure (viz. operational, delivery, employee and customer relationship). The paramount finding of the present work is that operational performance and delivery performance has higher path coefficient and lower path coefficient respectively. The present work presented eminent findings for managers as presented standard regression weight of each performance measure with respect to overall performance.

LIMITATIONS AND DIRECTIONS FOR FUTURE WORK

The outcome of present study depends on the sample of the respondent which is limited to manufacturing firm; it is worth testing the validity of the research models in other business sectors such as service and process industries etc. The effect of government policies and cultural issues is not being considered in this research work and can be another issue in future research work. The modified research path model showing mediating relationship between success factors and multiple outputs can be explored in future. There is major future scope in relation to elaborate each performance measure and respective parameters exhaustively.

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KEY TERMS AND DEFINITIONS

Average Variance Extracted: Measure of the amount of variance that is captured by a construct in relation to the amount of variance due to measurement error.

Competitive Strategy: Makes an entity better than opponents in order to achieve the goal.

Composite Reliability: Measures the overall reliability of a set of items loaded on a latent construct.

Customer Satisfaction: Quantify the degree to which a customer is satisfied with a product, service.

Delivery Completeness: Number of order deliver completely, that is, without any part delivery.

Delivery Correctness: Complete number of order delivery to the customer without any error.

Delivery Precision: Order reach to the customer at agreed time, that is, without any delay order.

Employee Skill: Ability and capacity acquired by an individual for doing job functions.

Flexibility: Capacity to adjust to changing conditions and necessities.

Marketing Strategy: Moving toward individuals and transforming them into clients for a business.

Process Efficiency: Value of outputs divided by the value of inputs for a business process.

Service After Sale: Arrangement of administration and support after deal.

Teamwork: Workers join their individual abilities in pursuit of a goal.

Technological Capabilities: Capacity to apply information into items and procedure to work and to create technology.

2

APPENDIX I

Questionnaire

Exploring the Relationship between Performance Measures and Overall Performance of Manufacturing System

PERSONAL PROFILE

Name: _____
Email ID: _____
Employer Name: _____
Job Profile: _____
Highest Qualification Attained: _____
Work Experience: _____

		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Rate the effect of Delivery performance on overall performance of manufacturing system						
Delivery performance	Delivery correctness					
	Delivery completeness					
	Delivery precision					
Rate the effect of Operational performance on overall performance of manufacturing system						
Operational performance	Technological capabilities					
	Process efficiency					
	Flexibility					
Rate the effect of Employee's performance on overall performance of manufacturing system						
Employee's performance	Employee skill					
	Competitive strategy of worker					
	Ability to work in teamwork					
Rate the effect of Customer relationship performance on overall performance of manufacturing system						
Customer relationship performance	Marketing strategy					
	Service after sale					
	Customer satisfaction					

A Model for Success in Agribusiness in the Portuguese Context

2

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INTRODUCTION

Over time, agricultural enterprises face a number of challenges in order to succeed. In the context of the area under investigation, Boehlje, Akridge, and Kalaitzandonakes (2002, p. 31) refer that:

“Successful agribusinesses will face eight key challenges in the agriculture of the future: globalization, adding value, achieving profitability, defining organizational capabilities, adapting to change, dealing with technological innovation, securing competence and intellectual capital, and achieving organizational transformation.”

In an increasingly digital environment that results in the technological advance of the fourth industrial revolution, referred as Industry 4.0, it becomes interesting to understand the agribusiness success in the Portuguese context, whether enterprises use e-business¹ or not, because all over the world business and government are preparing for this transformation.

The present research may be relevant in a country such as Portugal, because this country has been experiencing a serious economic crisis and to understand the success could be necessary for the agricultural sector to be competitive in an economy digital and boost economic growth. Another reason is that there has been a growth in agricultural production in Portugal in recent years, due to incentives through project funding and government support for the unemployed and young people. However, the lack of competitiveness becomes a problem of the agribusiness sector of Portugal. In this context, it is important to discover and analyze factors with impact on the agricultural business success, so that managers have more information available that can be useful for the definition of future strategies, in order to be more successful.

Given the importance of agribusiness success in a digital economy, the aim of this chapter is to develop a theoretical framework for agribusiness success in Industry 4.0, centered on a holistic approach. The researcher prepares a review of relevant literature on the subject, based on the knowledge of multiple disciplines that contribute to understanding the agribusiness success. The literature review reveals a wide range of research on growth, productivity or performance business and therefore on success. In addition, many of the models in the literature on success focus only on the impact of alignment on success, on e-commerce or only on companies that adopt e-commerce, in internationalization and characteristics of the entrepreneur/CEO/manager along with other organizational and environmental factors. However, these factors of success aggregates may be relevant to agricultural business success, whether they use e-business or traditional business.

Although success is a subject discussed in the literature, it is not yet clearly developed for agribusiness sector and this can be important for the national economy. In agribusiness, Clasen and Mueller (2006)

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analyze the impact of market characteristics on success for companies included in digital markets. The lack of research in this area and the focus of author's interest in the agricultural sector motivated this research.

This article contributes to research on success, since it develops a conceptual model of success for agribusiness, in three dimensions: growth, productivity and performance, based on a holistic approach. Having a broader view than the models found in the literature on success and suitable for companies that use e-business or not, in the specific context of agribusiness.

This chapter is structured as follows: the next section presents a synthesis review of the literature on measures for business success. The second section explores determinants with impact on business success. The third section presents the future research directions. The final section provides discussion and a few concluding remarks.

BACKGROUND: AN ANALYSIS OF THE LITERATURE ON BUSINESS SUCCESS

Success: Definition and Overview

Success is a broad term and conceptualized in different ways. According to the Oxford Dictionaries (2019), success can be understood as “the accomplishment of an aim or purpose”. Generally, success is understood as the achievement of goals and objectives for any sector of human life (Chittithaworn, Islam, Keawchana, & Yusuf, 2011; Islam, Khan, Obaidullah, & Alam, 2011). However, in the field of agribusiness enterprises, success is understood as the achievement of goals and objectives established by entrepreneur/CEO of agribusiness enterprises. Success is surviving in the business for a considerable time (Alom, Abdullah, Moten, & Azam, 2016) or a multidimensional construct that can be evaluated at the level of the system, individual or organizational (Molla & Licker, 2001).

It is possible to classify success regarding several criteria. For Chan, Sabherwal, and Thatcher (2006), success concerns the organizational performance and is measured in a single measure that incorporates various items comparing the company to competitors. Von Gelderen, Frese, and Thurik (2000) use measures of economic and personal success. Reijonen and Komppula (2007) suggest professional satisfaction and satisfied customers as criteria for measuring success. Success has a different meaning, for different companies, at different times (Bissessur & Alamdari, 1998) and can change in magnitude and over time (Trkman, 2010). It is a constant challenge for both management and researchers to measure business success (Hult & Ketchen Jr., 2001). Success has been measured in several different ways in the literature, as can be seen from Table 1.

The researcher decides to choose the enterprise growth, productivity and agribusiness performance. Unger et al. (2011) used the growth, size and profitability dimensions in their meta-analytical review. However, in this study the size is excluded because it is a control variable. In addition, agribusiness performance is added, measured through the perception of the manager. The managers' perceptions are important because they can support the future strategic decision-making for organizations, then opts to measure it through subjective measures – agribusiness performance perceived by managers. Moreover, instead of profitability the concept used is enterprise productivity. Sales per employees are more direct measures of profitability that is obtained from the Table 1. Productivity is the measure found in the literature most developed for the e-commerce endogeneity and it is represented through the sales per employees.

Table 1. Measures of success

Success	Schutjens and Wever (2000)	Von Gelderen et al. (2000)	Hult and Ketchen Jr. (2001)	Lussier and Pfeifer (2001)	Sabherwal and Chan (2001) e Chan et al. (2006)	Headd (2003)	Zhuang and Lederer (2006)	Zhou and De Wit (2009)	Lee, Jasper, and Fitzgerald (2010)	Chittithaworn et al. (2011) e Islam et al. (2011)	Unger, Rauch, Frese, and Rosenbusch (2011)	Lussier and Corman (2015)	Alom et al. (2016)
- Survival, success vs failure, success status for closed firms, perceived success	X			X		X				X		X	
- Size (number of employees, sales, business volume, expert rating, equipment value, scale organizational success)	X										X		
- Business growth (sales, turnover, employment, business growth, profits, revenues, assets, market share, cash flow, output, ROS)	X							X	X		X		
- Profitability (profit, income, revenues, ROA, ROS, ROI, sales/employee, cash flow, Earnings, owner's salary, return on cash flow)											X		
- Organizational Performance		X	X		X		X		X				X

Source: elaborated by the author from different sources.

Alternative Dimensions of Agribusiness Success: An Overview

From the previous analysis, it is justified that the success of agribusiness enterprises can be measured in several dimensions. For the purposes of this study the agribusiness success is conceptualized as growth, productivity and performance of the agribusiness enterprise. The growth and profitability dimensions are used by Unger et al. (2011) in its meta-analytical review to define success.

Nevertheless, in this study profitability is conceptualized as productivity, and is added the perceived organizational performance by managers.

Success depends, however, on the goals to be achieved. If the objective of the agribusiness enterprise is growth, then, according to the literature the growth of sales and the number of employees are important indicators for the growth of the companies. However, if the objective is productivity, the ratio sales/employees are widely used in the literature. However, if the agribusiness enterprise wants to obtain performance, the perception of managers can be an important measure. The managers' perceptions are important because they can support the organization's future strategic decision-making, then it is opted to measure it through subjective measures. No studies were found that explicitly analyze the impact of factors on agribusiness success in these three dimensions: growth, productivity and performance.

Success as Growth

Business growth is an important indicator of the economy. Furthermore, it is also used as a financial measure. Growing agribusiness enterprises are therefore successful enterprises, whereas, when they are stagnant, they are considered to be unsuccessful enterprises. In the literature, growth is measured by employment growth (Coad, Segarra, & Teruel, 2016; Nunes, Gonçalves, & Serrasqueiro, 2011; Schutjens & Wever, 2000; Sleuwaegen & Goedhuys, 2002; Zhou & De Wit, 2009), sales growth (Bahadir, Bharadwaj, & Parzen, 2009; Coad et al., 2016; Colombelli, Haned, & Le Bas, 2013; O'Regan, Ghobadian, & Gallea, 2006; Raymond, Bergeron, & Blili, 2005; Sleuwaegen & Goedhuys, 2002; Zhou & De Wit, 2009), growth of profits (Baum, Locke, & Smith, 2001) and productivity growth (Coad et al., 2016; Falk & Hagsten, 2015). As shown in Table 2, many explanatory variables are used in the growth literature.

Table 2. Papers contributing to the success literature, in terms of growth

Author name (year)	Explanatory Variables	Success indicator	Indicator Success
Schutjens and Wever (2000)	-Entrepreneur- associated factors (Thoroughness of preparation, Number of years in employed Service) - Firm-associated factors (Business partner at start-up, Monthly turnover at start-up, Employees at start-up) -External factors (Sector manufacturing / construction, Sector business services)	-Employment growth	Growth
Sleuwaegen and Goedhuys (2002)	-Age -Size -Age*Size -Capital intensity -Geographical location -Formal status -Efficiency -Sector	-Sales growth -Employment growth	
Raymond et al. (2005)	Assimilation of e-business -Funções de informação e comunicação (<i>e-communication</i>) -NE <i>intelligence</i> -Transaccional e colaborativas (CE e <i>e-collaboration</i>)	-Growth -Internationalization	
O'Regan et al. (2006)	-Internal (Innovation, Firm Ownership, Organisational Capabilities) -External (Strategic Orientation, Environment, E-Commerce)	-High growth sales	
Sapienza, Autio, George, and Zahra (2006)	-Internationalization	-Growth	
Zhou and De Wit (2009)	-Individual, organizational, environmental, growth barriers	-Growth in employment	
Coad et al. (2016)	LogSales or LogProd or LogEmpl, GrEmpl, GrInv, RDintensity, Young × RDintensity	-Growth of sales, growth of productivity and growth of employment.	

Source: elaborated by the author from different sources.

Success as Productivity

Labor productivity is understood as the result obtained from the resources that have been applied. Improve the productivity concerns to maximize what can be sold/provide services maintaining the same resources. The indicator sales per employees are conceptualized in different forms in different contexts. Bertschek, Fryges, and Kaiser (2006) measure sales per employees as labor productivity. However, this indicator is used as profitability (Unger et al., 2011). However, other indicators are used to represent productivity, Konings and Roodhooft (2002) use the total factor productivity (performance), Raymond and Bergeron (2008) apply gross margin per employee, Kubota and Milani (2011) use net revenue/employee, Liu, Chen, Huang, and Yang (2013) measure through sales minus the sum of intermediate goods, water, electricity and fuel.

For Karakaya and Shea (2008), one of the reasons for companies to adopt e-commerce is to generate short-term productivity gains. Konings and Roodhooft (2002) conclude that e-business has no effect on small firms' productivity but has a positive effect on large firms. Bertschek et al. (2004; Bertschek et al., 2006) show that there is a simultaneity relationship between Business-to-Business (B2B) e-commerce and the productivity of German companies. Based on the methodology of Bertschek et al. (2004), Kubota and Milani (2011) analyzed the impact of e-commerce on corporate productivity. Liu et al. (2013) show that e-commerce has a positive impact on productivity, and the interaction between e-commerce and Research and Development (R&D) and the network externality (network effect) of e-commerce also have an effect on improving productivity.

Success as Perceived Agribusiness Performance

Success can be understood as organizational performance (Chan et al., 2006). Several theories and disciplines analyze organizational performance. Strategic research is concerned with achieving factors that contribute to the success and competitiveness of organizations (O'Regan et al., 2006). From strategic management theory, organizational behavior theory and organizational theory, and entrepreneurship models, Baum et al. (2001) develop a model to test the impact of organizational, environmental and individual factors on growth. In the view of resource-based theory, it is resources that provide organizational success (Hult & Ketchen Jr., 2001; Jebna & Baharudin, 2014; Zhuang & Lederer, 2006). In the economic literature based on the foreign direct investment paradigm, Vaatanen, Podmetina, and Pillania (2009) analyze the effect of internationalization on performance. Therrien, Doloreux, and Chamberlin (2011) develop an economic model to analyze the impact of innovation on performance. Recent study by Alom et al. (2016) identifies entrepreneurial and entrepreneur characteristics, and economic factors that influence the growth represented by performance. In the entrepreneurship literature, Davis and Harveston (2000) analyze the impact of entrepreneurial characteristics and technologies in the growth of family businesses. Von Gelderen et al. (2000) analyze the relationship between strategy and performance. Walter, Auer, and Ritter (2006) develop a model to analyze the impact of network capacity and entrepreneurial orientation on performance. Marketing literature highlights the influence of e-business on organizational performance (Migdadi, Abu Zaid, Al-Hujran, & Aloudat, 2016; Theodosiou & Katsikea, 2012; Wu, Mahajan, & Balasubramanian, 2003). Vilaseca-Requena, Torrent-Sellens, Meseguer-Artola, and Rodríguez-Ardura (2007) explain factors determining e-commerce adoption and its extent or performance. Abebe (2014) analyzes the relationship between EC adoption and performance.

Previous research has used several indicators to measure business performance. In the literature, performance is measured by different measures, both objective and subjective. In this chapter, the researcher

Table 3. Papers contributing to the success literature, in terms of productivity

Author name (year)	Explanatory Variables	Success indicator	Dimension Success
Konings and Roodhooft (2002)	-Selling on line -Buying on line -Innovation	-Total factor productivity	Productivity
Bertschek <i>et al.</i> (2004, 2006)	-Ln (ICT), Ln (K), Ln (L), industry, region, B2B	-Sales per employee	
Kubota and Milani (2011)	Ln (fixed asset), Ln (number of employees), education of employees, % of gross revenue from other units, number of units, sector, region, request of capital, exports	-Net revenue/ employees	
Liu <i>et al.</i> (2013)	Capital stock, Number of employees, E-commerce stock, R&D stock, Intra-industry R&D spillover, Inter-industry R&D spillover, Intra-industry network externality of e-commerce, Inter-industry network externality of e-commerce:	-Value added (sales minus the sum of intermediate goods, water, electricity, and fuel expenses)	
Slavchevska (2015)	Gender of manager(s) and owner(s), Manager characteristics, Plot characteristics, Inputs	-Productivity for plot	
Bertschek and Niebel (2016)	% of Emp. Using Mob. Internet, % of Emp. Predom. Using PC, % of Emp. Using Internet	-Productivity labour	

Source: elaborated by the author from different sources.

opts by measuring it through subjective measures, because these are more straightforward and easier to get than the objective and various performance aspects can be incorporated through a multidimensional construct. According to Chittithaworn *et al.* (2011) and Islam *et al.* (2011), business performance is a complex and multidimensional phenomenon, it refers to success and represents the ability of the company to generate acceptable results and actions. These results and actions should be in accordance with the organizational objectives which are intended to be achieved, and in this case it is the overall performance of the agribusiness enterprise. It is in this context that is intended the conceptualization of agribusiness performance. The managers' perceptions are considered important, because managers may support the future strategic decision-making of the organization.

FACTORS INFLUENCING AGRIBUSINESS SUCCESS

Over the years the success has been the object of many studies and a number of authors have made several contributions. Previous studies have used several conceptual models and variables to analyze the growth, productivity, and performance of enterprises. The causes of success come from organizational, environmental and individual factors. Many factors that have impact on success were found in the literature consulted between 2000 and 2019, as can be seen in Table 2, Table 3, and Table 4. Despite the different perspectives adopted, based on this literature, four factors are considered relevant to the agribusiness success model and the expectation is that they are explanatory of success: e-commerce adoption, internationalization, strategic alignment and characteristics of the manager.

Table 4. Papers contributing to the success literature, in terms of performance

Author name (year)	Explanatory Variables	Success indicator
Davis and Harveston (2000)	-Owner-entrepreneur age and education -Internet use and technology investment	-Internationalization -Organizational growth
Von Gelderen et al. (2000)	success, strategy, uncertainty and alternative determinants	-Turnover, profit, personnel, personal income, goal reaching and subjective success
Baum et al. (2001)	Traits, general competencies, specific competencies, motivation, competitive strategies, environment, size	-Average annual percent sales growth, average annual percent employment growth, average annual percent profit growth
Sabherwal and Chan (2001) Chan et al. (2006)	Alignment	-Reputation among major customer segments, frequency of new product or service introduction, return on investment, net profits, technological developments and/or other innovations in business operations, product quality, market share gains, revenue growth
Huang (2013)		-Growth -Profitability
Raymond and Bergeron (2008)		-Growth, productivity and profitability
Wu et al. (2003)	-Intensity of E-Business Adoption (communications, internal administration, order taking, procurement)	-Efficiency, sales performance, customer satisfaction, relationship development
Migdadi et al. (2016)	-E-Business Implementation	
Bergeron et al. (2004)	-Coalignment	-Growth, Profitability
Aragón-Sánchez and Sánchez-Marín (2005)	-Firm Size -Family Firm -Prospector orientation -Defender orientation	-ROI -Knowledge and experience in the business; ability to provide quality products or services; capacity to develop new products and processes; ability to manage and work in a group; workforce productivity; and firm's responsibility concerning the environment
Xu, Cavusgil, and White (2006)	-Coalignment	Profitability Return on investment Cash flow
Vilaseca-Requena et al. (2007)	-Competitive environment -Organizational characteristics -Strategic orientation -Innovative capacity -Managers' characteristics -IT	proportion of the firm's total sales obtained through this channel
Vaatanen et al. (2009)	-Ownership -International price exposure	-Sales growth -Net profit margin -Labor productivity (Sales/Employees) -Market capitalization growth
Therrien et al. (2011)	Belong to a larger group, Industry, Size, Export, Collaboration, Knowledge, University degree holders, R&D related workers, Radicalness measures, Market-based, Originality-based, Market-based and originality based	-Product innovator, Sale from innovation

continued on following page

Table 4. Continued

Author name (year)	Explanatory Variables	Success indicator
Ganotakis and Love (2012)	Human capital (General experience, Commercial experience, Managerial experience, Technical experience, Sector experience, General education, Technical education, Business education), Formal commercial collaborative agreements (With customers/suppliers, With other companies), Market strategy (Exporter, Niche market, Customer dependence)	-Productivity
Abebe (2014)	E-commerce adoption, entrepreneurial orientation,	-Annual sales growth rate
Cao and Li (2015)	Cross channel, e-commerce (moderate)	-Sales growth
Alom et al. (2016)	Entrepreneur (Age, Education, Training), Enterprise (Age of enterprise, Size of enterprise), external (Demand for products/ services, Competition, Space to expand in city area, Accessible source of finance, Amount of finance secured is sufficient)	-Sales turnover, total revenue turnover, profit margins, employment growth, overall improvement over the past three years

Source: elaborated by the author from different sources.

Impact of E-Commerce Adoption on Agribusiness Success

The adoption of e-commerce is a strategic decision of the agribusiness enterprises that must influence the agribusiness success. This technology provides in the company the loss of focus on large sales outlets and the greatest concern with logistics (the packing in the warehouses of the orders made online and the delivery of the merchandise). Wen (2007) states that selling products through e-commerce is efficient and profitable for businesses, offers a much lower cost, easy alternative for business use and can remove intermediates in the value chain.

Karakaya and Shea (2008) analyze the reasons for companies to start adopting e-commerce. In the short term what motivates companies to adopt e-commerce are productivity gains, while in the long term it is the company's competitiveness. These authors have also studied whether these e-commerce initiatives are successful. They show the companies' satisfaction with e-commerce initiatives and that most of the companies studied by them achieve the planned return on investment (ROI).

The literature points to the positive impact of e-commerce on success. O'Regan et al. (2006) indicate that high growth companies are more likely to actively use e-commerce than companies with static or declining sales. Mei (2008) finds significant results in the relationship between the adoption of e-commerce and the growth of the company. Raymond et al. (2005) They show that the assimilation of electronic business, in terms of e-commerce and e-collaboration, positively influences sales growth. Vilaseca-Requena et al. (2007) confirm the impact of the adoption of e-commerce for the extension of e-commerce. Bertschek et al. (2004, 2006), Kubota and Milani (2011) advocate a relationship of simultaneity between e-commerce and productivity. Falk and Hagsten (2015) show evidence that increased sales through e-commerce causes an increase in labor productivity growth (performance). Abebe (2014) confirms the positive impact of e-commerce on the performance of SME (annual sales growth rate). It is also pertinent to point out, that the literature on e-commerce suggests the possible endogeneity of the adoption of e-commerce. Zhuang and Lederer (2006) Show that the performance of e-commerce influ-

ences the firm performance. More generally, Wu et al. (2003) point to a relationship between e-business and performance.

Achieving success in business through e-commerce strategies, is not only a new opportunity but a requirement (Jurado & Calabuig, 2001). Although no studies have been found on this subject in Portugal, nor specifically in the agribusiness context, several studies point to the relevance between the relationship between e-commerce and the success of companies, in different countries, both in developed and underdeveloped economies.

However, according to Bertschek et al. (2006), some companies do not opt for e-commerce probably because they predict that the cost of adoption would not be offset by the increase in productivity.

Impact of Internationalization

The internationalization strategy can positively influence agribusiness success. According to Coad (2009, p. 126), “expansion into new geographic markets can be an attractive opportunity for firm growth.” (...), “to boost sales” (...) and offers “advantages such as scale and scope economies, more market power, diversification of revenues, and the ability of spreading fixed costs such as R&D over a larger sales base”. Therrien et al. (2011) analyze the impact of exports on the performance (commercial success) in the services sector, and evidenced that to get more sales, enterprises need to enter the market early or introduce new products with high level of novelty. The authors propose that exporters are more likely to have innovative products and to market them. This may be because if an enterprise introduces a new product and has access to several markets it can spread its new product more efficiently.

Coad et al. (2016) test the impact of exports on business growth through econometric models, with growth measured through sales, productivity and employee growth, having a positive impact on all quantiles for sales growth, only for 25%, 50% and 90% quantiles for productivity and in all quantiles except 90% and 95% for job growth.

Lin, Liu, and Cheng (2011) point to a moderating relationship between internationalization and performance, with a higher level of organizational slack and attainment discrepancy.

From the same line of reasoning, agribusiness enterprises that export their products are expected to have higher sales growth, to increase productivity and sales performance and therefore a better agribusiness success. The impact of internationalization can be measured by the intensity of exports from agribusiness enterprises.

Impact of Strategic Alignment

Strategy is fundamental for enterprises to become competitive and survive in an ever-changing environment. The appropriate strategy improves the competitive position of the organization relative to competitors. According to Porter (1979, p. 143), strategy can be understood as the “building defenses against the competitive forces or as finding positions in the industry where the forces are weakest”. However, a successful agribusiness enterprise possibly needs alignment strategies to help achieve business goals.

According to Avison, Jones, Powell, and Wilson (2004), the concept of “strategic alignment” is also understood as fit (Porter, 1996), integration (Weil & Broadbent, 1998), bridge (Ciborra, 1997), harmony (J. N. Luftman, 1996), fusion (Smaczny, 2001) or linkage (Henderson & Venkatraman, 1989). However, all these definitions represent the integration between business and IT/IS strategies. Alignment is a “complex, multi-dimensional construct” (Johnson & Lederer, 2010, p. 138). Strategic alignment is a process in continuous adaptation and change (Henderson & Venkatraman, 1993). Strategic alignment

is about applying IT, appropriately and timely, in harmony with the strategies, objectives (goal) and needs of the business (J. Luftman, 2004). Strategic alignment shows us how organizations can express implementation of IT to improve performance (Bergeron, Raymond, & Rivard, 2004).

The literature on strategic alignment suggests that alignment has an influence on organizational performance, being this understood as an organizational success by various authors. In general, alignment is positively related to organizational performance (Bergeron et al., 2004; Chan et al., 2006; Naman & Slevin, 1993). Alignment presents positive results in performance in terms of sales growth, productivity and profitability (Raymond & Bergeron, 2008).

The choice of the impact of alignment on agribusiness success is due to the fact that this is important for organizational success, difficult to achieve and a major concern of management. As Naman and Slevin (1993) point out, the alignment is an important construct for the success of the company. According to Kappelman, McLean, Johnson, and Gerhart (2014), based on a survey of Society for Information Management (SIM), the main concern of management is the alignment of IT and business in the years of 2014 and 2013. However, it is the first concern, in 8 of the last 12 years, in the top 10 most important organizational IT management concerns. The authors suggest that, possibly, due to constant changes in organizations, markets, economies and technologies, alignment is a constant problem for management. However, many organizations have difficulty in achieving alignment (Johnson & Lederer, 2010).

The alignment concerns the degree to which the information technology (IT)/information systems (IS)/marketing/sales and organizational strategies adjust and contribute to agribusiness success, and corresponding how many departments of the same organization follow the same direction in pursuit of the established strategies, in terms of achieving the organization's objectives. Alignment is a process of continuous adjustment that agribusiness enterprises use to achieve the interconnection between strategies and objectives of information IT/IS or sales/commercial/marketing with the strategies and objectives of the business, whether the company works in electronic business or traditional business. In this investigation, it is expected that better alignment tends to provide better agribusiness.

Impact of Factors Associated with the Manager

In this subsection, the researcher discusses characteristics associated with the manager that appear to be relevant in the success literature. The agribusiness success is conditioned to the manager through her/his strategic decisions and is, therefore, necessary to identify her/his characteristics.

The literature presents evidence and arguments for the impact of the manager's individual factors on success. Davis and Harveston (2000) find the impact of age and education on sales growth, arguing that the aging of the entrepreneur slows sales growth, and a high level of education has a positive impact on sales growth. Lussier and Pfeifer (2001) indicate that successful owners/managers have significantly higher levels of education than those with failing firms. The same happens with results for the age of the owner. Baum et al. (2001) show the relevance of the traits, motivation and competencies of the CEO/entrepreneur for growth. Vilaseca-Requena et al. (2007) show that the performance is affected by the level of education of the manager (total sales through this channel). These authors argue that firms need highly skilled managers to lead and manage the changes that occur with adherence to electronic markets. Von Gelderen et al. (2000) find no significance in the relationship between the founder's experience and performance (success). Alom et al. (2016) show that the entrepreneur's age, education, and entrepreneurial skills positively affect growth (performance). The productivity of the agribusiness can be conditioned to who organizes the work. Therefore, it is relevant to understand the relationship between manager characteristics and labor productivity. Slavchevska (2015) shows weak evidence of

differences in productivity averages between men and women managers but conditional on the characteristics of managers.

In the literature several characteristics are analyzed. The present study uses an individual approach with emphasis on manager characteristics to try to explain the agribusiness success, through age and education. In the context of Industry 4.0, it would be expected that managers with higher education qualifications would have a positive impact on agribusiness success since higher education levels may reveal more general and technological knowledge. In addition, it would be expected that the aging of the managers slows agribusiness success because they have less knowledge of new technology and consequently less access to knowledge, and the managers need to adapt their skills for a smart farm. In addition, young managers are more dynamics to take new business opportunities.

FUTURE RESEARCH DIRECTIONS

This study offers avenues for future research. Based on this theoretical research, Negrão (2018) test a model through an econometric analysis of survey data using instrumental variables to deal with the endogeneity problem of e-commerce. However, it is suggested an empirical analysis using longitudinal data to analyze the dynamic effects of e-commerce adoption on agribusiness success. It is also suggested to carry out this study with other indicators of success, conducting this study in several countries in order to compare these results with other countries or replicate in other sectors could lead to different results.

Future investigation in this area involves further research to identify the factors critical for the success in agribusiness.

CONCLUSION

The literature review is elaborated to obtain a broad view of the subject. More specifically, it allows one to define the main concepts of this investigation, as well as the measures and determinants of agribusiness success. According to the previous studies showed in this article, the researcher develops a conceptual model of agribusiness success in Industry 4.0.

In this research, success refers to the achievement of the goals and objectives of agribusiness enterprises. This conceptual model incorporating three dimensions of success: growth, productivity and agribusiness performance. In this approach it is observed that the agribusiness success can be created from the e-commerce, the internationalization, strategic alignment, and characteristics manager. These variables are considered the fundamental criteria for the expansion of agribusiness enterprises and it is thought that it provides a complete approach of explanatory variables of the agribusiness success. In addition, to find determinants of agribusiness success is used the knowledge of several disciplines that encompasses the understanding of success to obtain a holistic view of SEA.

To measure the agribusiness success, objective and subjective measures can be used. The agribusiness success can be measured by the growth in sales that represents the enterprise growth, sales per employee that characterizes enterprise productivity and a set of items that make up the perceived organizational performance of agricultural managers.

Several general conclusions may be drawn from present chapter. Firstly, the researcher can conclude that success is a theme of interest in the scientific community that has allowed the development of studies over the years and up to the present time, thus becoming a relevant and current theme.

Secondly, it can also be concluded that there is no single measure for success, which is measured in different ways in several studies. The literature also presents several explanatory variables for success. However, there is no one way to arrive at the result. But a range of possible alternatives that are selected according to different criteria, namely, the area, the type of enterprise, the economy and the interest focus of the researcher. However, for the development of the conceptual model three relevant dimensions are analyzed and discussed: growth, productivity and performance. Moreover, it is considered to be relevant to analyze the impact of e-commerce, internationalization, strategic alignment and manager characteristics as explanatory factors of the agribusiness success. Subsequently, thirdly, it is also concluded that, the previous studies analyze the enterprises success, but with a more restricted vision. Fourthly, it can be seen that the problem of endogeneity of e-commerce adoption exists in the literature and is addressed in previous studies.

This approach has a limitation. Only agricultural companies are included because it is the interest focus of the author, however, this limits the scope, since, of course, there are other companies with an interest in success.

Based on this literature review, it is perceived that this subject is not yet properly studied, and therefore, it is proposed to investigate it empirically.

The present chapter contributes to the research on success, because it develops a conceptual model of agribusiness in three dimensions: growth, productivity and performance, whether the enterprise uses e-business or traditional business, based on a holistic approach. Success is presented a broader view than in previous models found in the literature.

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KEY TERMS AND DEFINITION

Agribusiness Success: The achievement of objectives set by agribusiness enterprises.

E-Business: The exchange of information electronically internal and external to the agribusiness enterprise, fundamentally made with employees, suppliers, partners, and customers.

Growth: The growth of the agribusiness enterprise in terms of the economic or financial performance.

Industry 4.0: The fourth industrial revolution – the digital transformation of industrial markets.

Performance: The agribusiness enterprise ability to generate results and acceptable actions. These results and actions should meet the objectives of the agribusiness company.

Productivity: The result obtained from the resources that have been applied by the enterprise by the agribusiness enterprise.

ENDNOTE

- ¹ E-sales, E-Know-How, E-Collaboration, E-Service, E-commerce, Supply Chain Management SCM, customer relationship management (CRM), Electric Data Interchange (EDI) and E-Community are the most used e-business actions that can be consulted in <https://pt.wikipedia.org/wiki/E-business>.

Section 3

Business Digital Economy and Knowledge

The Business Transformation Framework on Knowledge and Intelligence–Driven Development (KIDD)

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INTRODUCTION

Authors of this chapter based their research on an authentic and proprietary mixed multidisciplinary research method that is supported by intelligent neural networks combined with a heuristics module, named the Applied Mathematical Model (AMM) (Trad & Kalpić, 2017a; Trad & Kalpić, 2017b; Trad & Kalpić, 2017c; Gunasekare, 2015). The proposed AMM is similar to the human empiric decision-making process. The AMM is supported by a real-life case of a business transformation architecture in the domain of Knowledge and Intelligence Driven Development (KIDD) that is supported by the alignment of a various standards and technologies. The KIDD is based on a real-life case for detecting and processing an enterprise heuristic algorithm for business transformation, business engineering and enterprise architecture problems. This application-driven development model offers a set of possible solutions in the form of architecture, managerial and technical recommendations, coupled with a usable framework. The proposed executive recommendations are to be applied by the business environment's architects, analysts and engineers to enable solutions to knowledge-based environments.

BACKGROUND

This work's background combines knowledge management, enterprise architecture, mathematical models, heuristics, technology management, business transformation and business engineering fields. Building a KIDD based on a Decision Making System (DMS) is today the major strategic goal for business companies, as shown in Figure 1 (Cearley, Walker, Burke, 2016; Thomas, 2015). The proposed KIDD is a generic and cross-business reasoning engine that contains basically qualitative research methods that manage sets of factors, and can be used by a Business Transformation Project (BTP). The authors based their research method on intelligent neural networks and driven development, where both methods resemble to the human brain processing. The KIDD concept is business driven and is agnostic to a specific environment, as shown in Figure 1, it is founded on a research framework that in turn is based on the industry standard, Architecture Development Method (ADM) (The Open Group, 2011a). Enterprise architecture is a methodology used to develop BTPs, requirements, architecture, knowledge modules and its technology components. The Business Transformation Manager (BTM) or an enterprise architect can integrate a KIDD in the architecture of a BTP to support its DMS system (Trad & Kalpić, 2017b; Trad & Kalpić, 2017c; Thomas, 2015; Tidd, 2006). This KIDD proposal's aim is to deliver

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recommendations for managing aligned DMSs. The applied research methodology is based on literature review, a qualitative methodology and on a proof of concept for the related hypotheses. In a holistic knowledge management architecture, the BTM's role is important and his or her (for simplicity, in further text – his) decisions are aided by using factors within the AMM. A large set of factors can influence such an AMM, like: a) the role of the knowledge control mechanisms; b) enterprise critical success factors; c) enterprise resources; d) DMS skills; e) audit and technological conditions; f) financial predispositions; and g) security, financial and legal control mechanisms. A systems approach is the optimal choice to model such a KIDD (Daellenbach & McNickle, 2005; Trad & Kalpić, 2016a). As shown in Figure 2, the decision model interacts with the external world via an implemented framework to manage the DMS's factors and that is this chapter's focus.

Figure 1. The research framework's concept (Trad & Kalpić, 2016a)



Adapting just the underlined islands of technologies is not enough and the main problem can arise due to the lack of company's holistic agility approach, but it can be built on Knowledge and Intelligence Design Patterns (KIDP) (Thomas, 2015; Cearley, Walker, Burke, 2016).

FOCUS OF THE ARTICLE

The Research Processes

This research's main topic is related to BTPs and the ultimate research question is: "Which business transformation manager characteristics and which type of support should be assured in the implementation phase of a business transformation project?" Decision making concepts based on critical success areas are their main research component.

Critical Success Areas, Factors and Decision Making

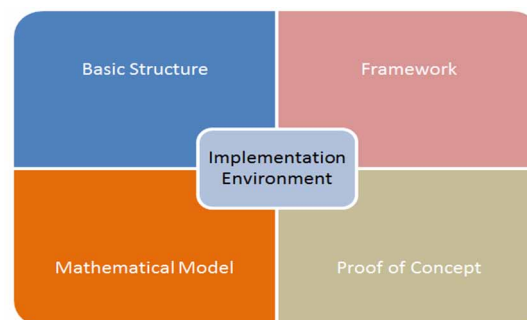
Critical Success Area (CSA) is a category of Critical Success Factors (CSF) where in turn a CSF is a set of Key Performance Indicators (KPI), where a KPI corresponds to a single requirement and/or knowledge feature.

For a given problem, an enterprise architect can identify the initial set of CSFs for the DMS. Hence the CSFs are important for the mapping between the knowledge constructs, organisational items and DMS (Peterson, 2011). Therefore, CSFs reflect performance areas that must meet strategic goals and defined constraints. Measurements are used to evaluate performance in each CSA, where CSFs can be internal or external; like: 1) knowledge gap analysis is an internal CSF; and 2) decisions-making in real time and in minimal time is also an internal one? Ili: is internal and external one. Once the initial set of CSFs has been identified, then the BTP can use the DMS to give solutions. The proposed KIDD delivers a set of recommendations and solutions for an aligned architecture that is part of the Framework (Trad & Kalpić, 2017b; Trad, & Kalpić, 2017c).

The Framework

The BTM or enterprise architect's decisions can be made in a just-in-time manner by using outputs from various credible technology logging sources. The defined knowledge alignment strategy should assess and govern global system knowledge assets that are formalized with KIDPs. A research framework can support such an undertaking, as shown Figure 2. Unfortunately, an immense set of archaic factors can influence such a process, like: 1) the influence of knowledge management on BTPs; 2) working with complex systems; and 3) architecture standards are non-existent. A global concept and the management of KIDD approach is optimal for such complex mechanisms (Daellenbach & McNickle, 2005). In this research chapter, the focus is on the KIDD module that supports the DMS's integration. The KIDD can be applied to many BTPs and general fields in the Framework and it is a part of the Decision management module (Dm) and the Architecture and modelling module (Am). In this chapter the authors propose a set of KIDD managerial recommendations and a reusable real-world module (Trad 2018a; Trad 2018b).

Figure 2. The implementation environment that enables knowledge management



The KIDD component is managed by The Open Group's Architecture Framework (TOGAF) architecture development method's phases, where each KIDP circulates through its phases. The KIDPs contain their private set of CSFs. These CSFs can be applied to (Peterson, 2011): a) select the important knowledge management factors; b) detect the DMS's most important assets; c) estimate the actual assets of the BTP using the decision support system's interface; and to eventually take a decision on BTP's continuation; d) control and monitor the needed KIDP instances; e) upgrade the BTP's DMS knowledge management skills; and f) support the BTP management activities. The Framework or the *Environment* is composed of the following modules:

- “Sm”: for the selection management of the Framework.

- “Am”: for the architecture and modelling strategy that can be applied by the Framework.
- “Cm” for the control and monitoring strategy that can be applied by the Framework.
- “Dm” for the decision-making strategy that can be applied by the Framework.
- “Tm” for the training management of the Framework.
- “Pm” for the project management strategy that can be applied by the Framework.
- “Fm” for the financial management’s support to the Framework.
- “Gm” for the Geopolitical mind-mining to the Framework.

This chapter is a part of the research cluster that has produced many articles, literature reviews, usable items and research artefacts. In this chapter, parts of previous works are reused for the better understanding of this complex research. This work can be considered as a pioneering one, in the field of global transformation and architecture projects. For that purpose, this phase’s research sub-question is: “How would knowledge and intelligence-driven development be managed in a transformation projects?”.

The KIDD is business-driven and is founded on a research framework that in turn is based on enterprise architecture and information technology (The Open Group, 2011a).

INFORMATION TECHNOLOGY

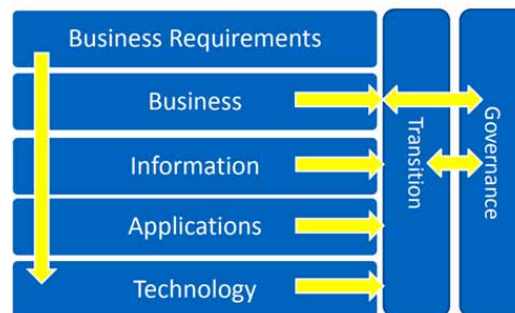
Patterns

A KIDP expresses a fundamental structural organization or schema for system’s implementations. It offers: 1) a set of predefined knowledge templates; 2) describes their responsibilities; 3) and includes the description of the relationships between these templates. A KIDP is a schema that can be used to refine the KIDD cycle. A KIDP describes the common structure for a general design problem within a BTP implementation context by using the “1:1” concept or a holistic pattern. A KIDP is a set of idioms, where an idiom is a basic pattern that is not specific to any environment. An idiom describes the aspects of an artefact and its relationships with other BTP artefacts. KIDPs refer to patterns that are used to develop knowledge models or modules.

Agility

Global enterprise agility is achieved by combining various methodologies that promote business and technological agility to be used on various levels of the BTP, in order to unbundle the existing business environment

Figure 3. The information system’s interaction with various modules



and glue its innovated parts using a dynamic Information System's (IS) components and KIDPs as shown in Figure 3. Using a bottom-up approach, the BTM can design an IS integration concept that can handle various types of subsystems to be used in knowledge microartefacts.

Knowledge and Intelligence Microartefacts / Building Blocks

KIDD's microartefact is an instance of the KIDP building block that can interact with other BTP's microartefacts in a traced and synchronized manner and uses TOGAF's ADM to assist it in the grouping of the needed services (The Open Group, 2011a). The KIDD includes KIDP scenarios that use interactive services to make the integration more flexible (Trad & Kalpić, 2017a). DMS components support the BTP by offering KIDP instances to handle various types of knowledge endpoints. The usage of knowledge endpoints provides some of the mechanisms needed to make DMS open to internal and external requests.

The Information System Critical Success Factors

Based on the literature review, the most important IS CSFs that are used are shown in Table 1.

Table 1. The information system's critical success factors

Critical Success Factors	KPIs	Weightings
CSF_IS_Pattern	InitialPhase	From 1 to 10. 4 Selected
CSF_IS_Agility	Basic	From 1 to 10. 6 Selected
CSF_IS_KIDP	NotReady	From 1 to 10. 3 Selected

The Modules Chained Link to the Legal Aspects

This section's deduction is that standards and mapping are central for the KIDD subsystem in which they can help the unbundling process.

STANDARDS AND MAPPING

Today many standards exist and they are very advanced; these standards and their related tooling environments can help in the unbundling of the actual traditional business environments, through the execution of a bottom-up approach for BTPs. The bottom-up approach may help the business company to become a part of dynamic knowledge ecosystem; and it helps also such an environment to interconnect easily to the standardized global knowledge environments.

Choreography

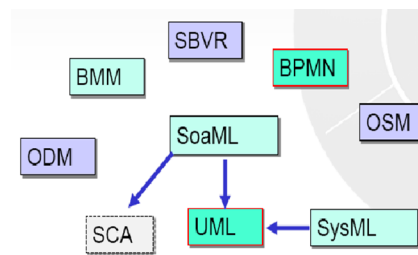
Actual integration and development environments are skeletons that enclose various technologies and methodologies representing a unified implementation strategy for the company's needs. The *Environment* offers a high level interpreted language environment that can be used to enable fast business transformation develop-

ment iterations and supports its DMS. Such a development environment must respect existing standards, and its main characteristics are:

- It delivers functional language building blocks.
- It uses the company's standard development environment(s).
- It delivers the needed intelligence mechanisms.

The KIDP is based on existing proven standards as shown in Figure 4. Standard architectures are based on service oriented architecture to support KIDD. This research chapter presents a solution in the form of a proof of concept for such an approach, using existing standards and a mapping concept.

Figure 4. Existing set of standards



Mapping

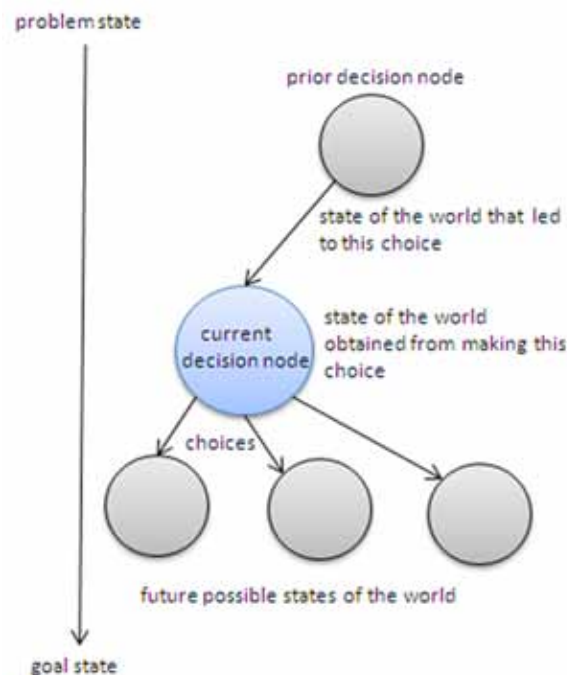
Defining granularity is a very complex undertaking in the implementation phase and the complexity lies in the “1:1” mapping and classification of the discovered services in business environments with limited and optimized resources. This mapping concept uses complex messaging system to interact with the KIDP's instances. Mapping of a requirement uses a range of KIDPs that can be modelled using a heuristic function. This mapping function is based on a set of services where the KIDP's functional language consists of building services to dynamically evaluate compound expressions, according to mathematical principles. The KIDP's mathematical system model is to evaluate requirements and to deliver solutions where requirements should be well-defined, so that the KIDP enables a holistic model that can perform an evaluation that affects the final result (Neumann, 2002).

A Holistic Knowledge and Intelligence Model

The enterprise's holistic knowledge and intelligence model is a set of multiple coordinated intelligence models that correspond to various just-in-time processing schemes (Cearley, Walker, Burke, 2016). Intelligence is a holistic human mental capability that combines information management and processing that coordinate and control various mental activities. Networked information coordination manages data, extracts and correlates them in space and time to detect heuristic patterns for various types of problem solving (Gardner, 1999). These heuristic patterns and their underlined semantics are used to generate sets of weightings for possible actions that are called intelligence artefacts in this research's *Environment*. Weightings' concept enables the KIDD to build a AMM based DMS that delivers solutions in the form of knowledge values. In many cases, fast change requests may generate an important set of corresponding solutions that can be ambiguous and make the DMS actions uncertain and complex to implement. The AMM is responsible for a rational heuristic approach for

enterprise problem solving, as shown in Figure 5. The KIDD's concept is based on a holistic systemic approach to use all the *Environment's* components, being this chapter's main focus (Daellenbach & McNickle, 2005; Trad & Kalpić, 2016a). A DMS can give a company the most important competitive business advantages that may insure its future and it is not a secret that intelligent knowledge artefacts are the basis of any successful BTP (Trad, 2015a; Trad, 2015b; Trad, 2015c). Major research and advisory firms like Gartner, confirm that knowledge services will leverage business ISS' components from various enterprise departments. Gartner confirms also that services are the dominating business enablers for Fortune 500 companies who need dynamic business intelligence support (Clark, Fletcher, Hanson, Irani, Waterhouse, & Thelin, 2013).

Figure 5. The neural network enterprise architecture component tree



An Adapted Architecture

An important factor in the BTP is the role of the architecture strategy (Open Group, TOGAF 2014); where the integration of KIDPs is the base of the future IS. KIDPs are crucial for the future of any knowledge system and hence adequate architecture strategy has to be established, by the choice and application of an optimal modelling environment, as shown in Figure 6 (MID, 2014). Architecture improves the quality of solutions to individual business requirements by simplifying their design, development and maintenance; that insures their business lifecycle. The business architecture of a business transformation process is based on a hands-on holistic approach (Greefhorst, 2009).

The Standards and Mapping Success Factors

Based on the literature review, the most important knowledge CSFs that are used are shown in Table 2.

Figure 6. Archimate modelling environment (Greefhorst, 2009)

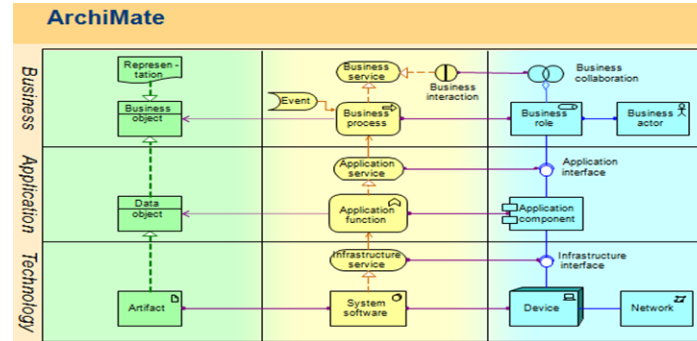


Table 2. The standards and mapping critical success factors

Critical Success Factors	KPIs	Weightings
CSF_SM_Choreography	Usable	From 1 to 10. 9 Selected
CSF_SM_Mapping	DifficultToImplement	From 1 to 10. 6 Selected
CSF_SM_KnowledgeIntelligenceModel	Synchronized	From 1 to 10. 10 Selected
CSF_SM_AdaptedArchitecture	Integrated	From 1 to 10. 9 Selected

The Modules Chained Link to the Architecture Aspects

This section's deduction is that the application of an architecture is central for the KIDD process in which the risks are mitigated.

ARCHITECTURE AND INTEGRATION

Architecture Development Method's Integration

The ADM's integration in the DMS and the BTP enables the automation of their activities, throughout all the ADM iterations. The ADM encloses cyclic iterations; where information about all its phases is logged. DMS platforms are not dedicated to any specific business and they offer: 1) knowledge assets performance; 2) reliability; and 3) knowledge assets security. The ADM is controlled and monitored in real-time and supports the KIDDs' interactions using driven developments.

Test Driven Developments

The Test Driven Development (TDD) is a manual approach and a concept where implementers design the test first and then do the implementation; whereas the Design Driven Development (DDD) that is also known as a model-first design approach, is based on best practices and it can handle all BTP requirements with the same priority for KIDD. TDD is addressed as a testing approach that supports the evaluation of the design and verifies its quality. For BTPs, the implementation phase is the most important phase and the TDD offers a maintainable design concept that returns the needed statuses which help in assessing the BTP's iterations'

outcomes. For KIDPs the question is: which type of development method is optimal, TDD or DDD or some other. Even if both development methods give the guidance for using and developing design patterns, TDD can be used in a larger sense, not in the beginning of the implementation process but as an auxiliary or even marginal support. In the case of a BTP that has large legacy implementations, the tests are developed much later. KIDP's integration needs a DDD concept that is optimal for larger environments that contain many types of technologies. This design approach is optimal for holistic projects like a BTP (Design Patterns, 2015).

Acceptance Test Driven Development

Like TDDs, Acceptance Test Driven Development (ATDD) design approach is also based on creating tests where tests represent the outcomes of the behaviour of various BTP components. In the ATDD's design approach, the BTP team creates acceptance level tests, then they implement the system. Afterwards, these test outcomes are verified to improve the BTP's implementation quality. ATDD is now a widely used synonym for Specification by Example, but the practice has existed in various forms since at least the late 1990s. Kent Beck and Martin Fowler mentioned the concept in 2015 though they observed that it was difficult to implement acceptance criteria in the form of conventional unit tests at the start of a project. But unit tests aren't the only way to write automated acceptance tests, and since at least the early 2000s, innovative teams have asked users to contribute to executable acceptance tests and have reaped the benefits. ATDD Planning is the idea that defining acceptance criteria for a feature leads to better estimates than doing a task breakdown.

Behaviour Driven Development

In Behaviour Driven Development (BDD) approach, acceptance tests offer the jumpstart for the BTP and serve as a concept for communication between the BTM, the business environment's client and the BTP's team members. In such an agile approach, acceptance tests are implemented in prose so that non-technical team-members and clients can understand the complex implementation constructs. In which there is an auto-generated mapping mechanism from prose to implementation code. The prose scenarios provide enough information to automate the extraction of the needed classes and the BTP's team-members suggest which code pieces can be extracted from the prose. The BDD enables a semi-automatic acceptance tests integration with the architecture iterations.

Design Driven Development

This Design Driven Development (DDD) that is also known as a model-first design approach is based on best practices and it handles all types of requirements with the same importance. This design approach is optimal for holistic projects like a BTP, where the designers can concentrate on building transcendent patterns.

The Architecture Critical Success Factors

Based on the literature review, the most important knowledge CSFs that are used are shown in Table 3.

The Modules Chained Link to the Knowledge Aspects

This section's deduction is that the application of a knowledge and intelligence management is central for the DMS subsystem in which the risks are mitigated.

Table 3. The architecture critical success factors

Critical Success Factors	KPIs	Weightings
CSF_Architecture_ADM	Mature	From 1 to 10. 9 Selected
CSF_Architecture_TestDrivenDevelopments	Mature	From 1 to 10. 10 Selected
CSF_Architecture_BehaviourDrivenDevelopments	Synchronized	From 1 to 10. 8 Selected

KNOWLEDGE AND INTELLIGENCE DRIVEN DEVELOPMENT

Unit of Work

In order to define an optimal unit of work for the KIDD, there is a need to align all the BTP's resources using a one-to-one mapping concept, the authors use a concrete artefact that is an object-oriented class artefact, that is represented by a class-diagram extensible Mark-up Language (XML). Such a mapping concept is based on XML and on the class artefact that insure the interoperability between all the BTP's resources. These resources can conform to one of the following artefacts' standard formats:

- The Unified Modelling Language's (UML) format.
- Design patterns and using their XML interfaces.
- The Entity Relational Modelling (ERM) using the XML Scheme Diagrams (XSD) format.
- Test Driven Development (TDD) format.
- Behaviour Driven Development (BDD) format.

Standard Patterns

Defining the unit of work for a KIDP using the one-to-one concept, serves as a concrete artefact that is a class, where mapping supports the interoperability between all BTP KIDPs who conform with the following standards:

- The Unified Modelling Language's (UML) and The System Modelling XML (SysML).
- Design patterns and their XML interfaces.
- The Project Management XML (PMXML)
- The Service Oriented Architecture XML (SoaML) and the Web Services XML (WSDL).
- Rational Unified Process (RUP).
- The Business Process Modelling Notation (BPMN) and the Business Process Execution Language (BPEL).
- The client-side frameworks like NodeJS.
- The Entity Relational Modelling (ERM) using XML Scheme Diagrams (XSD).
- Test Driven Development (TDD) and Behaviour Driven Development (BDD).
- Business Rules Management (BRM).

Knowledge Patterns

The mapping concept based on XML and on the class artefact, insure the interoperability between all the BTP's KIDD generated resources; these resources can conform to the following standards:

- The Project Management XML (PMXML) used by the project management body of knowledge (PMBOK) formats.
- The Architecture XML (ArchiXML) format.
- The System Modelling XML (SysML) format.
- Representational State Transfer (ReST) Web Application Description Language (WADL) format.
- RESTful API Modelling Language (RAML) format.
- The Information Technology Infrastructure Library (ITIL) that uses the Data Centre XML (DCML) format.
- The Control Objectives for Information and Related Technology (COBIT) using the Governance, Risk, and Compliance XML (GRC-XML) format.
- The Business Reporting XML (XBRL) format.
- The Business Process Modelling Notation (BPMN) format.
- The Business Process Execution Language (BPEL) format.
- The client side frameworks (NodeJS) format.
- The Entity Relational Modelling (ERM) using the XML Scheme Diagrams (XSD) format.
- Test Driven Development (TDD) format.
- Behaviour Driven Development (BDD) format.
- Business Rules Management (BRM) format.

Functional Environments

Today many methodologies, functional development environments, libraries and other resources exist, like for example the (Moore, 2014; North, 2010):

- Lambda expressions, also known as closures, function literals, or simply lambdas, describe a set of features defined in the Java specification request number 335.
- Functional languages, like LISP.
- Artificial intelligence and expert systems.
- Services architectures or micro architectures that support features functional environments.
- Features that are supported by Behaviour Driven Development (BDD) and Domain Driven Design (DDD) methods.
- BDD supports concepts of Neuro Linguistic Programming (NLP) and hard systems thinking.
- NLP supports neural network that forms the business intelligence application's infrastructure.

KIDP based KIDDs use BDD and NLP like interpreted scripts that can be modified, compiled and executed in real-time; such operations can be done by business professionals with no prior computer science background. That is why the authors recommend an interpretable BDD/NLP based KIDPs for the KIDD and that enhances the business intelligence by increasing computational capacities.

The Knowledge Management Success Factors

Based on the literature review, the most important knowledge CSFs that are used are shown in Table 4.

Table 4. The knowledge critical success factors

Critical Success Factors	KPIs	Weightings
CSF_Knowledge_UnitOfWork&Standards	Exist	From 1 to 10. 8 Selected
CSF_Knowledge_KnowledgePatterns	Advanced	From 1 to 10. 8 Selected
CSF_Knowledge_FunctionalDevelopment	Operational	From 1 to 10. 9 Selected

The Modules Chained Link to the Decision System Aspects

Due to the CSFs, this section's deduction is that decision making is central for the KIDDs.

INTELLIGENCE AND KNOWLEDGE BASED DECISION SYSTEM

Hard systems thinking paradigm refers to operational research, systems analysis and systems engineering; which is optimal for enterprise architecture and transformation initiatives. Hard systems thinking is a scientific approach for solving complex problems in transformation and operational situations and it replaces science laboratories experimentation environments with a set of applied mathematics models that simulate project situations and offer decisions in the form of solutions. The hard systems thinking paradigm's optimal solutions are adapted to BTP problems (Daellenbach & McNickle, 2005). BTP problems are solved by using heuristics, as shown in Figure 7 that in turn are based on critical success areas and factors.

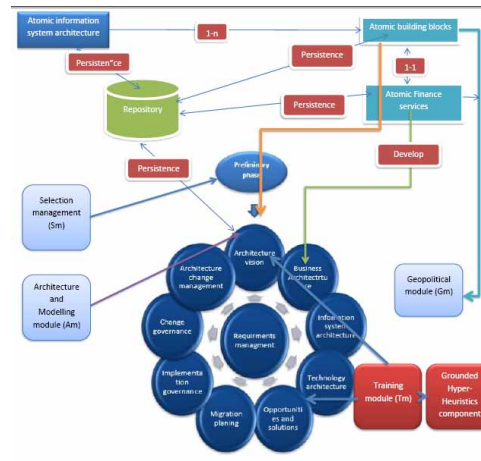
Figure 7. Various system approaches (Daellenbach & McNickle, 2005)

Systems paradigm	Hard	Soft	Critical
Systems approaches	Systems Engineering Systems dynamics Cybernetics Systems analysis Operations Research (OR) Non-linear dynamics	Soft Systems Methodology Other Soft OR approaches: SODA, Strategic Choice Multiple Perspectives Approach	Critical Systems Heuristics (CSH) Total Systems Intervention
Sociological paradigm (Burrell and Morgan, 1979)	Functionalist	Interpretivist	Radical humanist
Habermas' classification of interests (Mendelsohn and Gelderblom, 2004)	Technical (formal societal systems)	Practical (communication)	Emancipatory
Jackson's (2001) classification of challenges	Complexity	Subjectivity	Conflict and inequality
Goal	Efficiency of system	Understanding	Critique of method Helping the marginalised/oppressed

Resources and Factors

The mapping concept is used to assemble the BTP units and resources of work. This concept is used to manage autonomic KIDD instances in the implementation phase; and it is based on a real world iterative model that maps all the DMSs resources to CSFs (The Open Group, 2011a). The BTP's DMS has to identify the initial set of CSFs to be used for the performance measurement system as shown in Figure 8.

Figure 8. The factors based framework



The Artefacts' Model

The proposed AMM nomenclature is presented to the reader in a simplified form to be easily understandable on the cost of a holistic formulation vision. The DMS uses the AMM that is formalized as shown in Figure 9.

Figure 9. The applied mathematical model's nomenclature (Trad, & Kalpić, 2017a).

AMM

mcRequirement	= KPI	(1)
CSF	= $\sum$ KPI	(2)
CSA	= $\sum$ CSF	(3)
Requirement	= $\sum$ mcRequirement	(4)
(e)neuron	= action + mcIntelligenceArtefact	(5)
mcArtefact	= $\sum$ (e)neurons	(6)
mcEnterprise	= $\sum$ mcArtefact	(7)
(e)Enterprise	= $\sum$ mcEnterprise	(8)
mcArtefactScenario	= $\sum$ mcArtefactDecisionMaking	(9)
IntelligenceComponent	= $\sum$ mcArtefactScenario	(10)
OrganisationalIntelligence	= $\sum$ IntelligenceComponent	(11)
AMM	= ADM + OrganisationalIntelligence	(12)

As shown in Figure 9, the symbol $\sum$ indicates summation of all the relevant named set members, while the indices and the set cardinality have been omitted. The summation should be understood in a broader sense, more like set unions.

The Decision Making System Processing

A DMS must be managed by existing audit or governance frameworks, where the BTP's team configures the types of risks to be mitigated; these risks are orchestrated by DMS actions to deliver possible solutions. The DMS actions map to the governance processes, found in TOGAF's phase G, which is responsible for the implementation of governance needed to adjust the business objectives. DMS KIDP are implemented in all

the BTP's components and the implementation of governance mechanisms should be able to identify critical risks that relate to CSFs, which might need many iterations to contain the risks; such a chain of activities can be modelled and managed by the AMM (The Open Group, 2011a; Trad & Kalpić, 2017a; Trad & Kalpić, 2017b; Trad & Kalpić, 2017c).

The Enterprise Mathematical Model

The DMS is based on the KIDD concept which in turn applies the AMM. The DMS is a part of the *Environment* that uses services to support just-in-time decision-making. The DMS, as shown in Figure 10, is based on a light version of the ADM.

Figure 10. The architecture development method

Model's nomenclature	
mcEnterprise	A micro enterprise component
mcRequirement	A micro requirement
mcArtefact	A microartefact
action (or action)	An atomic service (or neuron) execution scheme
mcIntelligenceArtefact	A set that contains: dynamic basic intelligence + governance + persistence+ traceability + data_xsd + resources
mcArtefactDecisionMaking	A microartefact_decision making entity
mcArtefactScenario	A microartefact scenario

The Enterprise AMM (EAMM) is the combination of an enterprise architecture and transformation methodologies.

The Transformation Model

The transformation is the combination of an enterprise architecture methodology like the Open group's methodology and the AMM that can be modelled after the following formula for the Transformational Model (TM):

TM = Enterprise Architecture + AMM (1).

The DMSM is based on a concurrent and synchronized infrastructure using threads that make various models run in parallel and exchange dynamically data through a mathematical choreography.

The Applied Decision System's Critical Success Factors

Based on the literature review, the most important DMS CSFs that were used are:

Table 5. The decision system's critical success factors

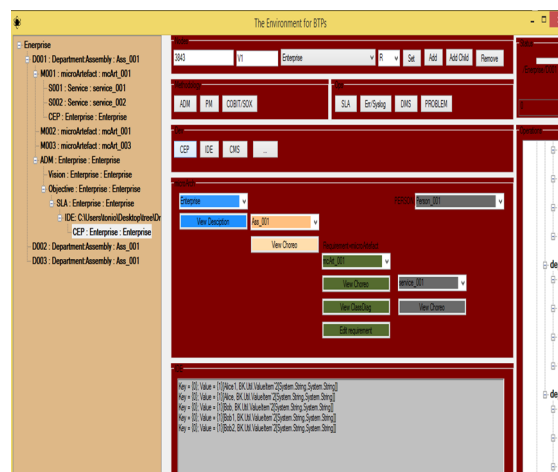
Critical Success Factors	KPIs	Weightings
CSF_DMS_HardThinking&CSFs	Integrated	From 1 to 10. 10 Selected
CSF_DMS_Artefacts&Processing	Synchronized	From 1 to 10. 8 Selected
CSF_DMS_MathematicalModel	Built	From 1 to 10. 9 Selected

THE MODEL IMPLEMENTATION

The Proof of Concept

The Proof of Concept (PoC) was built using the *Environment* that had been developed using the Microsoft Visual Studio .NET. The PoC is based on the CSFs' binding to a specific research resources, where the DMS was prototyped using an enterprise architecture tool. The reasoning model represents the relationships between this research's requirements, knowledge microartefacts (or building blocks) and the CSFs.

Figure 11. The Environment frontend.



The proof of concept was achieved using the development environment and the research framework that is shown in Figure 11. KIDD uses services that make calls to KIDPs as shown in Figure 12.

CSFs were selected as demonstrated in this article's tables and the result of the processing of the DMS, as illustrated in Table 6, shows clearly that the DMS is not an independent component and in fact it is strongly bonded to the BTP's overall risk architecture.

The model's main constraint is that CSAs having an average result below 8.5 will be ignored. This fact keeps the Standards Mapping and Architecture's CSAs (marked in green) that helps to make this work's conclusion; and drops the information system, knowledge management's and DMS' CSAs marked in red. It means that such a BTP will surely face failure and that the BTP must be done in two or even three transformation projects, where the first one should try to transform the information system.

Figure 12. The research flow

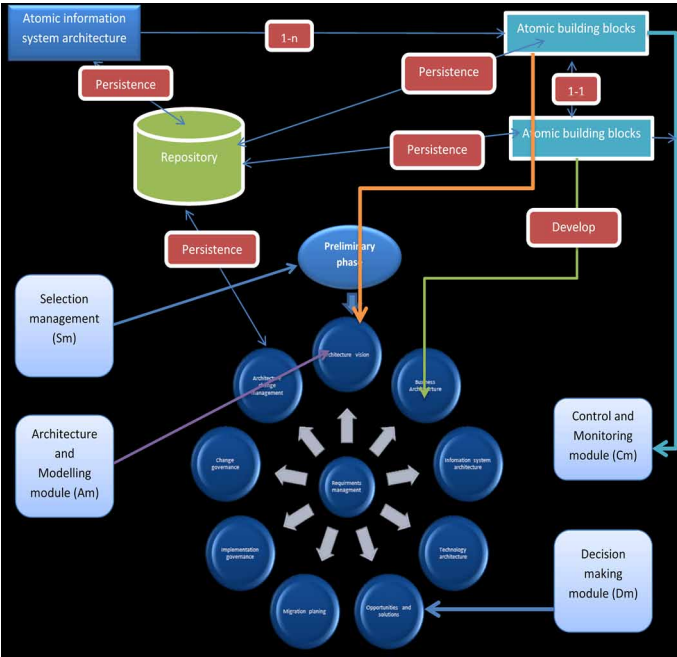


Table 6. The knowledge management research outcome

CSA Category of CSFs/KPIs	Influences Knowledge management	Average Result
The Information System	Built on silos/difficult to transform	From 1 to 10 5.25
The Standards and Mapping	Feasible but complex	From 1 to 10 5.75
The Knowledge Management	Difficult to implement	From 1 to 10 5.33
The Architecture	Feasible	From 1 to 10 5.00
The DMS	Difficult to implement	From 1 to 10 5.33

SOLUTION AND RECOMMENDATIONS

In this article, the authors propose the following set of architecture, technical and managerial recommendations:

- A BTP must build a holistic knowledge management concept in order to insure an efficient DMS.
- Enormous efforts must be applied to integrate underlying information system to support a knowledge management. Here is the main problem is alignment because information systems are silos.
- DMSs should replace traditional obsolete knowledge management systems.
- The architecture development method’s integration in a DMS enables the automation of all its knowledge and decision activities.
- The BTP must be separated in three transformation projects, where the first one should attempt to transform the information system.

FUTURE RESEARCH DIRECTIONS

The *Environment* future research efforts will focus on the evolution of the intelligence driven development in transformational initiatives in a cross-functional environment.

CONCLUSION

This research phase is part of a series of publications related to BTPs and enterprise architectures. This research is based on mixed action research model; where critical success factors and areas are offered to help BTP architects to diminish the chances of failure when building knowledge systems. In this article, the focus is on knowledge and intelligent systems. KIDD describes a structured inter-relationship development of various knowledge fields and the implementation of knowledge artefacts. The KIDD component's holistic integration is an important factor for the business information system's evolution. The most important managerial recommendation that was generated by the previous research phases was that the business transformation manager must be an architect of adaptive business systems.

The PoC was based on the CSFs' binding to a specific research resources and the reasoning model represents the relationships between this research's requirements, microartefacts and the CSFs. The result implies that an attempt of transformation is dangerously prone to failure. To avoid this scenario, we recommend to perform the BTP through two or even three independent transformation projects, where the task of the first ones to transform the information system

ACKNOWLEDGMENT

In a work as large as this research project, technical, typographical, grammatical, or other kinds of errors are bound to be present. Ultimately, all mistakes are the authors' responsibility. Nevertheless, the authors encourage feedback from readers identifying errors in addition to comments on the work in general. It was our great pleasure to prepare this work. Now our greater hopes are for readers to receive some small measure of that pleasure.

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KEY TERMS AND DEFINITIONS

ADM: Architecture development method.

Critical Success Factors: Can be used to manage the statuses and gaps in various project plans and gives the Projects the capacity to proactively and automatically recognize erroneous building blocks and to just-in-time reschedule the project plan(s).

EMS: Enterprise knowledge management.

Environment: Is this research's framework.

KIDD: Knowledge and intelligence-driven development.

KIDP: Knowledge and intelligence design pattern.

KMS: Knowledge management system.

Manager: Business transformation manager.

Project: Business transformation project.

TOGAF: The Open Group's architecture framework.

Continuous Assurance as Digital Transformation Enabler of Audit, Risk Management, and Business Compliance

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INTRODUCTION

The concept of Continuous Assurance began to arouse much interest when in 1999 a joint committee of the AICPA (American Institute of Certified Public Accountants) and the CICA (Canadian Institute of Chartered Accountants) took up the issue of Continuous Assurance and defined it as a set of services and technologies which enables independent auditors to provide written assurance on a subject issued simultaneously with, or a short period of time after, the occurrence of events underlying the subject (Vasarhelyi, Alles & Williams, 2010). Nowadays, the concept of Continuous Assurance is still relevant due its contribution to the current organizational context, in which there is a fierce competitiveness and a constant need for more timely, relevant and reliable information to support the decision making and achieve the strategic and operational objectives .

In this context of constant change and increasing competitiveness, seeking productivity gains and improving management tools have been a core priority. Thus, Continuous Assurance has been asserting itself and assuming an increasingly important role within organizations, with the function of management support and, in general, to ensure the economic and efficient use of resources, areas where the effects of the impact of new risk factors caused by the constant change, fierce competition and widespread access to global information are more felt (Morais, 2008).

Continuous Assurance and Auditing are sometimes used interchangeably. However, assurance is a much broader concept than auditing because whilst auditing is a systematic process of obtaining and evaluating evidences on organizational data and transactions in order to verify their compliance to standards, policies, or rules, assurance additionally includes professional services that ensure quality of information or its context, for decision makers (Soltani, 2007).

This chapter provides the concept of Continuous Assurance, its objectives and components, and a model which allows both to evaluate information systems with Continuous Assurance services and to help design the requirements of new ones. Finally, some implementations are also presented providing a comprehensive understanding the state-of-the-art and the benefits of Continuous Assurance.

BACKGROUND

Continuous Assurance is defined as the application of emerging information and communication technologies to the standard techniques of auditing, both mandatory periodic auditing and internal auditing. In that view, Continuous Assurance is a new step in the evolution of transactional auditing from manual

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techniques to automated methods. The term “continuous” does not mean real time, but to be effective considering, respecting and being consistent with the pulse and rhythm of each organizational transaction and process (Vasarhelyi *et al.*, 2010).

Furthermore, Continuous Assurance emerges as a set of services which aims to restore the credibility of auditing, simultaneously allowing organizations to meet the requirements of regulations. Hence, it can diagnose the company’s viability and allegations of fraud and illegal acts, assessing the economy, efficiency and effectiveness of organizations (Murcia, Souza & Borba, 2008; Vasarhelyi *et al.*, 2010).

In addition, it has provided a transformation in the auditing for the maximum possible degree of automation. Given the emphasis on the digital transformation of the entire auditing system, the development of Continuous Assurance requires a revision of all aspects of auditing, namely on how data is made available to the auditor, how alerts are managed, what kind of reports are useful, and how often and to whom they are sent (Rui Pedro Marques, 2019; Vasarhelyi, Alles, & Williams, 2010)

In 2006, a survey (PricewaterhouseCoopers, 2006) concluded that Continuous Assurance triggered corporate sensitivity to its adoption because in 2005 only 35% had a continuous auditing or monitoring processes in place or were planning to develop one, and this value increased to 50% in 2006. It is interesting to observe that 56% of respondents said their continuous auditing processes include both manual and automated elements, 41% indicated their processes are entirely manual, and 3% reported having fully automated processes.

Another study by Institute of Internal Auditors and ACL (2006) also showed similar results: 36% of surveyed organizations confirmed they implemented a Continuous Assurance approach in all their business processes or simply in some selected areas, and 39% intended to implement in the near future. However, it also states that regardless of the reasons that organizations may have had to neglect the continuing auditing in the past, the recent regulations, the stimulus for real-time monitoring and reporting of financial information and the ability to automate the traditional audit methods have strongly encouraged its adoption.

The issues discussed regarding the motivations which are driving Continuous Assurance include: the growth of complexity and amount of data, the growth of electronic exchange of information and outsourcing, the integration of the value chain; reports available on the Web, and the users’ desire for reliable information and disclosed more frequently, more timely and more detailed; and the need for disclosure of updated information imposed by the Sarbanes Oxley Act (section 409) (Brown, Wong & Baldwin, 2007).

Brown, Wong and Baldwin (2007) reviewed more than 60 articles on this topic and concluded that Continuous Assurance was still a concept for most organizations and a goal for the future. The implementation of systems with continuous assurance services was residual when comparing with continuous monitoring and continuous auditing systems. These latter systems presented high levels of maturation regarding their implementation in the inquired organizations.

According to the section, in this chapter, which describes some Continuous Assurance implementations, we can see that the implementations designated as providers of Continuous Assurance services, in the period 2002-2015, were still few and with some limitations regarding the diversity of services that Continuous Assurance should be expected to offer. This shows that this area is still developing and maturing (R.P. Marques & Santos, 2017a, 2017b).

CONTINUOUS ASSURANCE CONCEPT

The concept of Continuous Assurance refers to the set of services which, by means of technology, uses the information immediately and produces audit results simultaneously with or within a short period of time after the occurrence of relevant events. Furthermore, it allows analytical monitoring of business processes. It is intended to be timely, more comprehensive, more accurate and more supportive to management than the traditional auditing (Alles, Kogan & Vasarhelyi, 2003, 2004; Vasarhelyi, Alles & Kogan, 2004).

Moreover, Continuous Assurance has provided a change in the auditing practice for the maximum possible degree of automation. Given the emphasis on the transformation of the entire auditing system, the development of Continuous Assurance requires a fundamental reassessment of all aspects of auditing, in particular on how data is made available to the auditor, how alerts are managed, what kind of reports are issued, and how often and to whom they are sent

According to IFAC (2004), the subject matter, and subject matter information, of Continuous Assurance can take many forms, such as:

- Financial performance or conditions (for example, historical or prospective financial position, financial performance and cash flows) for which the subject matter information may be the recognition, measurement, presentation and disclosure represented in financial statements;
- Non-financial performance or conditions (for example, performance of an entity) for which the subject matter information may be a key indicator of efficiency and effectiveness;
- Physical characteristics (for example, capacity of a facility) for which the subject matter information may be a specifications document;
- Systems and processes (for example, an entity's internal control or IT system) for which the subject matter information may be an assertion about effectiveness;
- Behavior (for example, corporate governance, compliance with regulation, human resources practices) for which the subject matter information may be a statement of compliance or a statement of effectiveness.

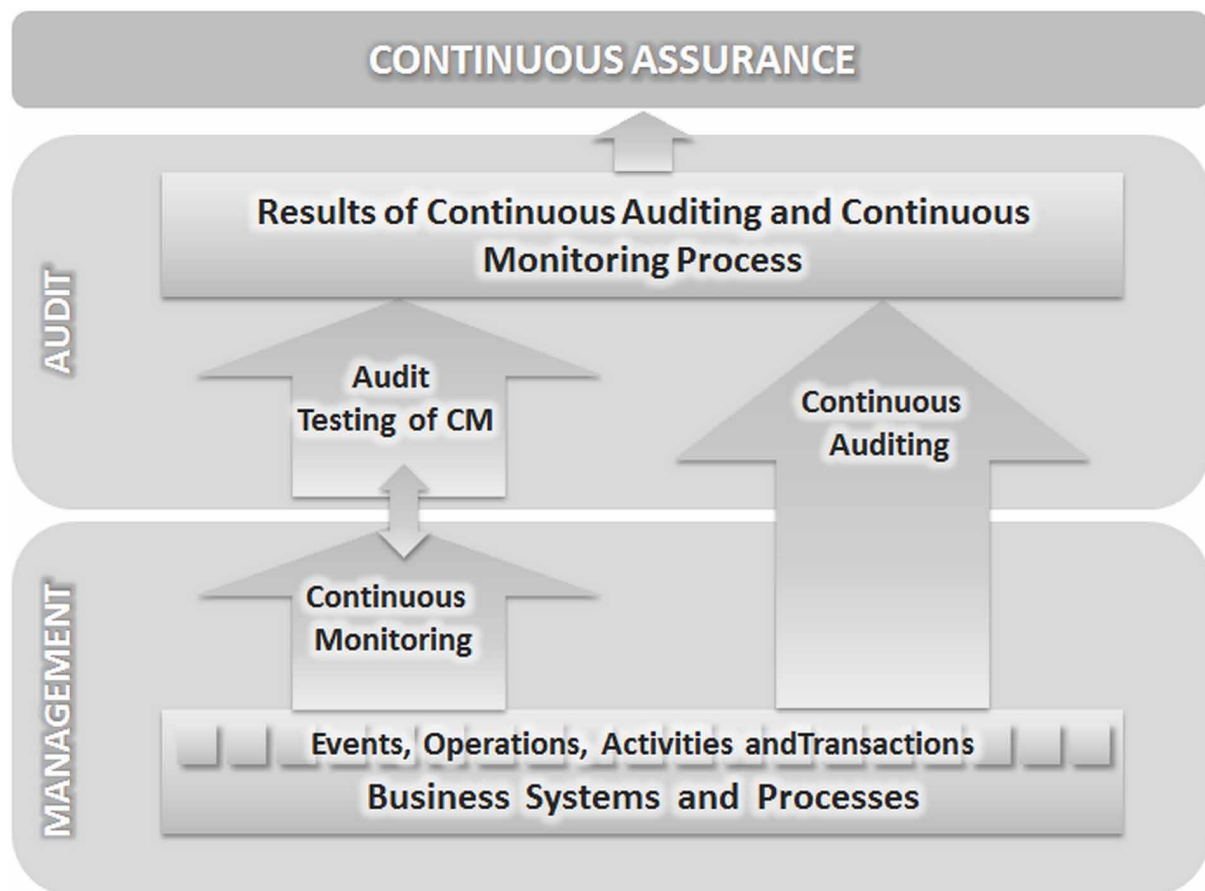
When Continuous Assurance services are running in real time, they provide the opportunity to manage transactions simultaneously with their execution or after a particular event, and even in some cases, the ability to interfere with the completion of the transaction, correcting it. When some service of Continuous Assurance points a wrong transaction, and this is corrected by the auditor, we can say the system becomes a proactive player in the processing of organizational information (Vasarhelyi *et al.*, 2004).

The terms Continuous Assurance, Continuous Auditing and Continuous Monitoring are sometimes used indiscriminately in literature. Therefore, it is crucial to understand what characterizes and distinguishes them, but mostly to understand how they can be relate to, complementing each other (Figure 1).

Continuous Assurance is a statement on the adequacy and effectiveness of controls and integrity of information. Continuous monitoring of controls is at the center of Continuous Assurance strategies; however, the audit activity ensures that management activities are appropriate and effective so that organizations have a greater level of certainty about the effective operation of controls, about risk management and about the integrity of information used for decision making (Alles *et al.*, 2003; Coderre, 2005; Kuhn & Sutton, 2006).

In turn, Continuous Auditing refers to activities undertaken to provide warranty and credibility to operations, besides giving a more timely character to issues of control and management of risk. Continu-

Figure 1. Continuous Monitoring, Auditing and Assurance (adapted from Coderre, (2005))



ous Monitoring is responsible for constantly monitoring and evaluating business transactions and their related controls, enabling a real-time view on effectiveness of controls and on integrity of transactions (Minnaar, Little & Farineau, 2008).

Evaluating the combined results of Continuous Monitoring and audit procedures, auditors can provide Continuous Assurance. However, only recently has an effort been made to understand their differences and distinguish between the concepts.

A bibliometric study (R.P. Marques & Santos, 2017b) about the evolution of research on Continuous Auditing aimed to find reasons for the very slow evolvement of research on Continuous Assurance, because author consider that Continuous Assurance represents numerous advantages for the organizational performance. Thus, they intended to understand if there is a relation between the evolution of research on Continuous Auditing and the still very low maturity levels of Continuous Assurance solutions. The study concluded that the number of publications is significantly reduced and that the slow growth of research on Continuous Auditing may be contributing to the lack of maturity of Continuous Assurance (R.P. Marques & Santos, 2017b).

CONTINUOUS ASSURANCE OBJECTIVES

The objectives of Continuous Assurance, making it really advantageous, are divided into four levels, which are difficult to define in a mutually exclusive way, but which serve to illustrate the functional dependence of Continuous Assurance on auditing (Vasarhelyi *et al.*, 2004).

Level 1 – Evaluation of Organizational Transactions

At this level, it is intended to evaluate organizational transactions, and analyze and verify the atomic actions of transactions execution (for example, movement of money or information to the level of data that compose it). With the use of corporate systems, such as ERP (Enterprise Information System) systems, it is possible to analyze, aggregate and evaluate data in order to classify and monitor organizational transactions.

At this level, input data should be tested in order to verify whether they are valid, and whether procedures in execution of transaction are consistent with the sequence of established operations, for example check whether a certain movement in the stock corresponds to a sale, to a certain bill, and whether it is in accordance with the order received. Contrary to traditional auditing, with Continuous Assurance it is possible to do this check in real time due to automation and integration of audit procedures. This transaction control can use the formal specification of workflow of processes defined in the ERP systems as a standard behavior of transaction. Thus, it is possible to verify whether transactions have been executed in compliance with all provided steps to foresee the flow of transactions, and whether these are missing or failing.

Level 2 - Compliance of Performed Operations

At this level it is intended to ensure that procedures applied in the execution of organizational transactions are appropriate (for example, are consistent with the rules, norms, or standards set by the organization or by external regulatory entities).

The procedures of this level use comparison with standards in order to verify the application of these rules and standards, and if any inconsistency is found, the situation will be forwarded to the auditors or other responsible person for consideration. Although in this latter case the resolution of the problem is not guaranteed in real time, this selectivity will allow greater efficiency in the auditors' tasks.

Level 3 - Quality of Estimates and the Consistency of Aggregate Data

In some businesses, estimates and forecasts are often used because the measurement or direct determination of some information is difficult and expensive to obtain. For example, the percentage of completion of a work is not always easy to measure, and therefore, must be estimated.

Even if an organization does not automatically generate an estimate, continuous assurance services can use their own formal models to ensure in real time that the estimate used is acceptable. Obviously, the creation of a formal model of an accounting estimate is not a simple proposition and can add significant costs to the development of Continuous Assurance. A simple and economical alternative is to use a formal model to automatically get an estimate, then the auditor's task will be reduced only to verifying the acceptability of this model, which can be done only once and off-line, based on knowing whether the used parameter values in model are reasonable.

This level of Continuous Assurance includes automation of analytical procedures based on internal and external parameters. The use of analytical procedures in an automated system of Continuous Assurance increases efficiency and effectiveness of auditing.

Level 4: Evaluation of Organizational Decisions

The auditing carried out by using ERP systems and advanced financial instruments must incorporate complex and high level assessments, which are especially important for decision making. Such judgments may have to deal, for example with the relevance of contingencies, the extent of related-party transactions, the boundaries of corporate systems, and the nature of the relationships across the value chain. Continuous Assurance and the current analytic technology allow the extensive gathering of exogenous evidence, which provides crucial input into these judgments. Continuous Assurance may use, for example data warehousing and data mining as tools that facilitate automation of some of these decisions, improving the quality of high-level decisions and decreasing the audit risk.

CONTINUOUS ASSURANCE COMPONENTS

Continuous Assurance is divided into three distinct components, but complementary (Vasarhelyi *et al.*, 2010):

- *Continuous Controls Monitoring (CCM)* consists of a set of procedures to monitor the operation of internal control mechanisms;
- *Continuous Data Assurance (CDA)* verifies the integrity of the data circulating in organizational information systems;
- *Continuous Risk Monitoring and Assessment (CRMA)* measures the risk dynamically and allows to sustain an auditing plan.

Continuous Controls Monitoring

CCM is a set of emerging technologies which monitors controls in ERP systems and other applications in order to improve business governance, monitor and verify access and transactional rules, and to automate audit processes. CCM assists the business in: reducing business losses from fraud or failure; following rules or procedures which govern transactions; and improving performance through monitoring and auditing of the controls implemented in the systems (Caldwell & Proctor, 2010).

Caldwell and Proctor (2010) identified many important CCM functionalities, namely controls monitoring functions, exception and remediation management, reporting and analytics, and workflow. With these functionalities, CCM adds value, in an organization, to risk management and to the following compliance initiatives:

- lowering compliance costs - CCM reduces the cost of auditing by eliminating some manual sampling and minimizing the time it takes to gather documentation;
- improving financial governance - CCM can increase the reliability of transactional controls, improve auditor trust and increase the effectiveness of antifraud controls;

- improving operational performance - CCM controls, such as those that monitor duplicate payments, incorrect discounts or misapplied warranties, go beyond what most people consider compliance.

A study (R.P. Marques & Santos, 2017a) concluded that research in Continuous Monitoring is still very scarce. Considering that this, together with Continuous Audit, is one of the essential components of the Continuous Assurance, it is possible to establish the relationship between this research scarcity and the slow pace in the development of complete Continuous Assurance solutions. In fact, we can only contribute effectively to the development of Continuous Warranty when all its components have been properly studied (R.P. Marques & Santos, 2017a).

Continuous Data Assurance

CDA has been a powerful tool in organizations, particularly in financial and accounting areas, to extract data from organizational databases and applications in order to make analyses at the transactional level and to provide more detailed assurance. It has the main objective to change the traditional vision of data auditing in which reports were prepared and audited only once a year; sampling was used rather than examining the entire population; data were analyzed at the trial balance level using ratios.

This aggregation and analysis at a higher level than the transactional level has been a cost and capability-based limitation rather than the ideal process for assurance. Thus, CDA can continuously monitor transactions, comparing their characteristics with expected behaviors, thus identifying anomalous situations. When substantial divergences occur, alarms will be triggered and routed to the respective stakeholders (Vasarhelyi *et al.*, 2010).

To implement transaction verification it is necessary to specify data validity, consistency and referential integrity rules which are then used to filter data. These rules aim to detect and remove two types of data errors: data integrity violations (for example, invalid purchase quantities, receiving quantities and bank check numbers) and referential integrity violations which are largely caused by many unmatched records among different business processes (for example a payment made for a non-existent purchase order).

Continuous Risk Monitoring and Assessment

CRMA is the process by which organizations address the risks attaching to their activities in pursuit of organizational objectives and across the set of all their activities. Besides, CRMA involves: measuring risk factors continuously, integrating different risk scenarios into some quantitative framework, and providing inputs for audit planning, i.e. it engages risk assessment, risk evaluation, risk treatment and risk reporting. The organizational risk management approach is intended to align risk management with business strategy and embed a risk management culture into business transactions (Collier, Berry & Burke, 2007; Vasarhelyi *et al.*, 2010).

INFORMATION SYSTEMS WITH CONTINUOUS ASSURANCE SERVICES

Marques, Santos and Santos (2013a) proposed a model composed of three dimensions and one requirement, which aims to evaluate an information system with Continuous Assurance services, and which intends to be regarded as a referential set of requirements when developing this type of information

systems. The authors used the Delphi method to validate the model in order to ensure the relevance of inclusion of these dimensions and requirement and also a set of metrics to be included in each dimension and requirement (Rui Pedro Marques, Santos, & Santos, 2016). Furthermore, this model was successfully used in a more comprehensive research project (Rui Pedro Marques, Santos, & Santos, 2015).

It is composed of the dimensions Monitoring, Compliance, Estimation and the requirement Reporting, which comprise all objectives and components of a system with Continuous Assurance services (Rui Pedro Marques et al., 2013a, 2016):

- Dimension ‘Monitoring’ relates with the objectives of level 1 and the component CCM. In this dimension, the following metrics may be found to assess whether the system can: monitor the various operations of a process as soon as they occur; identify an irregular (unforeseen or inconsistent) operation as soon as it occurs; verify whether the operations were processed at all the previous steps as required; detect lack of operations; and assess the continuity and completeness of transactions.
- Dimension ‘Compliance’ includes the features of the component CDA and the objectives of level 2. The metrics associated to this dimension aims to assess whether the system can: recognize which known execution pattern was or has been followed by each organizational transaction monitored; ascertain which rules, conditions and procedures were fulfilled and unfulfilled in the organizational transactions monitored; detect potential errors; inhibit inappropriate events or behaviors; and help compliance with existing laws, policies, norms and procedures.
- Dimension ‘Estimation’ covers the objectives of level 3 and the functions of the CRMA component. The metrics of this dimension assess whether the system can: estimate, given the current situation, what the possible results of the organizational transaction execution will be; and determine the execution pattern, or a set of execution patterns, which will be possible to be followed by the organizational transactions monitored, according to the current status of execution.
- Requirement ‘Reporting’ includes the features of all components and the objectives of all levels. The metrics of this requirement must assess whether the system can: report the results of the monitoring of transactions; notify the results of the verification of compliance; inform the results

Table 1. Dimensions of the model and their metrics

Dimensions and Requirement	Metrics
Monitoring (dimension)	– Real-time monitoring of operations – Real-time identification of irregular operations – Real-time verification of processing of required operations at all previous steps – Real-time detection of lack of operations
Compliance (dimension)	– Recognition of execution patterns – Ascertaining of fulfilling of rules – Detection of potential errors – Verification of compliance of existing policies
Estimation (dimension)	– Estimation of possible results – Determination of possible execution patterns which are likely to be followed
Reporting (requirement)	– Real-time presentation of the executed operations which were monitored – Real-time presentation of execution patterns which are being followed or are likely to be followed – Real-time presentation of the compliance verification in transactions executions – Real-time presentation of the risk estimated on determining possible execution patterns – Real-time alert for irregular situations in monitoring, compliance verification and estimation of negative results

of estimation; and alert users of irregular situations in monitoring, compliance verification and estimation of negative results.

Table 1 concisely summarizes this model, presenting quantitatively measurable metrics for each dimension and requirement.

CONTINUOUS ASSURANCE AS DIGITAL TRANSFORMATION ENABLER

Some solutions in the field of Continuous Assurance have been made available in the market and are mostly developed by well-established CAAT (Computer Assisted Auditing Techniques) manufacturers and vendors, which begin to position themselves in this still emerging market. Despite regarded as Continuous Assurance solutions by vendors, these products focus more on the CDA component. The implementation of CCM solutions is very complex due to significant differences in the types of business objects, process configurations and controls and then it is not cost-effective. Thus, these solutions have developed some very specific CCM modules targeted at specific enterprise systems. Such modules are quite laborious since they require customization for each new enterprise system (Vasarhelyi *et al.*, 2010).

An organization in the steel industry with 234 industrial and commercial units, present in 10 countries and with shares in New York Stock Exchange, was forced to implement measures of Continuous Assurance in accordance with SOX requirements. After these measures, all processes had to be documented and information started to be disclosed in time and with their integrity ensured and it held the participants responsible, inhibiting the occurrence of fraud (Hargadon & Fanelli, 2002).

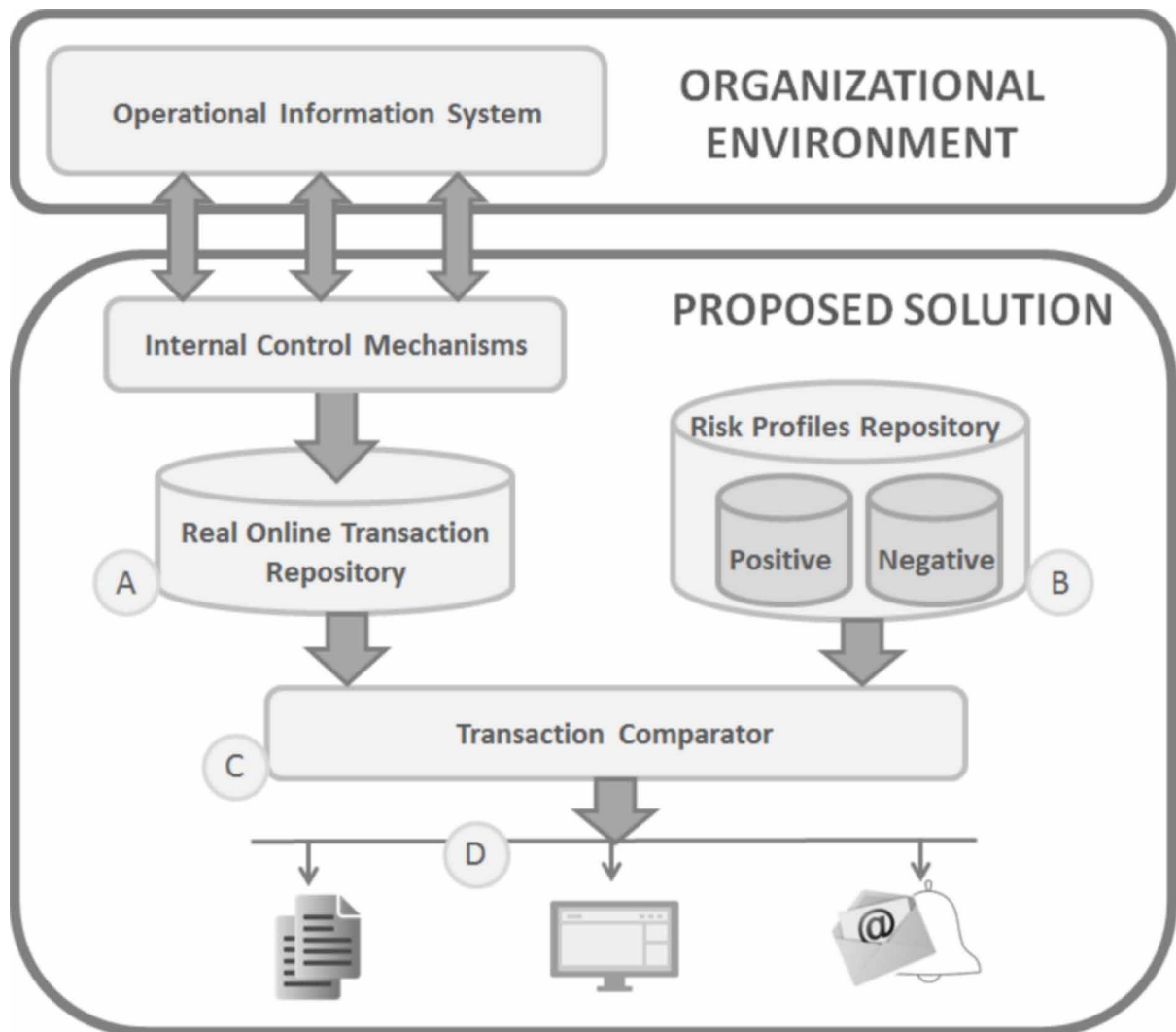
Siemens has made an effort in this area and it has successfully experimented some aspects of Continuous Assurance, namely to ensure the integrity of its ERP systems and their automated modules with audit functions. Siemens's project proposes a methodology to monitor and evaluate the daily configuration of various settings of existing controls through the use of CCM, because about 68% of its audit activities could be fully automated. Thus, an independent system was developed for interacting with read-only operations with the existing information systems and for reporting system and alarms in case of emergency. These implementations have ensured the effectiveness, efficiency and a timely character to the audit procedures. (Alles, Brennan, Kogan & Vasarhelyi, 2006; Alles, Kogan & Vasarhelyi, 2008). The use of CCM at Siemens Financial Services enabled significant improvements in the average exception rate, through the testing and monitoring of performance analytics (e.g. input checks, validity checks, and compliance with regulations and internal policies). In some departments, the reduction in the average exception rate was over 20% in the first year of implementation (Medinets, Gross, & Brennan, 2015).

Also according to Vasarhelyi *et al.* (2010), one of the biggest banks in Brazil, with more than 1400 branches, has implemented measures for Continuous Assurance, proving the viability and benefits of these measures. This institution has a CDA, a system which daily analyses more than five million accounts and generates about six thousand alerts a month. This system aims to increase productivity with efficiency and quality and its mission is to assess the risks and controls automatically and continuously in order to identify exceptions, anomalies, trends and indicators of risk; advise about controls, risk assessment; and contribute to the corporate governance. These features include all products, processes and services which enable data extraction and analysis. The taken approaches are of detection (routines to detect possible errors), of deterrence (routines to inhibit inappropriate behavior and events), financial (routines to reduce or avoid losses), and of compliance (routines to ensure compliance with applicable laws, policies and standards).

Recently, an innovative solution was developed to implement Continuous Assurance services in information systems applicable to any business process, regardless of its type, dimension, business area or even its information system support technology, supported by an ontological model at an abstraction level that guarantees that contextual independence. The results analysis from an implementation of this solution allowed to ensure the feasibility and the effective use of the solution (R. P. F. Marques, Santos, & Santos, 2013; R.P. Marques, Santos, & Santos, 2015).

The latter implementation showed to provide full services of Continuous Assurance, because it is able to record the operations which compose the organizational transactions and which are performed in the operational information system; enables the instantiation of risk profiles associated with organizational transactions; is capable of recognizing risk profiles, which were followed by the already concluded organizational transactions; is capable of determining possible risk profiles, which are being followed or likely to be followed by organizational transactions still in progress; provides the presentation of the executed operations, which were monitored; provides the presentation of execution patterns, which are

Figure 2. Conceptual architecture of the solution proposed by Marques et al. (2015)



being followed or are likely to be followed and the results of the compliance verification in the execution of transactions; provides the presentation of risk estimated on determining possible execution patterns; is able to alert for irregular situations in monitoring, compliance verification and estimation of negative results; and provides its functionalities in real-time. (Rui Pedro Marques et al., 2015)

Figure 2 schematically represents the conceptual architecture of this solution. The system is connected to the operational information system in which internal control mechanisms are incorporated in order to monitor operations and data related to the transactions we intend to control (Rui Pedro Marques, Santos, & Santos, 2014). The Real Online Transaction Repository (component A) manages and stores this information from the internal control mechanisms. The component B illustrates the risk profiles repository of the organizational transactions to be monitored and audited (Rui Pedro Marques, Santos, & Santos, 2013b). These risk profiles represent different ways, negative and positive, to execute transactions. The component C is the module intended to be able to compare the various records in the risk profiles repository and determine which profile is being followed by running each transaction, according to the information received by component A (Rui Pedro Marques, Santos, & Santos, 2018). Finally, the results from the comparison module are reported the users of the system (component D), enabling the viewing of the current and historic state of controlling of the audited transactions.

Finally, another study (Barros, 2018) concluded that the degree of importance assigned to a Continuous Assurance service by the internal auditors is superior to the degree of use of those services. Authors affirm that some Continuous Assurance services are already implemented in medium and large companies and present in the professional life of the internal auditors. However, they also state that there is still a lot of work to be done to ensure that the Continuous Assurance service is fully implemented in the organizations. Despite the relatively slow evolution, it can be stated that specially in the medium and large companies, most of the internal audit professionals are aware about the importance of implementing a Continuous Assurance system and that the use of some of its services is already somehow established in their daily routines.

FUTURE RESEARCH DIRECTIONS

The limitations of Continuous Assurance that can be found in the chapter are likely to be the next future research topics in this area. A major limitation is in the CCM, because its implementation is complex due to the variety of control mechanisms it has to monitor in different business processes and contexts. A CCM which can be independent of the business processes and contexts was already implemented (Rui Pedro Marques et al., 2015) although it is still very dependent on control mechanisms and on the initial system customization, which is a time-consuming and very hard task. Guerreiro, Marques and Gaaloul (2016) present a high-level conceptualization of an evolvable risk-based approach capable of self-learning the needs of monitoring, based on the continuous observation of business processes and of the results of continuous monitoring (approach with feedback control). This type of approaches has promising results and may be a future research direction.

Furthermore, a conceptualization of a model to assess the maturation of Continuous Assurance seems to be relevant to evaluate the services provided by the emergent solutions and, simultaneously, to follow the evolution of Continuous Assurance. Considering that reporting plays a crucial role in continuous assurance, there is also a need to propose innovative dashboards, validated by audit experts, to increase the efficiency of the use of outputs of such systems.

Finally, another future research direction may include assessing the impact of blockchain (Dai & Vasarhelyi, 2017; Kokina, Mancha, & Pachamanova, 2017) and robotics (Moffitt, Rozario, & Vasarhelyi, 2018) on continuous assurance.

CONCLUSION

Although Continuous Assurance is not a concept firmly established yet, it is clear that it is maturing both in practice and in research because of its proven benefits in various organizational branches. In the public sector, the health service, social security institutions, tax administration, banking can be stated as examples. In the private sector, any organization can benefit from the implementation of Continuous Assurance, although those with greater resources are more able to bear it and keep it, for example, the areas of banking and telecommunications.

Furthermore, recent researches have proved the feasibility of implementation of information systems with full services of Continuous Assurance, covering all components and levels of objectives, to any business area and any type, dimension and nature of business process, providing very positive outcomes to the operational performance and accountability of organizations.

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KEY TERMS AND DEFINITIONS

Continuous Assurance: Set of services which, making use of technology, uses the information immediately and produces audit results simultaneously or within a short period of time after the occurrence of relevant events.

Continuous Auditing: Activities undertaken to assess the business compliance to rules, policies, or legislation, providing warranty and credibility to operations.

Continuous Monitoring: Process responsible for the management of internal control mechanisms in order to ensure their effectiveness, allowing to obtain timely information about transactions.

The Risk Assessment Enhancement Process at the Federal Deposit Insurance Corporation

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INTRODUCTION

Government agencies often face increasing challenges to collect, process and analyze voluminous data from corporate and individual filers. Specifically, supervisory banking institutions have appreciated the imperative role of technological innovations to facilitate data processing to analyze business and financial risks of their bank filers. With the advancement in electronic reporting technologies and the intricacies of risk management process, bank regulators are challenged by the complexity of such process to provide better data that will support and inform the bank examination process. Bank regulators interested in the development and expansion of the risk assessment systems face some technical and organizational problems. Such problems are caused by the inherent complexity of the data in bank filings, the proliferation of compliance requirements, and the growing data security concerns, which can all hamper the pace of system development and the generation of quality data (Burton & Seale, 2005; Raghavan, 2007). One of the popular methodologies that have been adopted to overcome such challenges is the Unified Rational Unified Process (RUP®) system development methodology.

In this chapter, a leading government agency represented by the Federal Deposit Insurance Corporation (FDIC) has adopted the RUP® methodology to enhance its risk assessment process. The FDIC's decision was driven by the practicality and agility features of the RUP® and its compatibility with the agency's reporting systems. Specifically, the agency decided to use RUP® to develop its existing Examination Tool Suite (ETS), which supports the main structure of the risk assessment process at the agency.

The RUP comprises four important phases, which characterize the process of developing a system from inception to transition into the target user community. These phases have been explained in this chapter in the context of the FDIC's ETS development process. To better understand the agency's motivation to develop its risk assessment process, the chapter discusses the main characteristics and functions of the ETS application. The agency's main motivation to develop ETS application and choose RUP® to accomplish that goal are also explained. The rest of the chapter discusses the project development phases, challenges, realized benefits and learned lessons. Practical implications and concluding remarks are presented at the end of the chapter.

BACKGROUND

Organizations can select from a variety of software development methodologies. A software development methodology defines the process, documentation and techniques that could support the system

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developers to create and implement a new information technology system (Avison & Fitzgerald, 2006). One of the most notable methodologies in software implementation and development is the Rational Unified Process (RUP®). RUP is an agile process framework that has been created by Phillippe, Kruchten, Ivar Jacobsen and others at Rational Corporation and used in many software implementation projects (Jacobson, I. Christenson, M., Jonsson, P. & Overgaard, G., 1990; Kroll & Kruchten, 2003). The agility component of RUP® framework provides a detailed description of the process requirements which are needed for an agile methodology, often characteristics by its adaptive, straightforward, incremental, and cooperative features (Callahan, 2006). In addition, it is a software engineering process framework that could be used as a best practice for supporting software development projects. The structured approach of RUP® allows system developers to assign tasks and create milestones for deliverables based on predictable schedule and budget (IBM, 2006).

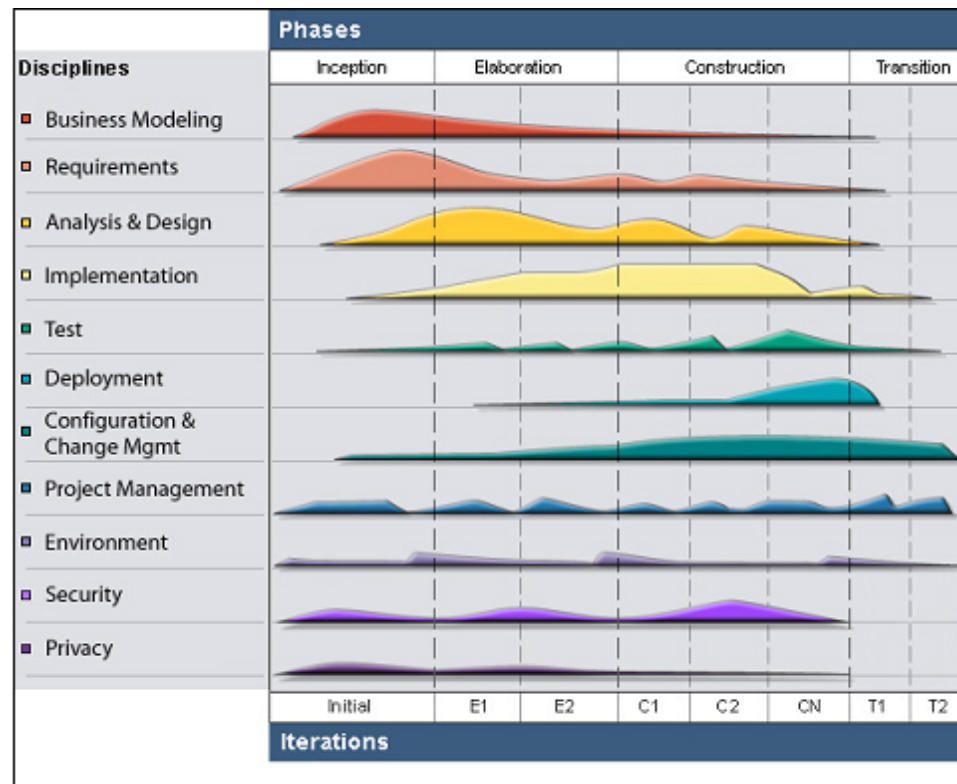
The Rational Unified Process methodology has four advantages. First, the RUP® improves the productivity of the software development team. The process is well-structured and document and offers and allows the development team members to have quick access to the process guidelines and templates, which creates a strong knowledge base for all the members (RUP, 1998). Second, RUP® methodology provides a framework that can be adapted according to the size and complexity of the operating system and the experience and skill of the development team (Jacobson, I., Booch, G. & Rumbaugh, J., 1999). Third, the use of the RUP® methodology is based on utilizing key best practices, which include the iteration of software development and the ability to verify the software quality, monitor changes, and develop risk mitigation strategies (RUP, 1998). Fourth, RUP® elevates the level of system abstraction by reusing existing assets, which subsequently reduce its complexity and project documentation (Geambasu, C., Jianu, I., Jianu, I & Gavrilă, A., 2011).

On the other hand, RUP® has some disadvantages. The increased level of project complexity amplifies the burden of financial, operational and human resources of the organization. The iterative nature of the framework could cause project delays because each phase of the project has to be done methodically and consistently, which could make the project less affordable and more difficult to manage (Callahan, 2006).

Previous research indicates that there are several factors that affect an organization's decision to adopt RUP® methodology. Geambasu et al. (2011) emphasize the importance of clarifying the initial systems requirements with the client prior to the deployment of development work to fulfill all the client's needs and preferences. The researchers also suggest that the first phase, Inception, provides an opportunity to draw realistic initial estimation of costs and development time of the project. In addition, the researchers report that the incorporation of required changes and the production of multiple 'versions' of the system resulting from iterations during the development process are important factors that could more or less expedite such a process. Finally, the authors suggest that the system development costs, the duration of the delivery time of the final version of the system, the system complexity and communication between the client and system developers are significant factors that companies should consider carefully before adopting RUP® methodology.

The RUP System Development Life Cycle process and Phases is presented in Figure 1: inception, elaboration, construction, and transition. Each phase contains one or more iterations that cover a series of disciplines. A discipline is "a collection of activities that are related to a major area of interest" (IBM Corporation, 2006). Figure 1 depicts two axes. The horizontal axis represents the time and showcases the dynamic evolution of the process as it is performed. It is expressed in terms of phases, iterations and milestones. The vertical axis represents the description of the disciplines in terms of activities and workflows.

Figure 1. RUP System development life cycle process and phases



Source: FDIC RUP Web site.

Inception Phase

The main goal of this phase is to achieve agreement among all stakeholders on the main objectives of the project. During this phase, the organization should assess and address the project's business risks, requirements, and constraints before proceeding to the next phase. Also, the organization should evaluate the project's business case based on its cost, scheduling and profitability.

Elaboration Phase

The goal of this phase is to create an architectural foundation for the system that will define its design and implementation efforts. The architecture is created based on identifying the most important system requirements and plans for mitigating risks and predicting costs. In this phase, decisions are made with an understanding of the system scope, functional and non-functional requirements such as performance requirements. Also, an executable architecture prototype is created in possibly multiple iterations depending on the system scope and size. Elaboration is arguably the most prominent phase in the RUP process. Decisions are made in this phase to determine the stability of the architecture, the adequacy of risk mitigation procedures, and the acceptance of the actual resource expenditure versus planned expenditure. Therefore, the outcome of the elaboration phase will determine whether an organization is committed to move to the next phase.

Construction Phase

The goal of this phase is to clarify the remaining system requirements and complete the system development based on the previously created architectural foundation. The emphasis is on the manufacturing process, resource management, schedules and quality optimization. In addition, the organization completes the product development and testing against pre-determined evaluation criteria. This phase entails a transition from the development of intellectual property, which characterized the inception and elaboration phases to the actual development of the deployable products during construction and transition phases.

Transition Phase

The focus of this phase is on ensuring the availability of the new system through the distribution channels and sales teams to the end users. User feedback is solicited through “beta testing” to configure the installation, resolve usability issues and develop new releases. In addition, the organization should prepare user-oriented documentation, offer training and product enhancement and fix potential bugs.

The Pre-Developed ETS Application

The Examination Tool Suite (ETS) application supports the FDIC’s bank examiners and risk assessment personnel in performing the following supervisory tasks (FDIC, 2015):

- Risk management examinations.
- Bank Secrecy Act/Anti-Money Laundering (BSA/AML) examinations.
- Reports of investigations.
- Specific information technology, trust, government security dealer, municipal security dealer, and registered transfer agent examinations.

The ETS imports information from multiple sources (FDIC, 2015). The first source is financial institutions and banks. The FDIC’s risk assessment personnel often request full or sub-set information on the bank’s asset portfolio, which can be provided via the FDIC portal (FDIC-connect) or encrypted memory stick. The data can be easily loaded into ETS application by authorized FDIC staff. Upon receiving bank portfolio information, the FDIC examiners edit the information to meet the specific requirements of the examination process. The second source of information is the Central Data Repository (CDR). The CDR is a central repository that is operated by the Federal Financial Institutions Examination Council’s (FFIEC’s) for the purpose of collecting, storing and distributing Call Report data. The Call Report is known as the Consolidated Reports of Condition and Income, which is submitted to the FDIC every quarter to monitor the bank performance and risk profile¹. The CDR provides Call Reports and Uniform Bank Performance Reports (UBPRs) to the ETS. The third source of information is the Corporate Business Information System (CBIS), which is operated by the Federal Reserve Board. The CBIS is a data warehouse facility that provides users with the FDIC’s financial data that has been sourced from banks and lending institutions. Similar to the CDR, bank data is also derived from the Call Report and uploaded to the ETS for examination purpose. The fourth source of information is the ‘DSC Hours’ system, which is an internal FDIC system. This system collects and stores the FDIC’s examiners information, which include their names, position titles, grades, department ID, and working hours. The fifth source is the Interagency Examination Repository (IER)². The IER provides historical bank examina-

tion data which include shareholder and management (including titles, occupation, attendance) to ETS via Report of Examination (ROE) service. The sixth source of information is the Structure Information Management System (SIMS). The SIMS provides publicly available bank information, which includes its name, certificate number, branches, CEO, and web address. The information is uploaded into ETS to support bank examination process. The last source is the Virtual Supervisory Information on the Net (VISION). VISION provides ETS with statistical information, metrics for analyzing insured banks, and examination-related information. Table 1 provides a sample of examination data from year 2015 to 2017.

Table 1. The FDIC Examinations Data from 2015 to 2017

FDIC EXAMINATIONS 2015-2017			
	2017	2016	2015
Risk Management (Safety and Soundness):			
State Nonmember Banks	1,440	1,563	1,665
Savings Banks	171	164	206
State Member Banks	0	0	0
Savings Associations	0	0	0
National Banks	0	0	0
Subtotal – Risk Management Examinations	1,611	1,727	1,871
CRA/Compliance Examinations:			
Compliance/Community Reinvestment Act	770	709	859
Compliance-only	393	594	478
CRA-only	5	8	10
Subtotal – CRA/Compliance Examinations	1,168	1,311	1,347
Specialty Examinations:			
Trust Departments	347	351	365
Information Technology and Operations	1,627	1,742	1,886
Bank Secrecy Act	1,640	1,761	1,906
Subtotal – Specialty Examinations	3,614	3,854	4,157
TOTAL	6,393	6,892	7,375

Source: (FDIC, 2017)

Examination Tool Suite Application: Background

Prior to the development of the application, the ETS was used primarily as an Automated Loan Examination Review Tool (ALERT) to support the Risk Management (RM) Division and examiners at the FDIC. The RM Division is responsible for examining and supervising state-chartered, non-federal reserve member banks to ensure that they meet the compliance requirements. As part of the examination process, the RM examiners use the Call Report to perform an in-depth analysis of a bank's loan portfolio quality to determine any potential risk to the FDIC insurance fund. The examination process also involves the processing of personally identifiable information of individual and commercial borrowers. Ultimately, the FDIC generates a Report of Examination (ROE), which includes a risk review of individual bank's compliance system focusing on the lending, deposit and investment activities.

The Risk Management personnel and bank examiners often use the ETS application every quarter to review changes in the quarterly Call Reports, manually interpret those changes, and update the application accordingly. In the past, the RM personnel had to wait certain cycles for such updates. By the time ETS was updated, the data had become too outdated for generating the FDIC's Report of Examination (ROE). The FDIC wanted to develop a better solution to expedite the publication of the Call Reports. In addition, the agency sought to provide the examiners with instant access to Call Report and Uniform Bank Performance Report (UBPR) data, analyze information in real-time, and reduce the delivery time for updates to ETS each quarter. Consequently, the generation of the FDIC's ROE will be expedited too (Montoya, 2016).

FOCUS OF THE CHAPTER

FDIC'S Motivation for ETS Development

The Federal Deposit Insurance Corporation faced the challenge of using multiple systems (e.g. GENESYS, Interagency Exam Repository)³ to analyze banking data for risk assessment purpose (CSBS, 2012). This challenge was coupled with the difficulty of eliminating redundant data, updating the current data, and securing remote and easy access of banking information for examination purpose. The agency opted to elevate the functionalities of one of its existing bank examination tools, known as the ETS-Supervisory Application Generating Exams (ETS-SAGE) application. Specifically, the development project was undertaken to achieve the following objectives (FDIC, 2015):

- Decrease maintenance expenses by reducing technical complexity and the number of systems that the FDIC examiners have to use to perform their job.
- Eliminate data redundancy and duplicative data entry.
- Improve ease of access, reporting, and data accuracy.
- Reduce risk and improve the security of examination data.
- Safeguard sensitive examination information by strengthening data security controls.

In addition to those objectives, the FDIC implemented multiple administrative and technical control measures to prevent unauthorized access and misuse of bank data. These controls included the installation of the newly developed ETS application on laptops and desktops which are compliant with FDIC's IT security policies and subject to regular vulnerability/penetration testing assessments. Finally, all the FDIC examiners would be required to pass background checks and comply with the FDIC security and privacy policies. Also, examiners only have access to data on a "need to know" basis (FDIC, 2015).

FDIC's Rationale for Adopting the RUP® Framework

The FDIC adopted the Rational Unified Process® (RUP) as the agency's system methodology for developing the ETS-SAGE application (Rational Software, 1998). The RUP® framework was used to meet specific requirements of the project based on the size and complexity of the data in the bank filings. Through the application of the RUP® Framework, the agency supported the practice of shorter software delivery which entails the delivery of small and short increments of implementation phases. The RUP® framework was also selected for its practicality that would allow the project implementers to develop,

test, style each feature and phase in the project before moving on to the next phase. Lastly, the framework allowed the system users to be involved in the project development and testing as the users' feedback is solicited.

SOLUTIONS AND RECOMMENDATIONS

The Application of the RUP® in the FDIC Context

The Inception Phase

During the inception phase in early 2012, the FDIC developed a detailed understanding of the needs and uses of the ETS application. A Project Initiation Review Committee met with the ETS project managers to review the start-up of the project, help establish priorities, resolve potential conflicts, and plan key activities to successfully initiate the project (FDIC, 2014). The project managers worked with a software vendor to develop the ETS application that would recognize interfaces with other systems. In addition, the managers worked on identifying key risks, determining acceptance criteria, capturing the reporting requirements, and developing costs and schedules.

The Elaboration and Constructions Phases

During the elaboration phase and at the end of 2012, the ETS software vendor built a prototype of the ETS to ensure that the proposed solution would support the ETS requirements at a reasonable cost and within an appropriate timeframe. At the end of this phase, an initial testing was performed to identify and mitigate emerging risks. Detailed iteration plans for the construction phase were laid out and a comparison between the actual and planned expenditure was performed. During the construction phase, the software vendor and the FDIC completed the analysis, design, development, and testing of the ETS's functionality (FDIC, 2014).

The Transition Phase

During this phase, a final testing of the ETS was performed and adjusted based on user feedback. Testing was performed using simulation, which involved the FDIC examiners and a sample of filer banks. At this phase, the user feedback became prominently focused on fine-tuning the configuration and installation of the ETS.

Project Challenges

The U.S.'s Government Accountability Office has identified the following common challenges that meet federal agencies adopting the RUP® framework in technology development projects (GAO, 2012):

- Project members at federal agencies often have difficulty collaborating closely. This is due to the fact that staff members are used to work independently and are less willing to provide consistent feedback regarding their work to their customers preferring to offer feedback on finalized outcome(s).

- The creation of cross-functional teams in federal agencies is a common challenge. Federal employees tend to be specialists in a specific functional area. Consequently, a team member could represent system users but may not be experienced in identifying all the users' needs.
- Some federal employees face challenges in providing timely and frequent feedback due to the typical fast pace of technology-based projects. If a project faces a critical issue, team members often stop their work to address it rather than make a decision and proceed to the next step.
- Project members often take long time to be familiar with new automated tools to support project planning. This is often due to the fact that there is an apparent delay in purchasing, installing, and learning to use such tools.
- Creating and maintaining technical environments in federal agencies poses another challenge. This is especially relevant to certain projects, which require the technology development and testing to be executed concurrently. The iterative nature of RUP®-based projects requires a sophisticated coordination of staff members and resources.
- During the execution of project, compliance reviews are difficult to perform within an iteration. Such reviews are expected to be performed within short and fixed timeframe, but that is often a great challenge in federal agencies as they follow slow-paced schedules.
- Rather than providing timely feedback on the current state of projects as expected in RUP® methodology, federal agencies prefer to report status on milestones. Upon reporting on milestones, federal agencies interestingly often flag deviations as negative ones even if the project runs ahead of schedule and is under cost.

The above-mentioned common federal challenges provide better understanding and context for analyzing the challenges that faced the FDIC during the development of the ETS application. Particularly, the FDIC faced certain challenges that mainly impacted its dynamic relationship with the contractors. The agency initially used the same software contractor (vendor) which previously developed the old version of ETS (ETS-ALERT), but later reversed its decision after the inception phase. This change of contractor teams presented four challenges to the SAGE's project team members (FDIC, 2014). First, the lack of time and knowledge transfer between the original and replacement contractor teams interrupted the pace of the project development. Second, the new contractor was not fully aware of the complexity of project. Third, the agency faced some difficulties in setting up different testing environments. Fourth, the testing of ETS-SAGE revealed that the application would only function in an ideal environment but would not work in remote locations where the application is mostly needed by the FDIC examiners. These challenges caused a one-year delay in completing the ETS-SAGE project. Eventually, the agency decided to postpone the launching to 2015 until the application would be successfully functional in all testing environments.

Realized Benefits

The development of the ETS-SAGE application enabled the FDIC examiners to pull the UBPR and Call Report data from the Central Data Repository (CDR) web services in real-time. When the FDIC bank examiners used the older version of ETS (ETS-ALERT), they spent long time in manually reviewing and interpreting the changes in the Call Report information (FDIC, 2014). By the time the review process of Call Report was finished, some of the data had already become outdated for the examiners. Consequently, the delay affected the evaluation of the bank performance and the statistical/rating analysis that followed the evaluation process (FDIC, 2015). After the development of the ETS application (ETS-SAGE), the

interpretation of the data was removed and the ETS was quickly updated, which enabled the examiners to have instant access to the Call Reports and UBPR. In addition, ETS-SAGE reduced the number of systems that the FDIC examiners have to use to perform their job, which resulted in eliminating redundant data inputted in different systems. Lastly, the development of ETS contributed to enhancing security control measures for the FDIC examiners to perform their job in remote locations where they are mostly needed.

Lessons Learned

The development project of the ETS-SAGE application provides some lessons that could be of importance to other banking regulators (FDIC, 2014). These lessons include the following:

- The selection process of the software (IT) contractor was rushed, which resulted in the lack of examining other potential contractors' solutions. When the project team members reflected on their experience, they mentioned that they should have given more time to consider alternative solutions or software contractors.
- The development of an existing application (ETS-ALERT) into an enhanced version, represented by ETS-SAGE, was originally considered as an "upgrade." However, a review of the testing challenges proved that it should have been treated as a major overhaul. The RUP® framework's guidance notes require elaborate inception phase for full system development efforts. This was not the case for projects focusing on enhancement to an existing system. Therefore, a proper classification of the project scope and complexity should have been well-defined and sufficiently planned.
- The project managers should ensure that the quality of the contractors matches the complexity of the project scope. The guidelines of the inception phase in the RUP® framework indicate the importance of reviewing the availability of resources and technical experience.
- The ETS project managers stated the contractors lacked knowledge of the FDIC's technical and operational environment. The contractors did not capture the importance of the data security requirements, age of the FDIC's laptop computers, firewall limitations, and data migration technology. That lack of understanding undermined the pace of the development and caused delays during system development testing. The testing should have been performed in the FDIC's IT environment, where the FDIC examiners work in remote locations.
- The ETS project managers mentioned that the review process conducted during the Elaboration phase was stifled by the lack of constant communication. Insightful discussions and preparation with the contractors could have helped in identifying issues related to the FDIC's technical environment. Consequently, the project faced many challenges due to the contractor's lack of understanding of the ideal work environment of the FDIC bank examiners.
- The development of the ETS application was mainly driven by the quality of the testing. The testing showed the project manager where the project was headed. In addition, the testing should be performed throughout the project lifecycle and has to be done in an iterative manner. The ETS team emphasized that the quality of the testing process is a function of whether the project will meet milestones and users' expectations.
- The ETS project managers reported that the manner in which milestone reviews were conducted focused on the completing the required paperwork rather than ensuring that the goals of each RUP phase were successfully accomplished. The managers stressed the importance of discussing the project accomplishments and risks at the end of each of RUP phase. When risks were identified, elaborate plans should have been devised to mitigate these risks in a timely manner.

Practical Implications for IT Managers

The FDIC case has several implications for chief information technology officers and project managers who are responsible for developing IT projects within their organizations. The following implications could inform information managers at government agencies:

- Managers should select carefully the right information technology contractors and solution architecture. The selection is best applied during the inception phase and should take into consideration the business and technical perspectives of the project. The technical perspective should assess each proposed technical solution based on the contractor's fundamental understanding of the project's needs rather than costs.
- The scope of the project should be well-defined, assessed and agreed upon by all stakeholders (including IT managers) during the inception phase. A scoping document could be created at this phase to devise the development plan and list potential risks and milestones for review purpose. In addition, the scoping document should provide elaborate guidelines for conducting milestone reviews and assessing the availability of resources, expertise and readiness of all stakeholders before moving on to the next phase in the development plan.
- IT managers should set and define attainable milestones. Unrealistic milestones may impede the success of the project and put project members under tremendous pressure to meet the deadline (milestone). In addition, contractors may have less time to understand the complexity and scope of the project. Realistic cost plans and schedules should be devised to facilitate an informed future review of performance.
- IT managers should precaution from letting contractors steer the project. The focus should be placed primarily on the client's specific business needs. In other words, Contractors should work with the government agency to identify the best IT solution that fits the agency rather than reengineer the agency's business process to fit the proposed IT solution.
- IT implementation plans can be best supported through the inclusion of an independent risk manager such as an in-house risk/compliance manager. The independent risk management process enables the timely identification and mitigation of all potential risks within certain projects and across multiple projects. The independence factor is crucial to minimize the possibility of "pointing fingers" at the IT manager or contractor for potential project setbacks. The risk manager should also attend the meetings of the project development and develop strong knowledge of the project needs, challenges and milestones.

FUTURE RESEARCH DIRECTIONS

In the FDIC's Office of Inspector General Assessment (OIG, 2019), the agency reported that an "agile approach to regulation that can evolve with innovation," with regard to the use of emerging technology without banning or impeding their adoption. For banking processes that do not require a high degree of decentralization, technologies such as 'Distributed Ledger Technology (DLT),' could help banks improve their governance and standards around data sharing and collaboration (Csiszar, 2019). However, the FDIC does not completely share that sentiment. In fact, the agency classified the use of DLT to simplify payment system such as blockchain and Bitcoin, as potential strategic risks, which may disrupt the banking sector's payment system. In that regard, the report continues to indicate that the agency

has planned to create an Office of Innovation. The Office will be tasked with evaluating the impact of technological innovations on banks, assess potential risks and adjust its IT processes and strategies. Furthermore, the Office will share information and resources with the FDIC's Consumer Protection Division and Division of Insurance and Research. The FDIC seems to be taking slow steps towards embracing technological innovations. In May 2019, the Crypto-currency prime dealer San Francisco Open Exchange (SFOX) announced its partnership with M. Y. Safra Bank of New York to offer traders and investors deposit accounts backed by the FDIC (SFOX, 2019). The partnership allows traders to have direct access to their funds to support crypto trading. On the upside, M.Y. Bank would hold segregated accounts in customers' names to reduce counterparty risk and facilitate access to crypto market. On the downside, the FDIC's protection (losses of up to \$250,000 of customer deposits) would only cover the cash portion of a crypto transaction, not Bitcoin, ethereum, or other digital assets. The safe approach of ensuring the cash portion enables the agency to continue using its existing risk assessment tools to protect the bank customers. Future research could further examine the role of such technological advances (e.g. blockchain and crypto currency trading) and their impact on the risk assessment process at the agency and how such advances can reduce the compliance burden on regulatory agencies. In addition, future research could examine the changes that the FDIC should implement in data usage, analysis and integrity to support the use of technological innovation while maintaining a safe financial environment for the banking industry. Finally, future research could discuss the broader role of the FDIC to promote the development of blockchain and crypto currency among small banks, which have limited resources and funding to secure the safe deployment of such technologies.

CONCLUSION

In summary, as supervisory banking institutions are keen to develop their existing risk management mechanisms, the motivation for a well-executed strategy and structured development methodology become more paramount for regulators operating under strict budgets. The FDIC's ETS development experience provides insights into how bank regulators and their stakeholders can collaborate to mobilize organizational resources and use stakeholders' expertise to overcome potential challenges and execute development plans. Furthermore, the FDIC mentioned in its information technology strategic plan that it seeks to develop mobile technologies that enables authorized ETS application users to conduct their work in new ways at remote locations. To accomplish this strategic goal, the FDIC created 1,549 authorized permanent and non-permanent positions in its field workforce to conduct risk management examinations in 2018 (FDIC, 2018). The case presents further evidence on the agency's efforts to realize this goal by learning from its ETS development project. As the supervisory banking industry's reporting technologies evolve and compliance requirements increase, so do heightened risks that might affect the outcome of the FDIC's risk management process. In this chapter, the FDIC's development work with the ETS should inspire the agency to continue its on-going efforts to provide secure quality data and effective risk assessment procedures. Moving forward, the FDIC's newly created Office of Innovation puts the agency at a leading position to assess the potential of technological advances such as blockchain, artificial intelligence and crypto-currencies. Many bank executives and regulators still associate technologies such as blockchain to wild fluctuations in crypto-currency values. Therefore, the agency has to consider carefully the viability and challenges of such technologies to facilitate banking operations while maintaining a safe regulatory environment.

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KEY TERMS AND DEFINITIONS

Agile: A group of software development methods based on iterative and incremental development, where requirements and solutions are created through collaboration of cross-functional teams.

Examination Tool Suite (ETS): It is a primary examination tool used by the FDIC's Division of Risk Management Supervision to produce the FDIC's Report of Examination.

Federal Deposit Insurance Corporation (FDIC): It is an independent government agency of the U.S. government that protects customer's deposits in insured banks and depository institutions.

Federal Financial Institutions Examination Council (FFIEC): It is a formal inter-agency government body that create principles, standards and report forms for the federal examination of financial institutions by the Board of Governors of the Federal Reserve System, the Federal Deposit Insurance Corporation, the National Credit Union Administration, the Office of the Comptroller of the Currency and the Consumer Financial Protection Bureau.

Rational Unified Process (RUP): A comprehensive and standard process framework that provides best practices for software implementation and development to support project management.

Stakeholder: A representative group of people and organizations that share a common interest in the organization. In the FDIC context, stakeholders include clients, employees, vendors, banks, and regulators.

System Development Life Cycle (SDLC): A comprehensive iterative methodology that drives the implementation of new systems through planning, requirement analysis, designing, building, implementing, testing and maintenance.

ENDNOTES

¹ <https://www.fdic.gov/regulations/resources/call/call.html>

² Interagency Exam Repository is a system that routes and stores electronic copies of the FDIC's Report of Examination.

³ GENESYS stands for General Examination System, which is an application that summarizes and communicates examination findings to a bank's Board of Directors.

Artificial Intelligence as an Enabler for Developing Business Systems

3

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INTRODUCTION

Decision making in any business is considered to be a primary activity. All managerial activities revolve around decision making. Business executives in enterprises are the decision makers. Enterprises have executives at the various levels in their organizations. Some of them are assigned the task of taking decisions in their functional areas. Executives at the senior management level will take the responsibility of taking decisions for the various business activities. Their decisions are considered to be policy making decisions. Their policy decisions will be in the areas such as Capital investment purchases, setting targets for production and marketing of their products. Their other policy decisions will be related to other important activities and functional areas related to their business. Effective information systems in an enterprise will facilitate the executives in taking decision. Over a period many new concepts have emerged in the discipline of information and communication technology. These concepts have provided a scope for designing and developing a business model to suit the business needs of an enterprise. One of the concepts that recently emerged is artificial intelligence. It is gaining importance in the present business scenario for multiple reasons. One of the reasons is the severe competition in the global market. This chapter mainly talks about the importance of the concept of artificial intelligence in designing and developing decision support systems for the enterprises.

Background

In earlier years the process of decision making was considered to be an art and a special talent. This talent was acquired by executives over a period through their experience. It was an art because a variety of individual styles could be used in approach and solving the same types of issues or problems related to a business. Their styles have been based on creativity, judgement, intuition, and experience. Their approach is not the basis of systematic quantitative methods (Efraim Turban, Jay E Aronson, and Ting-Peng Lang, 2006). In the present business scenario, business and its environment are becoming more complex day by day. Business executives need to equip themselves and keep changing in their approach for taking decisions in the present changing scenario.

Changes in Decision Making Process

The process of making a decision has become more complicated and difficult. This is because of several reasons. First reason, there are several alternatives available much more than earlier days. The advancements in the discipline of information and communication technology have also created many alternatives for decision making process. The second reason is the cost of making errors can be large because of the complexity and magnitude of business operations. Continuous rapid changes in business

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environments are forcing the business executives to change the method of decision-making process. This can be considered as a third reason. Finally responding quickly to the changes in the market is forcing the business executives to change their decision-making process (Efraim Turban, Jay E Aronson, and Ting-Peng Liang, 2006).

Decision Support Systems in Enterprises

Management information systems facilitate business executives to take a decision in the areas of budgets, financial analysis, and business forecasting. The process of taking decisions in this area is generally considered to be as a structured approach. The category of semi structured decision process covers such as production scheduling, inventory management, new product designs and quality assurance. Ready-made software packages related to customer relationship management, supply chain management, and knowledge management are available in the market. These software packages facilitate the decision process in the above areas. The decisions pertaining to investment in acquiring hardware and software, new technology, planning in research and development can be considered as an unstructured decision process. Software related to knowledge management system, expert system, and enterprise resource system is generally developed within one's organization for taking business decisions. This is because of the sensitivity of the data for taking decisions in an enterprise (Janakiraman V S, Sarukesi K, & Gopalkrishnan P, 2017)

Concept of Decision Support Systems

Decision support systems are designed and developed by the combination of the intellectual resources of individuals and the concepts of information and communication technology. These decision support systems facilitate in improving the quality of decisions taken by the executives. It is interesting to note that many decision support systems are the result of making use the concepts emerged in the discipline of information and communication technology over a period. In the case of supply chain management, the stakeholders are vendors of components, production department in an enterprise, and the customers of the enterprise's products. The software is developed based on the interactions of the stakeholders of the supply chain management. The knowledge management systems are the result of the participation of the employees of an enterprise by sharing their knowledge and experience. It may be noted that the role of the stakeholders is important in creating a decision support system for an enterprise. In the present business scenario, the concept of artificial intelligence is gaining importance for designing and developing decision support systems for an enterprise.

Technology Trends

Several technologies in the discipline of information and communication technology directly and indirectly play an important role in decision support systems. Many new technologies have been around for decades. These technologies have become feasible after the easy availability of inter connectivity between the computer systems (Khanna V K, 2004).

Evolution of Artificial Intelligence

The development of artificial intelligence has mainly four stages. First in the year 1956 a group computer scientist at Dartmouth college have discussed the great potential of computer applications. They were

confident that when the computer systems were provided enormous computing power, would be able to solve many complex problems and outperform human beings in many areas. At that time, scientists had little understanding of the complexity in human intelligence. They were only optimistic about what the computer could achieve. Many solutions created at that time were primitive. Hence this stage can be called native solutions stage.

After several years of trial and error, scientists started focusing on the development of more effective problem-solving methods such as knowledge representation schemas, reasoning strategies and effective search heuristics. The approach followed at this stage was the development of general- purpose methods software packages. This stage can be termed as the general method stage.

After developing enough general methods, software the application software related to real world purposes has started gaining momentum in the business world. The application at this stage was different from the earlier stages. Solving common sense problems is difficult. Therefore, most applications have been targeted at narrowly defined domain and with specialized knowledge systems of this kind are called expert systems. The feature is that acquisition of expert knowledge plays a key role in the development of such systems. This stage can be said as domain knowledge stage.

Since 1990 more advanced problem-solving methods have been developed. It has become a strong need to integrate multiple techniques and solve problems in multiple domains. Hybrid computer systems such as integrating rule based and case-based systems or integrating artificial neural networks have started becoming popular in the business world (Robert J Schalkoff, 2011). It has become necessary to make use of genetic algorithms. This stage can be termed as the integration stage. The use of artificial intelligence in decision support system is the result of integration stage.

Concept of Artificial Intelligence

The artificial intelligence is an area of computer science. The artificial intelligence has two basic elements. First, it involves understanding the thought processes in the human mind. Second, it deals with the replication of these processes in computer systems. If a computer system performs a particular act in a similar way or equivalent to the behavior of a human being, it can be considered as an artificial intelligence. A human being is an intelligent based on the following abilities (Ayaz Ahmad, 2012).

- 1-Learning or understanding a situation from one's experience
- 2-Making sense out of ambiguous or contradictory statements
- 3-Responding quickly and successfully to a new situation
- 4-Aplying reasons in solving problems or handling a situation with a clear mind
- 5-Applying rational approach in a perplexing situation
- 6-Applying one's knowledge in evaluating the various options available for solving an issue

Difference Between Artificial Intelligence and Human Intelligence

Both types of intelligence have its own advantages and disadvantages.

The following comparison gives the potential value of the above two intelligences (Rajendra Akerkar, 2014).

- 1-Artificial intelligence is permanent as long the computer systems and programs are not changed. Human intelligence is not dependable from the enterprise's perspective.

It is because executives can change of employment. Other executives in the organization may not be aware the approach followed by the executive who has left the organization.

- 2-Transforming knowledge from one person to another person usually requires a lengthy process. Expertise can seldom be duplicated completely. However, knowledge stored in a computer system can be easily transformed from one computer to any other computer system.
- 3-There are many instances in which computer systems cost is less expensive when compared to hiring professionals. This is especially true when knowledge is disseminated over the computer systems.
- 4-Artificial intelligence in a computer system is consistent. Generally, people are erratic. They do not always perform consistently.
- 5-Decisions made under artificial intelligence process in a computer system can be easily documented. On a later date it is possible to trace the decision process in the computer system. In the case of human intelligence, a person who has taken decision may not be able to recall the reasoning process and assumptions made while making the decision.
- 6- Artificial intelligence in a computer system executes certain tasks much better and faster than human beings.

Unique Ability of Human Beings

Acquiring knowledge is inherent in human beings. In the case of knowledge in the computer systems requires carefully designed and developed. It may be said that Artificial is a tailored knowledge (Elaine Rich, Kevin Knight, & Shivashankar B Nair, 2014).

Cognitive Limits

The term cognitive limits indicate that an individual's problem-solving capability is limited when a wide range of diverse information and knowledge is required. A group of professionals with diverse knowledge is required to handle the issues or problems. There may be issues related to coordination and communication in some groups. In such cases arriving at a decision will pose a problem. Computer systems facilitate executives in enterprises to get access to the vast stored information in the computer systems for processing (Dan W Patterson, 2017).

Characteristics of Human Beings

Sensing, reasoning, and action are the three main characteristics of human beings. Sensing helps individuals to identify the problems. Reasoning facilitates individuals in selecting one of the alternatives available for arriving at the decision process. Once the alternative is selected, the individual can act on his/her decision. The above three characteristics are required to be embedded in a computer system for creating artificial intelligence in a system (Kavitha S & Balasubramanian, 2012).

Sensors

Sensors are used for image processing and speech recognition in computer systems. The image processing sensor recognizes the important

Faces, objects, and other related business tags and devices.

Sensors can be human sensations.

Reasoning

Reasoning in the computer systems is generally related to language processing, assessment of a situation, logic and evidence- based interface.

Action

Sensors and reasoning in computer systems facilitate for taking decisions by executives in the business enterprises.

Machine Learning

Human learning is a combination of many complicated cognitive processes, including induction, deduction, analogy and other special procedures for observing and analyzing examples. Machine learning techniques are no different. Most of the professionals adopt similar ideas and have them implemented in the computer systems for artificial intelligence. There are many methods followed in machine learning technique for artificial intelligence (Vinod Chandran S, & Anand Hareendran S, 2014).

Machine Learning Process

While creating a business model under the artificial intelligence concept, the following steps need to be followed (George F Luger, 2009).

Identification of Data

Identifying the relevant data sources is the first important test.

Improving the target data in the relevant data sources needs to be carefully handled, while developing machine learning algorithms.

Preparation of Data

The relevant data identified for the specific model should be secured and clean. This facilitates to create a good machine learning application

Selection of Machine Learning Algorithm

There are many machine learning algorithms available in the market. One must select the appropriate machine algorithm on the basis of the business needs of an enterprise.

Creation of a Business Model

One must apply the algorithm depending on the type of data chosen for a particular type of business application. It will be better to test the model as many times as possible before the model is implemented.

Business Forecast

Machine learning algorithms are applied to analyze on the vast data for business forecast.

Assessment of the Business Forecast

One must assess the outcome of the business forecast. This assessment will help the executives in enterprises either to accept the business model or they can suggest for an improvement.

Team Members in Machine Learning Process

Machine learning is a joint effort of the various specialists. A team consists of data scientists, data engineers, business analysts, domain and functional experts to collaborate the task. This team must focus on the business problems and business issues (Sharma D P & Sweta Sharma, 2013).

Machine learning is a main element in artificial intelligence. This learning process enables a computer system to learn from the data. This is not through the conventional explicit programming. Significance of algorithms is a set of instructions for a computer in interacting with the data for manipulation and transforming data (Eugene Charniak, & Drew McDermott, 2006).

Knowledge Harvesting and Intellectual Capital

It is required that the team members should be familiar with the concepts such as knowledge harvesting and intellectual capital while developing decision support systems under the artificial intelligence environment. These concepts are briefly explained below.

Knowledge Harvesting

In agriculture the cultivable land is made use of growing a crop. Depending on the season a particular type of crop is grown on the same land.

The manure is used to increase the output of the crop of the cultivable land remains same. The agricultural output from the same land depends on the season and the type of manure used.

Similarly, the knowledge harvesting system is similar to the agricultural land in an organization. Data and the information from the knowledge management are made use by an employee depending on his/her wisdom. This approach is known as the knowledge harvesting initiative. The method followed by an employee inferring and interpreting the information varies depending on his/her experience and business knowledge. This can be compared to using different type of manure for the different type of crop output from the cultivable land.

Information is the main base in the knowledge harvesting system. Cultivable land is the main base in agricultural harvesting. Knowledge and wisdom are the important elements in the knowledge harvesting system. They can be considered to be equivalent to the manure. Manure and the latest cultivation

Manure and the latest cultivation techniques play an important role in the agricultural harvesting (Rezgui & Miles, 2011).

Intellectual Capital

Intellectual capital is the creation of more wealth by the dint of knowledge. The cycle of intellectual capital begins at an inner faculty of a human being such as application of skills, knowledge, experimentation and research. These elements lead in the process of creating the intellectual assets. Thus, it begins at the knowledge level and ends at the creation of intellectual capital.

Knowledge is more valuable and more powerful than natural resources. In the present environment of shortened business cycles and rapid technological change, the intellectual framework represents the primary value creation dynamics of the firms. Now the term intellectual capital has different connotations and is very often synonymous with intellectual property, intellectual assets, and knowledge assets.

There are mainly four components in the intellectual capital. They are human capital, structural capital, business assets, and intellectual property.

Human Capital

It relates to a firm's human resources, including knowledge and know how that can be converted to value. This is said to reside in people, organizational routines and procedures.

Structural Capital

It relates to the firms supporting infrastructure.

This includes both physical infrastructure such as buildings, computer systems, other related assets and intangible structure such as history, culture and management.

Business Assets

Business assets are defined as the structural capital a firm uses to create value in its commercial process such as processing facilities, and distribution network.

Intellectual Property

It relates to the intellectual assets of the firm for which legal protection is obtained. It includes patterns, trademarks, copyrights, trade secrets, technology, and digital information.

Case Illustration

The following case illustration gives an idea in making use of the concept of artificial intelligence in a textile mill in India.

Coimbatore is a textile town in South India. This town is known as Manchester of South India. There are many textile units in this town producing yarn, cloth, and dress materials. The first generation of people in this town has either started their units after getting formal training or inherited the textile units. Most of them have basic education only. They have started their units with a small capital. Most of the units were established in the middle of the last century. It was because of the favorable market conditions; many units made profits and expanded their business activities. Most of the units have created a brand image for their textile products. The people who start a textile unit is known as a mill owner. Even

though many of them have more than one textile unit, still they are known as mill owners. Generally, they are never referred as industrialists.

3 G textile mill was started in mid 1950's by a textile mill owner. He has rich experience and good knowledge about the textile business. He has a basic schooling only. His interest and passion for textile business has helped him to create a name for his textile products. He has trained a group of employees for his business. They are loyal to him. They take pride being associated with him for a long period of time. Most of them have either formal or no basic education. The mill owner alone thinks of business strategies. He never involves the group trained by him for designing business strategies. He expects them to carry out his instructions only.

Mill Owner's Method of Working

Cotton is very important raw material for manufacturing yarn. Cloth material is manufactured on the quality of yarn used. Selection of cotton mix is an important element to produce yarn. He updates himself with the latest information pertaining to the technical aspects and markets for his textile business. He is confident of himself because of his rich experience in the technical process of manufacturing yarn and cloth material.

The mill owner has identified a large room in his mill premises for selecting cotton to produce yarn. Samples of cotton are brought by the different cotton merchants and kept on a big table in the room. Brief details of sample cotton are kept along with it. The details mostly cover the information pertaining to the year of production name of the country type of cotton has been grown along with the rate of cotton per bale. The mill owner makes use of his both hands for testing the strength of the cotton. He is able to select the cotton from his manual method. He does not believe in using any equipment for testing and selecting the cotton for production of yarn. Further, he decides the mix of cotton from his experience. His decision is based on the percentage of imported cotton to be mixed with the cotton produced in India. While mentally he thinks of the mixture of the different variety of cotton and he visualizes the color of dyes to be used. He also works out mentally the cost of yarn per spindle. He also decides the price at which the yarn is to be sold. While deciding the type of cloth is to be produced, he keeps in mind the prospective customers' tastes and trends in the market. He also interacts with the suppliers and makes inquiries of the welfare of their families. He feels that this interaction with them is required for maintaining a good relationship with the suppliers. Later he gives instructions to his supporting staff for placing the orders. He has been following the above procedure from the day he started his business activities.

The next generation of his family is not interested in the management of the mills. They prefer to pursue their own professional interests. He has not forced his **sons** to take over the management of the mills. He has realized that he did not make efforts to create interest among his sons in the textile business. Further, he felt bad that he did not give the opportunities to his loyal staff for involving the decision process. He did not encourage them to express their views and strategic planning for the business. He decided to share his concerns with his granddaughter Ahalya who has got a master's degree in computer science. Ahalya felt it would be advisable to help her grandfather in the business. She started going along with her grandfather to their textile mill daily. She observed that her grandfather is involved in every activity in the mills. Everyone takes instructions from him. Some of them are not clear about technical and business process.

Ahalya felt that identifying the right type of people and forming a team within in their organization acquiring the knowledge from her grandfather will be a difficult proposition. One interesting aspect is her grandfather mainly depends making use of the information from his memory.

She felt making use of the concept of artificial intelligence for taking care of the process followed by her grandfather will be the best solution.

Ahalya has expressed to her grandfather that she would make use of the concept of artificial intelligence to capture his knowledge for the posterity.

Grandfather has felt happy that her granddaughter has taken initiative to create a system to guide the employees in his organization. He explained every aspect of the business. He also explained how he makes use of his knowledge and experience in the areas of production of textile products, marketing, pricing and costing. Based on the inputs provided by her grandfather, she created a database. This database mainly contains the procedures and business processes followed by him.

This database is mainly for her to know the various aspects of the textile business

Artificial Intelligence and Machine Learning for their Textile Business:

Ahalya herself been an information technology professional, she has recruited a group of software professionals who have experience in making use of the concepts such as artificial intelligence and machine learning for their textile business. Ahalya explained in detail the process followed by her grandfather. After analyzing the procedures, she along with the new team of software professionals designed another database with different modules. Various modules contain all the required information relating to cotton, supplier, types of dyes, tastes of customers, market trends, and costing. This database provides the selection process of cotton, color combination of dyes. Production planning details of yarn and cloth are also stored. This database is known as textile knowledge-based system.

Machine Learning Algorithm

The group has allocated themselves the task of writing machine learning algorithms the various processes and activities in the textile mill. One of their algorithms suggests the mix of cotton. On the basis the suggestions from the machine learning algorithm, the strength of the cotton is physically tested in the quality testing laboratory. Once the favorable report is received from the quality testing laboratory. The machine learning algorithms will suggest the mix of dyes, on the basis the tastes of the customers in the various parts of India and other countries across the globe. The team has trained the computer system through machine learning algorithms to suggest various aspects

Of designs, color combination to produce the cloth material. The team has introduced many new aspects in the textile business through machine learning algorithms. Ahalya is thrilled to know that her grandfather is happy with the outcome of her initiative with the concept of artificial intelligence.

She has organized for the orientation course in the area of artificial intelligence for their employees who have evinced in making use their textile artificial intelligence system. She has encouraged them to provide

Their ideas for fine tuning their artificial intelligence system. They are also given an opportunity to think differently. They can also suggest changes in the business process of their textile business.

Discussion

Ahalya has started recruiting young talents with experience to assist her in the business activities. She encourages every member of her team to make use of artificial intelligence system created by her team. She has weekly meetings with them. She is open to the suggestions from them. In one of the meetings a group of young executives who joined the textile mill recently, have expressed to suggest an innovative way for designing textile products. They have indicated that the textile mill is not making use of multi-

media concepts in the design of a cloth and dress material. They are given freedom to design the textile mill products with their ideas. They have designed samples with the various color combinations with multimedia concepts. They have invited selected priority customers to their office during the office hours to view the design on the computer screen at their office. Some of the customers have expressed their views and gave suggestions to the design shown to them. The executives have taken note of their views and suggestions. The inputs are discussed with Ahalya. After analyzing the inputs, they have decided to carry out the changes wherever are feasible. These interactions helped them to know the latest tastes of the group of customers. This helped them to redesign their products. The Sale of their products is likely to increase. An open innovation initiative with the artificial intelligence system approach by the young executives has widened their knowledge in designing the textile products for the needs of the market (Stuart J Russell & Peter Norvig, 2007).

Observation

A mill owner with having a rich knowledge and experience in the field of textile business could not find the next generation in his family to the management responsibility of his textile mill. His knowledge and experience have not been documented. His granddaughter Ahalya who belongs to the third generation in his family has taken the initiative in making use of the concept of artificial intelligence in creating an information system for their textile mill (Oguz F & Sengtin, 2011). Her interaction with her grandfather and her interests in the textile business has enabled her to store his knowledge and experience in the information system. This information system is mainly created for making use of machine learning algorithms to facilitate creating a decision making system for their executives in their organization. This information system developed under the artificial intelligence environment has helped the young executives in her team to think differently. Their initiative has also resulted in an open innovative approach in designing and marketing of their textile products.

Future Directions

Shortened business cycles and rapid technological changes are forcing business enterprises to adopt the concept of artificial intelligence for facing new realities in the present business world. Some studies have indicated that only a small portion of the corporate knowledge is in the shareable form. The majority is in their employees' brains and it is not in a shareable form. Business enterprises should make use of the human centered assets in their organization for creating an artificial intelligence environment in their organizations. There is a good scope for developing a decision-making process system with the machine learning algorithm in the artificial intelligence environment (Judith Hurwitz, & Daniel Kirsch, 2018).

CONCLUSION

There are many structured and unstructured data are available in the present business world. Most of the structured data is created in a particular format. Unstructured data do not follow a specified format. Unstructured data is still widely underutilized by business enterprises. The unstructured data are mainly provided by social media sites. The concept of artificial intelligence plays an important role in handling structured and unstructured data for decision making process for business enterprises (Kristian Hammod, 2015).

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Exploring the Possibility of Managing Knowledge With Business Process Management Software (BPMS)

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INTRODUCTION

Knowledge management (KM) is a term that has existed since the 1980s and can be defined as a systematic and intentional creation, updating and using knowledge to maximise the efficiency of an organisation (SlavĀcek, 2011) generating a common language and improving communication across it (Nadarajah and Latifah, 2016). This topic has received particular attention because it offers a means for organisations to develop competitive advantages (Wang & Yang, 2016). Among other issues, questions related to individual knowledge and its externalisation or formalisation, or the dissemination of knowledge in organisations has been deeply investigated (Kalpic & Bernus, 2006).

Organisations concerned with knowledge management focus on creating organisational knowledge to achieve efficiency, generate innovative products and improve customer service (Birasnav & Rangnekar, 2010). These organisations, upon making better success, come to realise the importance of knowledge as a resource that generates organisational benefits (Bitkowska, 2016). On the other hand, business processes are a fundamental part of daily work in organisations (Giacosa, Mazzoleni, & Usai, 2018). Business Process Management (BPM) is considered an important area of organisational design and a recognised source of business performance. At the same time, BPM research has paid a lot of attention to the development capacity of process management in organisations (Lehnert, Linhart & R  glinger, 2016). Currently, BPM has reached a certain maturity. This is justified in the amount of literature about it and, the existence of specialised journals, for example, The Business Process Management Journal and conferences, for example, The BPM-Conference in the seventh year, as well as the institutionalisation of specialised BPM degree programs in several universities, show that it is not a temporary fashion but an orientation encompassed in the science of management (Houy, Fettke Loos, 2010).

Since the 1980s, the management of business processes has been an intensely discussed topic in the field of information systems research (Houy et al., 2010). In previous decades, many organisations have embraced technological initiatives that allowed them to make changes, manage their businesses and improve their performance (Harmon, 2010). These initiatives had been extended through departmental and organisational boundaries, including clients and suppliers, resulting in a transformation of functional organisations into process-led organisations. The latest phenomenon in flexible technologies to changes

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in market trends are known as BPMS (Wong, 2013). BPMS represent a type of software that allows the promulgation and management of business processes of an organisation (Aalst et al., 2003), through the design and modelling of these processes (Smith & Fingar, 2003). Thus, BPMS paved way for the faster adaptation of organisations to continuous changes in the market and its consumers. Companies, that adopt this technology, are interested in the value that these systems generate through the continuous improvement of business processes. This enables them to position themselves at the forefront of a competitive market (Wong, 2013).

Wu, Kao & Chen (2015) indicate that knowledge creation is strongly linked, among other aspects, to processes. Based on this, it is implied that, if the knowledge of an organisation is used and linked to the processes, BPMS play an important role in knowledge management when these processes are automated through this technology. In this way, process management and knowledge management are two interconnected paradigms that can generate synergies, for example, the speed and agility with which knowledge can be managed and standardised once BPMS is incorporated in a company. The main objective of this article is to present a transition analysis, through previous literature, knowledge management, process management and automation, as well as the possible relationship between knowledge management and BPMS.

BACKGROUND

In modern times, the competitiveness of organisations is derived mainly from intangibles instead of tangible resources (Matayong & Mahmood, 2013). The intellectual capacity of individuals, that is, their knowledge, is considered an intangible resource possessed by the organisation in which these people work (Šajeva, 2010; Van Looy & Van den Bergh, 2018). In general, knowledge resides in the minds of people and organisations have to ensure their availability whenever necessary (Tseng, 2008). Knowledge is considered such a valuable resource for an organisation that it is very important to manage it, in the same way, that any other business resource, whether human or capital, is managed. At present, it is perceived as a strategic resource within the company, therefore, it should be subject to constant identification, measurement, acquisition, development, utilisation and protection (Bitkowska, 2015). Thus, in the era of the knowledge economy, organisations have a great interest in managing such knowledge (Wang & Yang, 2016). The term “Knowledge Management” is seen as an organisational activity that leads to success and is a stimulus for debate, since it is subject to a wide range of interpretations (Rechberg & Syed, 2014). This discipline, in organisations, evolved around the need to increase sales, improve work practices and make decisions, as well as shorten development time, improve customer service, train employees and innovate (Dotsika & Patrick, 2013). Knowledge Management (KM) provides efficient procedures which enhance value creation in organisations (Šajeva, 2010). As knowledge is the central element of this management, the competitiveness of organisations will depend on how they are applied, exploited and integrated into them (Alavi & Leidner, 2001, Šajeva, 2010). KM refers to a deliberate and systematic approach to ensure the full utilisation of the base knowledge of an organisation (Han & Park, 2009).

Knowledge management is creating a growing concern in the field of management research and practice (Giacosa et al., 2018). It develops a very important role in the innovation capacities of a company and also improves the quality of the working life of the workers (Wang & Yang, 2016). In contemporary companies, observation has shown a decrease in the interest for assets, such as inventory or capital, and an increase in the importance of non-material assets, such as skills or professionalism, which are

constituted by knowledge. The management of knowledge in a company determines the value of the organisation as a whole and not only its material assets (Bitkowska, 2016).

In another sense, it is necessary to refer to the systems used in knowledge management in an organisation. These systems will serve to capture the knowledge, as well as store and distribute it. These systems could be technological, performing the previously mentioned activities in an automated way. In this perspective, the use of technology for the automation of processes can be framed in specific reference to the BPMS. Hansen, Nohria & Tierney (1999) suggested that if the task can be routinely and easily standardised, technical solutions are appropriate for knowledge management, but if they cannot, then human relationships are preferable. Referring to the technical solutions that can automate knowledge management, it should be noted that substantial investments in technology and infrastructure do not always guarantee the success of knowledge management. Rather, it is with the commitment and willingness of employees to participate in initiatives that achievements are made (Lin, 2011).

Nowadays, information technologies have become relevant for business management, being a verifiable reality that its application is drastically changing the manner of competition between companies and what they demand from professionals (Polakovic, Šilerová, Hennyeyová, & Slovákova, 2018). However, although companies are aware of the important role that technology plays in their information systems, it does not imply that they will incorporate them into their business processes (Arjonilla Domínguez & Medina Garrido, 2009, p.37). On the other hand, information and communications technologies (ICTs) by themselves do not make business management efficient as organisations need other resources, such as human resources or management skills (Powell & Dent-Micallef, 1997). A true balance between technology and process is necessary, otherwise, users and administrators can bypass information systems (Bendoly & Cotteleer, 2008). Jackson & Sloane (2007) remarked that technological development offers consistent improvements to business processes. In this way, an organisation can improve the efficiency and effectiveness of its business processes, develop new processes or generate re-engineering processes. These new processes will increase in value when designed and disseminated through the BPMS, which will execute and monitor these processes (Hammer & Champi, 1993). Information technologies support the management of business processes and involve changes in: (1) The organisation (in the corporate culture, the form of leadership, etc.), (2) The Processes (service support, service provided, etc.) and, (3) In the technology itself (application integration, analysis, visualisation, automation, etc.) (Climent, Mula & Hernández, 2009).

In the past decades, many organisations have sought to embrace technological initiatives for change and thus, manage their business processes with the intention of improving their performance (Harmon, 2010). These technologies have extended along functional and organisational boundaries to include clients and suppliers, resulting in the transformation of an organisation by functions into an organisation by processes (Polakovič et al., 2018). However, the existing technology was not flexible to adapt to new needs, but thanks to the BPMS, the processes became more executable, and work can be automated without the need for programming. This allows the systems to adapt to the company and not the other way around. Hence, the business process is released from its mould. And it is through an agile process management that the entire value chain can be monitored, improved and continuously optimised (Smith, Fingar & Scott, 2002). BPMS make processes operative, making explicit designs of them (Weske, Van der Aalst & Verbeek, 2004). Shaw, Holland, Kawalek, Snowden & Warboys (2007) determine that the BPMS seek to improve the efficiency, effectiveness and governability of business processes. The importance is such that, for example, the company Gartner, in the year 2008, had its BPMS among the third of the top 10 strategic technologies¹.

It is also noteworthy that, at a professional level, there is much confusion with the term BPM (Business Process Management). It is thought that by acquiring the technology the processes can be automated, solve the problems of coordination and improved efficiency will come automatically (Polakovič et al., 2018). Nothing is further from the reality. The acquired technology is nothing more than a software that does not include techniques, methods, or knowledge about how it is better to design the processes. Technology is only a tool that supports the business processes already implemented in an organisation (Laurentiis & Robledo, 2011) and its subsequent modifications, as prescribed by those responsible for designing or redesigning the processes. In other words, BPMS are tools that provide companies with the ability to model, execute, monitor and analyse business processes. Process modelling is used to get the graphical representation of a current or future process within the organisation². Business analysis is a prerequisite for the design and development of information systems, as it can reduce the number of problems caused by misunderstandings between people who belong to the business area and those of Information technology (Bernardino Araújo, Rodrigues Filho & Franco Gonçalves, 2016). These systems are not intended to replace existing applications within the organisation. The idea is to add the use of these applications to a new process and use their information, being able to integrate all that information in a more flexible and adaptable way than if the software should be reprogrammed (as it does with the workflows), this way businesses become more agile (Wong, 2013). This makes it much easier to integrate with other heterogeneous systems and normally, serves as a platform for the development of process-based applications (Rhee, Bae, & Choi, 2007; Smith & Fingar, 2003).

As just mentioned, one of the most attractive features of BPMS technology is flexibility. This is because it uses a process modelling system and not programming. This modelling system allows the owner of the process to be able to redesign it graphically whenever necessary, without resorting to programming. Another interesting feature is that BPMS provides the ability to coordinate activities across multiple applications and not replace existing systems, but integrate people and available applications and make the processes work at the service of the organisation at all times (Arjonilla & Medina, 2009, p.128). In this sense, companies pay a lot of attention to the efficiency of BPM, due to the high number of processes they can manage. The more business processes are controlled by this tool, the more efficient these processes will be (Rhee, Cho, & Bae, 2010). Today, the market requires a quick response to customers. To react quickly a company has to perform better in its business, and the efficiency in the execution time of its processes is one of the objectives to achieve (Rhee et al., 2010). The analysis of the academic literature on BPMS reveals two different perspectives in its scientific treatment, Houy et al. (2010): The management perspective and the technological perspective. In this sense, there are two important paradigms in the field of information systems that can be matched with each of these perspectives: (1) “Science of behaviour” and (2) “Science of design”. The first seeks to develop and justify theories in the context of the analysis, implementation, management and use of information systems. In contrast, the design paradigm focuses on innovation, design and use of technological devices. Therefore, the academic papers on BPMS can be grouped into those that give greater importance to the technological component, that is, to design, and those that try to analyse BPM as an administrative theory (Houy et al., 2010; Poelmans, Reijers & Recker, 2013; Rhee et al., 2010). The present work, as has been observed, is framed in the second perspective, that is, analysing BPMS from a managerial, administrative or management point of view.

On many occasions, BPM systems have been considered as just another application software, although based on the above, it is not surprising that there are those who understand them as the basis of a new paradigm (Ravesteyn, 2007). It is wrong for companies to believe that the adoption of BPMS will mean the automatic achievement of their operational and strategic objectives. Even the best BPMS technol-

ogy will not be able to offer answers on how to design and manage the processes better, this will always be the responsibility of the administration of each organisation. Nevertheless, BPMS can contribute to this, helping in the execution of the strategic planning of the organisation, allowing a better adaptation between the strategy and the business processes of the company (Trkman, 2010).

BPMS TRENDS

Certainly, the future is unpredictable; however, it is possible to set trends based on information and knowledge of this subject. First of all, companies seek to gain in simplicity, they want to reduce their methods and use processes that are easy to create and modify according to their needs. In short, they seek to reduce dependence on rigid technologies and appreciate the advantages of BPMS in this regard. Second, companies seek to anticipate and predict results, which can be obtained from data analysis. Being able to control operations and predict or prepare is a great advantage. In this sense, the flexibility of the BPMS allows organizations to be more agile and efficient to achieve these ends. And thirdly, the BPMS allows raising the level of collaboration which will improve the productivity of the organization, as well as increase the level of commitment among the employees (Paschek, Ivascu, & Draghici, 2018).

On the other hand, there are other issues that BPMS can support: (1) the shift from business processes to customer-focused processes, which expands processes beyond the boundaries of the organization, (2) mass-produced processes are replaced by more individualized processes, (3) processes will be digitized and will not require human intervention, or in any case human, machines and things will coexist, giving rise to new processes, (4) anticipating the client's needs, even before he interacts with the process, being open to share private data and, (5) based on experimentation, it is all about learning from customers as soon as possible, with prototypes or other versions of the process (Paschek et al., 2018).

Digital transformation (DT) is also a trend in which BPMS have a place. DT is an organizational issue, in which people creatively use new technologies to change how they do their work, making new business models available. Those who create new models have the advantage of using the process or business in their behalf. In this way, firstly digital transformation takes place and, secondly, it emerges as a new opportunity for BPM to achieve the promised results and change the business as we know it (Pihir, 2019). Following this idea, some researchers try to integrate the technologies with other paradigms, such as KM. Thus, an important future trend is to complete processes with systems capable of containing information or knowledge (Żytniewski, 2018). In this context, BPMS are systems capable of boosting the impact of KM within organizations, due to their flexibility, their integration with other tools and their capacity to disseminate information.

KNOWLEDGE MANAGEMENT AND BUSINESS PROCESS MANAGEMENT

The management of business processes and knowledge management have been widely developed as autonomous disciplines. However, for an organisation that considers both issues, both must be managed in a coordinated manner (Slavicek, 2011). Organisational knowledge represents the intellectual capital that must be captured by the organisation to incorporate its value into business, thus, knowledge becomes a resource that creates value for the company (Rastogi, 2002). The knowledge that is in a person's mind is limited in value but that value can be increased exponentially when redirected, reused, and integrated into business processes (Douglas, 2002). In the 1990s, companies became aware of the risk of losing

key knowledge belonging to their organisations, which is often present in the heads of their employees (knowledge that is not explicit and is not available for the use of other individuals). At the same time, the demand for faster growth of knowledge and skills of employees has become a new point of reference for managing organisational knowledge (Kalpic & Bernus, 2006). Increasingly, organisations are looking for possible ways to make their processes include the necessary knowledge and thus, be able to compete better in their markets (Marjanovic & Freeze, 2012).

Process management and knowledge management are intimately connected and synergistically inter-related. In this sense, elements of process management, such as the result of organisational learning in the execution of processes (learning by doing), the re-engineering of business processes, the modelling of business processes and the management of the quality of the processes can be used for exhaustive knowledge management and the construction of knowledge bases in companies (Kalpic & Bernus, 2006). Kalpic & Bernus (2006) believe that a BPMS, specifically designed for the efficient management of processes, is also an important tool for knowledge management that allows the transformation of informal knowledge into formal knowledge and facilitates its externalisation, distribution and subsequent internalisation. Also, it is logical since those users of a BPMS who generate knowledge in their daily tasks will probably incorporate the knowledge generated into the processes and the BPMS itself. Uncoded knowledge is slow and expensive to transmit. Ambiguities abound and can only be overcome when communication is face to face, so the errors of interpretation can be corrected by the use of immediate feedback. On the other hand, the transmission of encoded knowledge does not require the contact of individuals and can be carried out through impersonal means. Messages are better structured and less ambiguous if transferred in encrypted form. This is precisely what happens when organisational knowledge is integrated into a BPMS because that knowledge indicates the best way to perform a process (Lehnert, Linhart and Roeglinger, 2017). Thus, the executors of the processes put into practice the knowledge that has been codified in the BPMS that manages the operation of this process. Considering the modelling of business processes and the capture and distribution of knowledge, BPMS are not only important for the engineering of processes but also because it allows the transformation of informal knowledge into formal knowledge and that facilitates externalisation (conversion of tacit knowledge into explicit knowledge), distribution and subsequent internalisation. In this way, BPM has the potential to improve the availability and quality of the knowledge captured, due to its formal nature, increases reuse and consequently, reduces the cost of knowledge transfer (Kalpic & Bernus, 2006; Bitkowska, 2018).

Wu, Kao, & Shih (2010) were also concerned about the transfer of knowledge. According to these authors, if the information system is used to support interaction and collaboration, then, it is capable of achieving the purpose of transferring knowledge through the interaction between the knowledge provider and the receiver, and among those tools included in workflow systems. As explained above, workflow and BPMS systems have many characteristics in common. Therefore, even with greater flexibility and speed than a workflow, BPMS represents a type of technology capable of transferring knowledge throughout the organisation. In addition, according to Bider & Jalali (2016), it is necessary to consider the knowledge built within the information systems that support and control the processes. That knowledge cannot be recorded, nor is it explicit knowledge. People who use the system do not know how it works internally, so it is not tacit knowledge, because it belongs to the system and does not reside in the minds of people. Consequently, these authors refer to this kind of knowledge built within a system as “embedded knowledge”.

In short, organisations are incorporating information systems that support processes, as it is the case with BPMS, which could become useful components for knowledge management. BPMS is an important tool that allows the transformation of knowledge informal or tacit to formal or explicit or,

more specifically, the development of embedded knowledge. They also facilitate their outsourcing and can be shared. BPMS have the potential to establish uniform comprehension criteria and improve the availability and quality of knowledge captured due to their formal nature (Bitkowska, 2018), increase the reuse of knowledge and reduce the costs of their transfer. Summarily, these tools allow knowledge to be encapsulated in business processes (Kalpic & Bernus, 2006).

Definitely, KM allows generating, amplifying and accelerating the creation of value in business processes, which indicates that KM can improve the performance of BPM. Without knowledge or KM the processes could not be optimized, or even created. In short, all knowledge needs to advance through processes, and in the same way all processes that do not apply the improvements allowed by knowledge will be out of context and will not make sense (Paschek et al., 2018). In this way, the integration of KM with business processes makes it necessary to consider the characteristics of both solutions. Systems, capable of propagating knowledge through the tasks of a business process, must focus on the end users of the System and their information needs. In this way, in a study carried out among twelve commercial companies, the perceived usefulness and the satisfaction of the user were determining factors when using a BPMS for KM (Martín-Navarro et al., 2018). From all of the above, we can deduce the importance of combining KM and BPMS

DISCUSSION AND RECOMMENDATIONS

The arguments discussed in this chapter show the importance of KM and how BPMS can play a fundamental role in this management. In this section, recommendations are offered for those managers that decide to successfully implement BPMS for the KM. From the management point of view, studying the BPMS seems to be a consolidated practice. But within this field, it is interesting to note that researchers are quite attracted to the deep-reaching success of the systems (Alam et al., 2015; Antonucci & Goeke, 2011; Bai & Sarkis, 2013; Bălănescu et al., 2014; Filipowska et al., 2009; Gabryelczyk, 2016; Janssen et al., 2015). Since the most studied research topic consists in the evaluation of the tool. Therefore, it seems that determining the success of this type of software is a matter that arouses a lot of attention among the researchers of this discipline. But how is the success of BPMS measured? It seems a delicate issue since, as indicated by Poelmans et al. (2013), in an ideal scenario, the success of the systems could be measured through cost savings or individual performance basis. In practice, however, it is not usual to measure the benefits from this perspective, because this type of data is not usually accessible and the benefits are intangible. However, many authors have learnt that the use of the system, as well as the satisfaction of the end users of a certain technology, serve as measures of success (Asmah, Ofoeda & Gyapong, 2016; Chang, Chang, Wu, & Huang, 2015; DeLone & McLean, 1992; Jiang & Wu, 2016; Poelmans et al., 2013; Sultono, Seminar & Erizal, 2015; Urbach, Smolnik & Riempp, 2011; Wu & Wang, 2006; Yusof & Yusuff, 2013). In this way, studying the end users is considered a good indicator for measuring the success of information systems. Therefore, when evaluating the success of a BPM system, the opinion of an end user is considered an accepted measure.

One of the most used models in the academic literature for measuring the success of the information system is the ISSM (Information System Success Model). This model was proposed by William H. DeLone and Ephraim R. McLean, through their work published in 1992, in the journal, *Information Systems Research*. The objective they pursued with their research was to present an integrated view of the concept of success of information systems (DeLone & McLean, 1992). This model allows measuring the individual and organisational impact of a system based on variables such as satisfaction and use of the

system. At the same time, the quality of the system and the quality of the information are variables that are related to satisfaction and use. Over the next decade, almost 300 articles in specialised journals will refer to the previous success model, which has enjoyed great popularity among researchers, although it has also had its detractors. In this way, the previous authors are aware that numerous studies have tested and validated the success model of the information systems they developed, but they also know that there are authors who have challenged it by criticising it, which has contributed to a better understanding of its success and dimensions. From this learning, it follows that it seems appropriate to add a third dimension called quality of service and continue to maintain the characteristics of the original system in the quality variable of the system, as well as the output in quality of the information. In addition, it seems more appropriate to combine individual impact and organisational impact into a single variable; the net benefits. Also, it is preferable to call it that, rather than impacts, because these can be positive or negative, which leads to possible confusion as to whether the results are good or bad. Therefore, net benefit is probably the most appropriate term that indicates the final success of the variable. From these conclusions, a re-specification of the ISSM was developed (Delone & McLean, 2003).

In order to measure the success of the BPMS, factors that influence the end users must be clearly shown. In this way, it is necessary to analyse factors that determine the use of the BPM tool for knowledge management. Thus, starting from the original model of DeLone & McLean (1992), Wu & Wang (2006) developed a model of success for the KMs. Using this model as a theoretical framework, they introduced the quality of information and knowledge as a measure of success. This work is an interesting framework to determine if BPMS can function as a system for knowledge management. And on the other hand, in 2013, the researchers Poelmans, Reijers and Recker published a study on the operational success of BPMS. The research model was inspired by the updated ISSM, although it was not a replica. In this way, before the quality of the system, they determined a new variable that is the quality of the input, and also divided the attributes of a system between general and specific. The generals are those of any system and consist of reliability, responsiveness and integration. And the specific ones are those typical of the BPMS and assignment of tasks and routing. They also determined that the quality service, which is measured by the training and support received by the user, had an impact on the quality of the system. Another novel aspect is the introduction of a variable that they called dependence on the system, which measures the time the user spends working with the software.

FUTURE RESEARCH DIRECTIONS

The literature review carried out in this paper indicates how it would be possible to manage the knowledge of organisations through a BPMS. However, there are not many works that simultaneously relate to both topics, which opens an interesting way to investigate them together. Especially, future research should be focused on determining the different factors that may impact the utility perceived by users when a BPMS is used for knowledge management, as well as the determinants that make the user feel satisfied with the system.

It is also interesting to test hypotheses through theoretical models that can measure the success of BPMS for KM. As already mentioned, measuring the success of an information system is a complicated issue, but among researchers, it is accepted that it is measured through the use and satisfaction of the users of the tool. For this reason, it is necessary to carry out empirical studies that can provide answers to these questions, using samples obtained from both public and private organisations.

CONCLUSION

Nowadays, knowledge management is a paradigm widely accepted and valued by organisations. Companies need the knowledge that workers have on a personal level to be transferred to the rest of their colleagues. Through this means, they get the best practices in business processes known to all employees, improving the way in which these processes are carried out. That is why managing this knowledge and achieving improvements in processes have become important organisational objectives. BPM was born as a style of business management whose purpose is to constantly improve processes from the beginning to the end with the singular aim of improving customer satisfaction (both internal and external). BPM aims to improve the efficiency and effectiveness of business processes through continuous improvement. In order to carry out good management of the business processes, BPM strives to make the business strategy operational. Although BPM can be carried out in an organisation without making use of technologies, most academics in their discussion of this paradigm, include systems that support the management of business processes. Within these systems, BPMS represent a type of technology capable of automating business processes in a flexible way, coordinating with other existing applications in the company. This flexibility is possible, thanks to the modelling capacity of these systems which are capable of improving a process without the need to reprogram the tool.

The BPMS connect and coordinate the daily tasks performed by the employees of an organisation. In this way, users of the system can use the tool in their daily work, receiving clear specifications of the tasks to be carried out at all times. The design of the business processes carried out through graphic modelling with BPMS allows for the incorporation of the information and knowledge provided by workers who execute the processes. At the same time, the specifications included in the BPMS, when describing how to perform a certain specific task, also allows it to be codified or to explain the expert knowledge of workers participating in the process. This ensures that this knowledge is shared and reflects the capacity of the BPMS for KM.

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KEY TERMS AND DEFINITIONS

BPM: Management methodology whose objective is to improve productivity by optimising the business processes of an organisation. It intends to carry out an integral management of the processes, the information, people, and applications that support them.

BPMS: Software that facilitates the management and coordination of tasks within a business process. It uses process modelling rather than programming which makes it a very flexible tool.

Business Process: Set of related activities that follow a logical and specific sequence, with the aim of creating value in an output intended for the organisation, investors or customers.

Information System: Interrelated technological and non-technological elements (hardware, software, communication networks, data, human resources and procedures) according to a certain structure with the objective to capture, debug, store, retrieve, update and process data for the place and time required by the user.

Knowledge: Within an organisation, knowledge is the result of human action on the data and information that the organisation possesses. It is an organisational resource that enables the conversion of information in decisions and actions. It is located in processes, technology and people.

Knowledge Management: Processes and systems aimed at increasing the intellectual capital of the company. It seeks to make tacit knowledge public, actionable, useful, and explicit.

Workflow: Software that automates intelligent movements of information. They allow the coordination, control, and automated communication of the work to be done, both by people and computers in the processes which unlike BPMS needs programming.

ENDNOTES

¹ Disponible en: <https://www.gartner.com/> (último acceso marzo 2017).

² IIBA (2009), A guide to the business analysis body of knowledge (BABOK® guide) Version 2.0. 1st ed. International Institute of Business Analysis (IIBA), Whitby, ON.

ICT Measurement From Information Society to Digital Economy

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INTRODUCTION

Over the past twenty years, technologies using microelectronics for collection, storage, processing, retrieval, transmission, and presentation of data, texts, images, and sound, collectively known as ICT have completely changed all people's activities. The pattern of ICT development and its impact on economic growth and welfare has been reflected in a sequence of theoretical concepts based on a certain degree of understanding of allied transformations (Figure 1). Influence of ICT led at to emergence of a new socioeconomic configuration commonly referred to as the Information Society on the edge of 1990-2000s.

The Information Society is based on extensive use of information and its proliferation into economic and social processes, and engagement of all economic agents – business, governments, and citizens – into the system of communications. Due to inclusion of all these agents in the digital space, big data generated in the digital form has become a factor of economic productivity (Figure 1).

The rapid proliferation of ICT and their impact on all spheres of modern life (see [Ahmad *et al.*, 2004]) – production processes, the interaction of individuals and organisations between themselves and with public authorities, the development of social infrastructure, and privacy issues – has stimulated the interest to statistical analysis of the ICT trends at the global, national and regional levels. Demand for statistical data has been changing along with the transformation of the very nature of various aspects of the economy and everyday life due to its digitalisation, while new measurement opportunities appear out of the progress of digital communications and the availability of large data arrays suitable for statistical processing and analysis. Overall, there is a need for the measuring of the digital technology and digital economy as a whole, while relevant international statistical standards have not yet been developed.

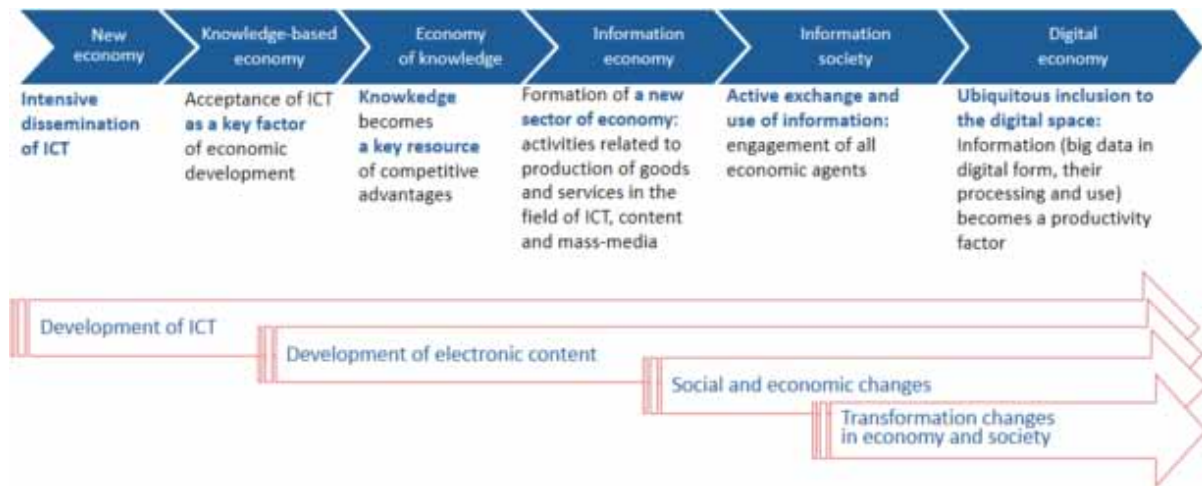
BACKGROUND

The Information Society is usually understood as a society that makes extensive use of information networks and technologies, produces large quantities of ICT goods and services, and has a diversified content industry. Both theoretical and practical issues related to measuring different aspect of information society have been increasingly addressed by many authors during the last two decades (see for example [Gokhberg, Boegh-Nielsen, 2007; Blank, Groselj, 2014; Dolničar *et al.*, 2014; Billon *et al.*, 2016]). As

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Figure 1. Evolution of definitions of economic formations and processes related to ICT

Source: compiled by the authors.



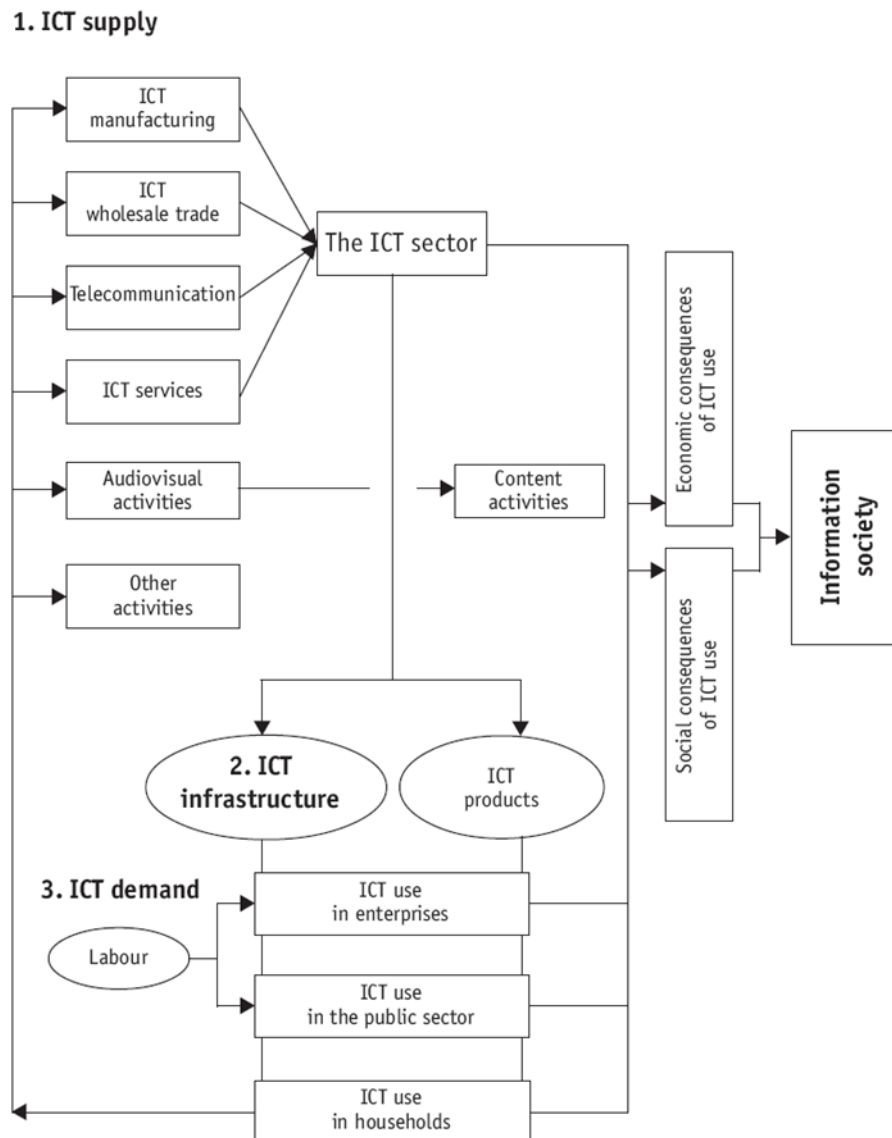
we can conclude from existing international statistical practices in this sphere, the key three thematic “pillars” related to the measurement of ICT are as follows (Figure 2):

- The ICT sector and supply of ICT: which industries it includes, how important are they for the national economy, how many enterprises are involved and how many persons are employed, which types of products and services are produced, and what is the total turnover?
- Technical infrastructure, including the penetration rates of landline and mobile telephone networks, the number of computers per inhabitant and the intensity of Internet connections (whether or not a country is ready to become an information-based society).
- ICT demand: which enterprises and individuals are using ICT products and services? Which technologies are being used, and why? What barriers hamper a country’s integration into the global Information Society?

Best practice national and international experiences in the field of Information Society statistics have been accumulated in a set of indicators and methodological guidelines. The Organisation for Economic Co-operation and Development (OECD), Statistical Office of the European Union (Eurostat), International Telecommunication Union (ITU), and United Nations Educational, Scientific and Cultural Organization (UNESCO) Institute of Statistics play the leading roles in these efforts (Table 1).

Statistical standards are produced by the dedicated working groups at the international organisations in close collaboration with national statistical services, in particular: the OECD Working Party on Measurement and Analysis of the Digital Economy, Eurostat Working Group on Information Society Statistics (WG ISS), ITU Expert Group on Telecom/ICT Indicators, ITU Expert Group on ICT Household Indicators. Implementation of the international statistical standards at the national level is usually voluntary; however, in order to ensure full-scale participation in international data exchanges, and to be able to assess the country’s positions vis-a-vis the global trends, most nations follow the international recommendations on measuring ICT. The most recent agenda of those working groups is focused on methodological approaches and standards for measuring the new phenomena related to the digital technologies and digital economy.

Figure 2. The conceptual model of the Information Society
Source: [Gokhberg, Buegh-Nielsen, 2007].



INTERNATIONAL STANDARDS FOR THE INFORMATION SOCIETY STATISTICS

Information Society statistics is one of the newest branches of socioeconomic statistics aimed at measuring all aspects of activities related to production of ICT goods and services, proliferation and usage of ICT in the economy, social and public sectors, and private life [HSE, 2014].

Information Society statistics is aimed at the following objectives:

- regularly collecting and processing relevant data to provide a basis for studying ICT development trends and assessing policies aimed at promoting the Information Society;
- conducting international comparisons, calculating international rankings;
- communicating reliable and comprehensive data to users.

Table 1. Existing international standards for ICT statistics

Areas covered by international statistical standards	References
ICT supply	
The ICT sector and content and media sector definitions by economic activity in accordance with international classifications	OECD, 2011 UNCTAD, 2009
The ICT product definition by goods and services in accordance with international classifications (CPC, HS)	OECD, 2011 UNCTAD, 2009
Core list of ICT sector and trade in ICT goods indicators	Partnership, 2016
ICT infrastructure	
ITU Telecommunications/ICT Indicators	ITU, 2014 OECD, UNCTAD
Core list of ICT infrastructure and access indicators	Partnership, 2016
ICT demand	
ICT usage by businesses (enterprises) survey	Eurostat, 2016a OECD, 2015 UNCTAD, 2009
Core list of ICT access and use by enterprises indicators	Partnership, 2016
ICT access and usage by households and individuals survey	Eurostat, 2016a OECD, 2015 ITU, 2014
Core list of indicators on ICT access and use by households and individuals	Partnership, 2016

Source: compiled by the authors.

The main international agency which has initiated and pursued development of relevant methodologies, since the very beginning, has been the OECD. Several issues of the OECD Guide to Measuring the Information Society were published, summarising the experience accumulated over the years (2005, 2009, the latest edition – 2011). The 2011 Guide presented basic concepts, definitions, and classifications, and included practical recommendations on collecting internationally compatible statistical data in the following areas [OECD, 2011]:

- **the Information Society:** the conceptual model in statistical terms;
- **ICT products** (definitions and classifications relating to ICT goods and services, measurement of international trade in ICT goods, prices and quality of ICT products);
- **ICT infrastructure** (access, quality, investments, tariffs);
- **ICT Supply** (the ICT sector and its impact, other suppliers of ICT, ICT patenting activity);
- **ICT demand by businesses** (the OECD model survey of ICT usage by businesses including statistical standards for e-business and e-commerce, business ICT investment and expenditure, economic impacts of ICT investment and use);
- **ICT demand by households and individuals** (the OECD model survey of access to and usage of ICT by households and individuals; includes a discussion of e-commerce and social and economic impacts of ICT use by households and individuals);
- **Content and Media sector** (statistical issues related to the information and electronic content, and more recent work on defining the content and media sector and its products);
- **The international scene and the road ahead** (overview of the international activities on measuring ICT as well as arising future challenges).

Currently most of the countries and many international organisations apply, to a different extent, the OECD-proposed methodological approaches to statistical surveys and analysis of the ICT sphere.

Basic OECD statistical standards for measuring ICT usage by businesses, e-commerce, and households' and individuals' access to and usage of ICT were harmonised with statistical methodology and data collection practices adopted by the EU countries. In its turn, the European experience prompted further development of the OECD and other international organisations' activities in this area. Methodological issues are dealt with by the Eurostat, jointly with national statistical services (the WG ISS is responsible for this work). The Eurostat mostly concentrates on coordinating two major surveys: ICT usage in organisations (the Eurostat Model for a Survey on ICT Usage and e-Commerce in Enterprises) and in households (the Eurostat Model for a Survey on ICT Usage in Households and by Individuals). These surveys are based on Model Questionnaires and the accompanying methodological guidelines for their implementation. The surveys are developed in close collaboration with the EU Member States and the OECD and are adapted to the changing needs of users and policy makers [Eurostat, 2016a].

The ITU provides definitions, which serve a basis for producing ICT infrastructure indicators. Its Handbook [ITU, 2011] is a key reference document for the collection of internationally compatible indicators on telecommunications/ICT based on administrative sources (i.e. supply-side data mainly provided by telecom operators). Due to the rapid development of the telecommunications sector, indicators have to be regularly adjusted. The impressive growth and transformation of the mobile communications and the Internet sector made it necessary to review the existing definitions. The current version of the Handbook contains definitions and methodological clarifications for 81 internationally accepted indicators and corresponding sub-indicators proposed by the ITU. It fully reflects the main aspects of monitoring the telecom infrastructures: landline and mobile telephone communications, Internet, tariffs for communication services, investments in telecommunications, and other relevant indicators.

Activities of UNCTAD refer to collecting and analysing national statistics, as well as providing consulting and training services to countries willing to produce internationally compatible ICT indicators. "Manual for the Production of Statistics on the Information Economy" [UNCTAD, 2009] contains recommendations for national statistical offices on methodological and practical aspects of statistical surveys of ICT development and application in the economy. It includes definitions, data sources, and methodologies for calculating important indicators, questionnaires and methodological issues commonly arising in the course of relevant statistical surveys, together with suggestions on dissemination of statistical information.

Following the 2003 World Summit on the Information Society in Geneva, the Partnership on Measuring ICT for Development (Partnership) was established, and started its official operations in 2004. The Partnership is an association of international and regional organisations involved in studying ICT development trends. Its current members are Eurostat, ITU, OECD, UNCTAD, the United Nations Department of Economic and Social Affairs, UNESCO Institute for Statistics, World Bank, and four UN regional commissions [Partnership, 2010].

The Partnership strives to produce internationally comparable and reliable ICT statistics. To achieve this, its members participate in developing and maintaining a Core List of ICT indicators. Other activities include compilation and dissemination of ICT data, and provision of technical assistance to help statistical agencies collect data for the Core List of ICT indicators. Its first edition was approved by the UN Statistical Commission in March 2007. There were 41 indicators on ICT infrastructure and access, ICT usage by households, individuals, businesses, and in the ICT sector, and on trade in ICT goods.

In 2008, taking into account new methodological guidance by the ITU and UNCTAD and the UNESCO proposals¹, the Partnership's List was reviewed, with Core Indicators on ICT in Education

added. Other changes to the List were updated indicators, elimination of differences between basic and core indicators, and more precise definitions of the terms used in the indicators, to reflect the revised international statistical standards. In 2012, a set of core indicators on e-government was added to the List [UN, 2012]. The latest revision of the Core List was based on a supply/demand conceptual model of the Information Society and covered such areas as the ICT infrastructure and access, access to and use of ICT by households and individuals, the use of ICT by businesses, the ICT sector, trade in ICT goods, ICT in education, e-government, and electronic waste [UN, 2014].

The last two decades have demonstrated an explosive growth of online economic activities including the Internet access provision and Internet-based services. Therefore, a new direction of statistical analysis has been developed – the assessment of the contribution of the Internet economy to GDP. A variety of studies covered the direct impact of the Internet on the economy [BCG, 2014; McKinsey, 2011; Bakshi, 2016], indirect economic impact of the Internet [Stiglitz, Sen, Fitoussi, 2009; BCG, 2010] as well as its social impact [OECD, 2013; Shah, Kwak, Holbert, 2011; Morton, 2006; Greenstein, McDevitt, 2011].

INDICATORS OF ICT AND CONTENT-RELATED ACTIVITIES

All ICT and content-related activities (the so called Information Economy) are divided into two sectors: the ICT sector and the Content and Media sector.

Figure 3. OECD Information Economy sectoral and product definitions

Source: [OECD, 2011].

Year	Sectoral definitions		Product definitions		
1998	First ICT sector definition (based on ISIC Rev. 3)				
2002	Revised ICT sector definition (based on ISIC Rev. 3.1)		First ICT goods classification (based on HS 1996/2002)		
2003					
2007	Second ICT sector definition (based on a late draft of ISIC Rev. 4)	First content and media sector def. (based on a late draft of ISIC Rev. 4)	First ICT services classification (based on an early draft of CPC Ver. 2)		
2008			First content and media product class. (based on a late draft of CPC Ver. 2)	Revisions to 2007 ICT services (based on a late draft of CPC Ver. 2)	Second ICT good classification (based on a late draft of CPC Ver. 2)
			ICT product classification		
			Information economy product classifications		
2010			Information economy product classifications (Correspondence: CPC Ver.2 HS 2007 – HS 2002)		

Statistical measurement of the ICT sector is centred around identification of the ICT-related activities (industries) and goods and services produced in this area.

Yet in 1998, the OECD adopted a definition of the ICT sector based on identifying and selecting ICT activities: in manufacturing, the products of an activity must be intended to process and communicate information, or to transmit and display information. They may also use electronic processes to detect, measure and/or record physical phenomena, or to control a physical process. In service activities, the products must be intended to enable the processing and communication of information through the use of electronic means [OECD, 2011]. The selection was based on the UN International Standard Industrial Classification (ISIC Rev. 3) and included only whole activities, not parts (*Figure 3*).

The latest changes were made in 2008, in line with the adoption of the modified ISIC Rev. 4. These were particularly relevant to the services sector. In the end, the scope of the ICT sector definition was reduced: the relevant industries' products and services must be intended mainly for data processing using electronic communication means, including data transfer and provision, or for supporting such activities.

Although in the new definition "electronic processes to detect, measure and/or record physical phenomena, or to control a physical process" were excluded, the list of functions belonging to the ICT sector was extended due to the coverage of a broader range of newly emerged service activities. The ICT sector definition was introduced as an official alternative analytical aggregation in the ISIC Rev. 4. The activities (industries) in the ICT sector can be grouped into ICT manufacturing industries, ICT trade industries and ICT services industries.

The ISIC Rev. 4 industries that comply with the above definition are as follows:

ICT Manufacturing industries

- Manufacture of electronic components and boards;
- Manufacture of computers and peripheral equipment;
- Manufacture of communication equipment;
- Manufacture of consumer electronics;
- Manufacture of magnetic and optical media.

ICT trade industries

- Wholesale of computers, computer peripheral equipment and software;
- Wholesale of electronic and telecommunications equipment and parts.

ICT service industries

- Software publishing;
- Telecommunications, included Wired telecommunications activities, Wireless telecommunications activities, Satellite telecommunications activities, and Other telecommunications activities;
- Computer programming, consultancy and related activities, included Computer programming activities, Computer consultancy and computer facilities management activities, and Other information technology and computer service activities;
- Data processing, hosting and related activities; web portals, included Data processing, hosting and related activities, and Web portals;
- Repair of computers and communication equipment, included Repair of computers and peripheral equipment, and Repair of communication equipment [UN, 2008].

The Classification of ICT Products is based on the same principles. It enables statistical agencies to produce two types of data: about production, based on the Central Product Classification (CPC) Ver. 2, and about imports (exports) of relevant products, based on the Harmonised System (HS) (*Figure 3*).

In addition to the ICT product classification, there is an obvious need for a harmonised classification of ICT services. However, due to a very rudimentary state of the earlier services classification, structuring new, rapidly developing service activities (such as web hosting or software initialisation, etc.) only became possible at the end of 2006, based on the new CPC Ver. 2 [OECD, 2011], which provided a detailed structure of the CPC Ver. 2 subclasses linking them with the ISIC Rev. 4 and HS 2007.

An internationally agreed definition of the Content and Media sector (comprising organisations whose economic activities involve production, publication, and/or dissemination of content) was developed in 2007–2008 on the initiative of the OECD, based on the ISIC Rev. 4. The sector covers the following industries:

- Publishing of books, periodicals and other publishing activities, included Book publishing, Publishing of directories and mailing lists, Publishing of newspapers, journals and periodicals, and Other publishing activities;
- Motion picture, video and television programme activities, included Motion picture, video and television programme production activities; Motion picture, video and television programme post-production activities, Motion picture, video and television programme distribution activities, and Motion picture projection activities;
- Sound recording and music publishing activities;
- Programming and broadcasting activities, included Radio broadcasting, and Television programming and broadcasting activities;
- Other information service activities, included News agency activities, and Other information service activities n.e.c. [UN, 2008].

The core indicators of the ICT sector and Content and Media sector are value added and employment as well as their percentages in the respective national totals.

INDICATORS ON ICT INFRASTRUCTURE

Statistical surveys of ICT infrastructure describe activities of telecommunications (as a segment of the ICT sector) and of broadcasting organisations as a segment of the Content and Media sector. The surveys include communication services output, revenues, and personnel.

ICT infrastructure indicators cover access to the Internet, telephone, telegraph, satellite communications; radio communications; the Internet and mobile traffic, including numbers of internet users with mobile, fixed, and broadband access, mobile subscribers, etc.

Indicators measuring accessibility of communication services, such as tariffs for local landline telephone calls, mobile communications, and landline broadband Internet access, are also given necessary attention.

Due to convergence of networks, services, and devices, indicators on ICT infrastructure now include television indicators. Development of the television segment is measured by availability of mandatory TV channels and the population's coverage by digital on-air and cable TV broadcasting.

These indicators are important not only to measure the level of ICT availability, but also for the estimation of the ICT productivity [Byrne, Fernald, Reinsdorf, 2016].

INDICATORS ON ICT USAGE BY BUSINESSES, HOUSEHOLDS (INDIVIDUALS), AND THE SOCIAL SPHERE (HEALTH AND EDUCATION)

The Eurostat collects data on the Information Society in the EU, focusing on the availability of ICT usage by individuals and within households [Eurostat, 2016b] and by enterprises [Eurostat, 2016c].

The main areas of statistical surveying of ICT usage in the business sector are availability of ICT, objectives and results of the Internet usage.

Statistical surveys of ICT usage by households and individuals allow to measure availability of and access to ICT; use of mobile phones, computers, and the Internet (places of access, purposes and frequency of usage); ICT-related skills, etc.

Internationally harmonised indicators of ICT usage by individuals are intended to reflect variations across countries and specific population groups in the same country, by the following parameters:

- application of cutting-edge technologies to provide higher-quality broadband Internet access;
- use of the opportunities provided by the Internet;
- replacement of conventional forms of socialisation, work, leisure, information search, shopping, etc., with new Internet-based formats;
- factors promoting or hindering ICT proliferation among the population.

Particular attention is devoted to e-commerce and e-government indicators, both with respect to enterprises and individuals.

E-commerce is defined as the sale or purchase of goods or services conducted over computer networks by methods specifically designed for the purpose of receiving or placing orders. The payment and the delivery of the goods or services do not have to be conducted online. E-commerce transactions exclude orders made by manually typed e-mail messages [Eurostat, 2015].

E-government is referred to as electronic contacts via the Internet with public authorities and allied public services. Contacts through manually typed e-mails should be excluded. Contacts and interactions with public authorities and public services include websites concerning citizen obligations (e.g. tax declarations, notifications of moving), rights (e.g. social benefits), official documents (e.g. ID cards, birth certificates), public educational services (e.g. public libraries, information on the enrolment in schools or universities), public health services (e.g. services of public hospitals) [Eurostat, 2015].

Surveys on the ICT usage in the social sphere, health, and education sectors have a structure similar to those on the ICT usage in the business sector. They also cover certain specific issues, such as, for the health sector – development of telemedicine, application of ICT to create and maintain medical registries and databases, provide electronic services to patients, etc.; for education – availability of various kinds of ICT in all types of educational institutions, along with conditions for the efficient application of ICT in teaching, ICT usage by teachers and students, introduction of new ICT-based teaching formats and techniques, etc.

NEW FOCUS OF STATISTICS – MEASURING DIGITAL ECONOMY

Digitalization of businesses, households, and the government leads to radical changes in the scope and scale of the demand for official statistics [Gokhberg *et al.*, 2018]. This also refers to the measurement of the new socioeconomic phenomena (such as, for example, the substitution of conventional (i.e. analogue) processes with digital ones²) related to the digital economy [Gokhberg, 2019].

Official statistics has to respond to the new challenges and provide evidence-based answers on the issues like:

- application of and demand for digital technologies;
- availability of and demand for digital technology-related products and services;
- the rate of the digital economy development and its contribution to economic growth and societal wellbeing;
- digital technologies' impact on business performance, labour productivity, and other socio-economic parameters;
- government efficiency in the digital economy, including the effects of digital technologies on the quality of government services and relations between the state, the public, and businesses;
- the effectiveness of public expenditures on implementing government digital economy policy and its impact;
- assessment of national advantages and barriers hindering competitiveness in the global digital economy, etc.

OECD designed an inventory of existing indicators drawn from a wide range of areas statistics, including those on education, innovation, entrepreneurship and economic growth, against current digital economy policy issues, as reflected in the OECD Internet Policy Principles [OECD, 2011b]. By doing so, it identified gaps in the current measurement framework and assessed progress achieved to cover them. In this respect, advancement of the measurement agenda is the overarching objective of measuring the Digital Economy [OECD, 2014, 2019].

The first attempts to measure new areas related to digital technologies have been already made. An example is statistical surveys of organisations using cloud services, robotics, and 3-D printing [Eurostat, 2018]. Another case is introduction of indicators of demand for cloud services into the existing surveys of ICT use by households [Eurostat, 2018].

SOLUTIONS AND RECOMMENDATIONS

Despite the above mentioned extensive methodological groundwork, measurement of ICT and the digital economy remains a substantial challenge to the official statistics. Many traditional approaches have become obsolete against the background of the rapid changes in this area, while some new issues are still outside the existing measurement frameworks.

For example, the broadband Internet definitions require revisiting. Broadband is defined as a service providing download speeds of at least 256 Kbit/s [ITU, 2011]. In order to adequately reflect the development of the high-speed Internet for broadband access the lower boundary should be set at a speed of at least 2 Mbit/s.

The next point refers to the surveys of ICT usage by households and individuals. For this purpose, international organisations typically consider all people living on the same premises, both related and unrelated to each other, as a household, if at least one of them belongs to the target population group. The recommended age range for the surveyed population is 16–74 years. National statistical offices may collect data about individuals outside this age group (they might be particularly interested in the ICT usage patterns by people aged above 75 years). Many OECD member countries have actually extended the age coverage and also survey individuals under 15. In about a half of the OECD member states, the target group's age range was extended to 10–72. Some countries, such as Korea, Mexico, and the USA, even survey children aged 3–6. Many countries have also eliminated the upper age limit of the target group. Inclusion, worldwide, of increasingly large population groups into the survey samples is explained by the wide penetration of information technologies into the people's everyday life at any age.

It is recommended to introduce international standards in statistical methodologies in order to avoid an existing significant data distortion (currently – up to 20–30%), which complicates cross-country comparisons on an equivalent basis and production of reliable international statistics. It is also recommended to introduce standardised approaches for data collection on ICT infrastructure indicators, such as the revenues from all telecommunication services; from mobile communications; and investments in telecommunications, in particular in developing countries.

FUTURE RESEARCH DIRECTIONS

Methodological approaches and statistical indicators described above should be seen as the basic ones. They are quite suitable for application in practically all countries. At the same time, ICT-related processes are inherently so dynamic, and the changes are so rapid that statistical measuring techniques need to be regularly updated and improved. Conventional statistical monitoring of ICT should be complemented with experimental indicators reflecting the digital economy processes, including its impact on economic growth (e.g. quantitative assessment of the Internet-induced openness's consequences in innovation, entrepreneurship, labour productivity, etc.), societal wellbeing, and environment; trust, personal data protection, privacy risks, and cybersecurity [OECD, 2016].

Among the perspective future research directions there are statistical methodologies for the following issues [Gokhberg, 2019]:

- Expenditures on digital economy;
- Creation and dissemination of digital technologies (including R&D, protection of intellectual property rights, technology transfer, innovation, digital engineering);
- Human resources and labour market; digital skills; employment, including the remote and platform-based ones;
- Use of digital technologies in sectors of economy and social sphere (e.g. in education, health, and social services);
- Production of digital content (digital products and services: images, video, audio, texts, games, etc.);
- E-commerce;
- Foreign trade in digital technologies and relevant goods and services;
- Digital trust (cybersecurity, protection of personal data);
- Digital equality and inclusion of the socially vulnerable groups of population (disabled, retired, inhabitants of remote areas, etc.).

Another important area for statistical activities is related to the rapid increase in new (e.g. big) data sources, in particular those generated by digital equipment in industry and households. International organizations and national statistical offices are looking forward into innovative ways to utilize big data as a source, which may complement to or substitute for traditional statistics allowing to overcome substantial data gaps [UN, 2016; Gokhberg et al., 2018].

CONCLUSION

Digital technologies permeate countless aspects of the world's economy, impacting sectors as varied as banking, retail, energy, transportation, education, media or health. ICT is transforming the ways social interactions and personal relationships are conducted, with landline, mobile and broadcast networks converging, and devices and objects increasingly connected to form the Internet of Things. Development and diffusion of artificial intelligence, robotics, advanced manufacturing technologies, virtual and augmented reality, wireless communications are also the areas which are more and more frequently mentioned for the measurement purposes.

This leads to an increasing demand of businesses, society and the government for respective statistical data. To meet this demand, a new generation of internationally harmonised statistical standards is required to provide national statistical offices and policy makers with more advanced methodologies of statistical measurement of the digital economy, envisaging relevant definitions and classifications, efficient data collection and processing procedures, and modern channels and formats of data visualisation and dissemination between various categories of users.

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KEY TERMS AND DEFINITIONS

ICT Sphere: Supply, demand, and usage of ICT.

ICT Usage Statistics: A sub-area of information society statistics studying all aspects of activities involving application of ICT in the business sector, social sphere, public administration, households, and by individuals.

Information and Communication Technologies (ICT): Technologies using microelectronics for collection, storage, processing, retrieval, transmission, and presentation of data, texts, images, and sound (HSE, 2014).

Information Industry Statistics: A sub-area of information society statistics studying all aspects of the ICT and content-related activities.

Information Society Statistics: The newest branch of social and economic statistics aimed at studying all aspects of activities related to the production of ICT goods and services, distribution and usage of ICT in the economy, social and public sectors, and private life (HSE, 2014).

International Statistical Standards for Measuring ICT: A set of internationally accepted recommendations on statistical surveying of information society, specifying requirements to statistical data and describing methodology for building basic indicators, based on harmonisation of national statistical standards.

International Statistics: Harmonised statistical methodologies and data collected and published by international organisations based on standardised programmes, to conduct regional and international comparisons.

ENDNOTES

¹ UNESCO develops harmonised methodological approaches to measuring ICT usage in education, including development of relevant definitions and concepts and sets of internationally compatible indicators. These include applications of radio, TV, and the Internet in education processes, training of ICT professionals, etc. The main principles for building such a system of indicators are described in UNESCO (2009).

² For example, digital transactions such as online purchases and deliveries should be counted separately from the “conventional” trade.

Organizational Knowledge of Digital Economy in Transformation, in Big Data, and in Internet of Things

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INTRODUCTION

As it is well known, the management issues, related to planning, searching, production, distribution and delivery of products or services (from a place from their production to a place of their consumption) are expressed by the term ‘Supply Chain Management’ (SCM). Currently, this term is a promised standard that is officially accepted. Modern SCM consists of popular business processes which implement newest technologies and innovative solutions. The main goal SCM is to be highly efficient supply management, when the product is available where and when its consumer needs it.

SCM is implemented as a technology that includes various tools, including artificial intelligence, performing machine learning with cognitive computing, which makes it possible to support constant analytics and transformation between the cyber-physical real environment and the digital space. In fact, SCM provides the transformation of traditional linear supply chains into intelligent, scalable, customizable, and fast delivery networks. Additionally, for ordering the technology to work, two more components are needed: the correct economic business models (under the conditions of the digital economy, it can be named as a joint economy) and mechanisms for providing trusted relations in business (that are grouped around the system of blockage or Internet values). In the chapter, avatar-based supply chains are considered also as an expert knowledge source for smart solutions to develop sustainable urban systems. The avatar-based supply chains as expert knowledge is a new concept that includes planning, searching, production, distribution and delivery of Mkrttchian’s digital avatars from the place of origin to consumption (Mkrttchian & Aleshina, 2017). This kind of supply chains are very different from the traditional one, because they relate to a specific product-expert knowledge, which is formed from electronic data, distributed in the Internet. The data belong to business partners and value-added service providers, operating in a general digital economy paradigm using blockchain technologies (Blockchain..., 2016).

The chapter focuses on analysis of business relations and their integration into sustainable urban systems. The supply chains of the 21st century are more complex and dynamic than ever before. Companies, that form the real value of business and, in general, of competitive global economy, need to improve their management in such aspects as inventory, costs, assets and introduction of new products. The improvement cannot be essential without use of the digital supply chains, which, working together with the technology of blocks, will transform the world of modern logistics. Even largest organizations

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lack the capacity, resources and knowledge to deploy end-to-end information integration in their supply networks. The networks consist of many components, or “supply chain nodes”, that are connected through flow paths. Inventory and products: the use of these flow paths has the ultimate goal of ensuring that customers’ needs are realized in a most beneficial way. Governments and companies have now the urgent need of cooperation to accelerate such integration within the framework of the Digital Supply Chain (DSC) concept, using the principles of joint economy and blockbuster technology. Collaboration in the DSC creates a multi-stakeholder environment for different needs and objectives, in which large companies are integrating with their main suppliers. Even competing companies are forced to cooperate for integrating the entire supply chain.

Value-added service providers play different roles, but their cooperation, supported by the common interests, should establish a common trusted environment. For the success of this kind of joint activity, DSC should offer the company competitive advantages, but for this a number of prerequisites must be realized: intermediate products should be quickly integrated; logistics partners should make deliveries using the tracking and visibility functions; and information and communication technologies (ICT) should be introduced in all the business processes. Joint activities are possible only on the basis of expert knowledge, which can be supplied, for example, by Mkrttchian’s digital avatars (Mkrttchain, 2013).

Within the framework of the Fourth Industrial Revolution, not only the list of end-to-end technologies is changing, but mental and methodological approaches to the development of jerk scenes are radically transformed. It is especially noticeable in the sphere of urban economy. It is obvious that the actively recovering industry in the coming years will become one of the main drivers of economic growth, which will have an impact on into sustainable urban systems. The main driver of breakthrough development in these conditions will be promising fast-growing industrial companies that have the highest leadership potential global markets. These are domestic private high-tech export-oriented companies, leaders in terms of development rates. Within the rating of Texas, 62 such companies were selected (Mkrttchian, et al, 2019). In 2018 it is planned to select an additional 30 companies. It is these circumstances that determine the relevance of the research in this chapter.

BACKGROUND

The advantages of Mkrttchian’s digital avatars (Mkrttchian et al, 2019) include profitability of services and the creation of value of joint activities that are beneficial to many ecosystem entities (Chenyshenko, Ruzich, 2013), including firms and their suppliers, employees and customers will be discussed below. Development of the avatars, as a special branch of computer science, has been booming in recent years (Arifovic et al., 2010; Dawid & Fagiolo, 2008; LeBaron & Winker, 2008). For the considering problem, the basic model “Triple H Avatars” was proposed in (Mkrttchian, 2013). A parallel trend in the computer science is multi-agent models and methods of computer simulation (Gilbert & Troitzsch, 2005), which are useful for solving such problems as forming an “environment” algorithm, which unites a set of agents or avatars into a system.

The digital avatar supply chain can be defined as a set of avatars of three or more subjects (i.e. organizations or individuals) directly involved in downstream flows of products, services, finance, and / or transfer of information from source to client. This definition emphasizes the role of information flows between firms, especially in business and business areas and process levels. The digital avatar of Mkrttchian refers to the software industry or to the development of programs. As in any production, there are tools in programming that allow you to produce certain parts (blocks), platforms (develop-

ment environments) for assembly, operating conditions, testing and product life cycle. And of course the combination of the virtual, digital and physical worlds that were published in the IGI Global publishing house in 2010-2018.

Since the governments of all countries today absolutely strictly support open source software development, Mkrttchian's digital avatars are written exactly with this code. The main reasons for this are to avoid software silos or create closed systems for interaction, to take advantage of the economic advantages of open source code and to clearly represent security issues. Open Source Software (OSS) is a computer software with its source code available with a license in which the copyright owner grants the rights to study, modify and distribute the software to anyone and for any purpose. Open source software can be developed in conjunction with the public. According to scientists who studied it, open source software is a prime example of open collaboration. Development of open source software or joint development from several independent sources creates an increasingly diverse field of design than any company that can develop and maintain a long-term perspective. And this is also one of the phenomena of a joint digital economy with its own and very significant indicators (Tolstykh, 2018).

Transition process to the digital economy was predicted quite long ago (Tapscott 1996; Brynjolfsson, Kahin, 2003). There are three levels of its development: markets and industries; platforms and technologies; environment (Bershadsky, et al, 2017). Suppliers and consumers interact at the first level. Development of markets and sectors of the economy take place at the second one. The third level is an environment for forming conditions for the development of "cross-cutting" technologies to operate in the global market and to form infrastructure for the digital economy (Mkrttchian, et al, 2016).

New technologies and processes are investigated within the concept of Industry 4.0, which supposes the use of network approach that is based on the ability of creating smart products, such as powerful, flexible and affordable Cyber Physical Systems' applications with various production types. The Internet of Things (IoT), Big Data and blockchain are three main trends that could combine to create an entirely new methods and tools for managing regional innovation system and provide their economic development (Kohler et al., 2009). This development looks at the 'art of the possible' and this new way of thinking could provide powerful ways for a business to run autonomously (Sun, et al., 2018).

Blockchain technology gives an alternative possibility, which allows to a single participant to "out-source" management, communications and scalable infrastructure problems to the peer-to-peer network (Swan, 2015). Instead of using a central server, a distributed public ledger will be maintained to store the transaction records and every node will possess a copy of this immutable public ledger. The "scalability" feature of blockchain can be used in the IoT world (Asharaf and Adarsh, 2017). The blockchain method is gaining popularity for elaboration of "self-developing" information systems of various profiles (Mohan, 2017). The use of intelligent avatars is based on semantic analysis of distributed information, so we need in blockchain-*knowledge* base (Zhang et al., 2017).

The transition to advanced digital, intelligent production technologies, robotic systems, new materials and design methods, the creation of systems for processing large amounts of data, machine learning and artificial intelligence. Big data technique for data storage, searching and analytics is a new achievement in the field of innovation, research and development (Chen and Zhang, 2014; Gandomi and Haider, 2015) Big data and its emerging technologies made essential changes in the business standards, as well as changed traditional data mining and business analytics (Sun, et al., 2018; McAfee and Brynjolfsson, 2012). The intelligent big data analysis becomes the disruptive technology for the age of trinity in terms of healthcare, web services, service computing, cloud computing and social networking computing (Ramzan et al., 2018).

MAIN FOCUS OF THE CHAPTER

Issues, Controversies, Problems

The purpose of this chapter is to achieve a global competitiveness in high-tech markets by dynamic industrial enterprises, increase labor productivity, improve the quality of life of the population, create innovative and active human capital, and increase the number of people employed in non-primary sectors by developing methodological bases and corresponding theoretical and practical tools for developing and implementing scenarios of breakthrough development. As a result of the analysis of Issues, Controversies, Problems, we established that the main focus of our chapter will be directed to the following tasks, which will determine the purpose of our research. The purpose of the research in this chapter is predetermined the need for the formulation and solution of the following tasks:

- To form the original concept of managing fast-growing industrial enterprises for the purpose of breakthrough development and technological breakthrough in the entire Russian industry.
- To develop a methodology and principles for the breakthrough development of fast-growing industrial enterprises in conditions of digital transformation.
- To propose a conceptual model and management system for the breakthrough development of fast-growing industrial enterprises.
- To carry out a synergetic modeling of the breakthrough scientific and technological development of companies - national champions.
- To substantiate the benchmarks, develop and test scenarios for the breakthrough development of fast-growing industrial enterprises.
- To offer a compliance-management system for the problems-calls of industrial enterprises.
- Propose the procedure for the introduction of digital counterparts and on their basis digital shadows in industrial enterprises.
- Develop and test the methodology for assessing the KPI breakthrough development of fast-growing industrial enterprises.
- Develop a program for the digital transformation of industrial enterprises.
- The focuses on the analysis of business relations and this integration into sustainable urban systems. The supply chains of the 21st century are more complex and dynamic than ever before.

The goal of clearly articulating these tasks, according to the authors, is to help readers understand the logic of the decisions made, and if necessary, readers can refer to the list of additional readings.

Open source software has long become a ubiquitous industrial production and business. There is, for example, a tremendous amount and variety of open-source software components and third-party components that arise in every software development environment in the world. With proper use and management, these components are a huge source of energy to accelerate innovation in the digital economy. Otherwise, they are directly related to security vulnerabilities, licensing risks, huge improvements and wastes, as in any production. The digital avatars of Mkrtchian's are work only on the basis of expert knowledge. Components are delivered to organizations through supply chain software that work is with many parallel traditional production supply chains. Therefore, a huge network of component suppliers creates 1000 new projects and provides 10,000 new versions per day. The software industry has already produced as many as tens of millions of products and their number is continuously increasing. Within it, OSS has the largest growth dynamics. The number of employees in the software industry is enormous

and is estimated at tens and hundreds of millions of people. But the laws of reducing costs and improving profitability are also valid in it. We need new innovative technologies and, in structure, they should resemble a system of blockchain.

The scientific novelty of the research is the development of theoretical and practical approaches to the construction of scenarios for the breakthrough development of fast-growing industrial companies, the implementation of which will provide the necessary scientific and technological and socio-economic breakthrough in priority and promising in the context of new markets industries of Russian industry (Karapetyants et al., 2017).

The methodological basis for the study is the integration of the systemic and synergetic approaches, taking into account the most important dialectical regularities. The basis of this approach is the methodology of system analysis, which serves as a methodological framework combining all the necessary methods, research methods, activities and resources to solve the research problem. System analysis organizes our knowledge of the problem in such a way as to help choose the best strategy for its solution or to predict the results of several alternative strategies that seem appropriate to eliminate the contradictions that gave rise to the above-mentioned research problem. In the framework of the system approach, it is proposed to use the method of systemic potential as one of the methods of system dynamics, used to study complex adaptive systems, adapting it to study the development processes in the economic system. Theoretical and methodological basis of the research will be general scientific empirical-theoretical methods of system analysis, abstraction, analysis and synthesis, induction and deduction, analogy, modeling, concretization, historical and logical methods of research. Specific scientific methods will be applied to continuous and selective observation, expert methods, content analysis, cluster analysis, methods of detailing, comparative, factor and correlation-regression analysis, optimal solution method, predictive extrapolation method, mathematical apparatus of genetic algorithms, SimBrain neural simulator, the software product IBM SPSS Statistics Subscription, as well as standard (Evolver and Risk companies Palisade Corp.) and the original add-ins MS Excel.

The study of the processes of interaction of economic agents in the economic system necessitates the use of a neo-institutional approach, which makes it possible to institutionalize the basic incentive to strengthen the interaction of economic agents, namely, the level of transaction costs of economic activity. Reducing the level of transaction costs for economic activities, provided by the digitization of social and economic processes, will increase the efficiency of the functioning of formal institutions, and will enable the unrealized potential of the economic system to be used. Ultimately, the achievement of the optimal level of costs of economic activity will make it possible to launch the process of self-development of socio-economic systems. Thus, the use of the system approach will allow to correctly structure and establish the relationships between the elements and development factors, and also to identify bottlenecks in the development of the economic system. The synergetic approach will make it possible to take into account the dynamic aspect of the development of the innovation system, such categories as the growing complexity, uncertainties, etc., which are inalienable, which are inherent attributes of economic activity, and allows it, on the basis of cooperative interaction of its participants, to generate new criteria, components and structures that facilitate the adaptation of the system to changing conditions.

Within the framework of this methodological approach, dialectical methods of cognition will also be used, providing a comprehensive and objective character of the study of the problem, logical, structural-functional, strategic, evolutionary, factor analysis, modeling, economic-statistical and other methods.

At all stages of the study, the use of the content analysis method with appropriate tools will be appropriate. For the analysis of foreign experience, historical and logical methods of research will be used. The basis of theoretical methods is the methods of organization and functioning of systems with one of the

most powerful methods of adaptation - self-organization. To collect information from economic agents on the level of transaction costs of economic activity, it is proposed to use sociological research methods. The tools for conducting a survey will be a poll program, the design of a representative sample, and the form of the questionnaire. For the assessment of transaction costs, mathematical models of fuzzy logic and metric are supposed to be used. This is necessary to evaluate the various in nature and essence of both quantitative and qualitative factors and parameters under conditions of nonlinearity and uncertainty (under conditions of ambiguous, asymmetric information). Metric methods provide the opportunity to carry out measurements under such conditions.

SOLUTIONS AND RECOMMENDATIONS

The mathematical apparatus of the theory of fuzzy sets provides new tools and possibilities for processing qualitative factors and parameters that have high uncertainty. The analysis of the collected empirical data will be carried out using the IBM SPSS Statistics application package.

Thus, the use of the integration of a number of methodological approaches to the research problem presents in aggregate a constructive tool that allows to solve the problems posed in the study:

- The original author's concept of managing fast-growing industrial enterprises, containing classification characteristics and content characteristics, to ensure global, innovative, inclusive, proactive and sustainable breakthrough development of Russian industry.
- Methodology for managing the breakthrough development of fast-growing industrial enterprises on the basis of laws and development principles, which includes a set of theoretical foundations in terms of hypotheses, applied theories and basic approaches, basic organizational and management mechanisms and basic efficiency assessments.
- Conceptual model and management system for the breakthrough development of fast-growing industrial enterprises at mega-, macro-, meso- and microlevels, which allows preparing all actors of the ecosystem for effective sustainable development in accordance with the goals set.
- Multi-variant scenario design of scientific, technological and socio-economic breakthrough development of fast-growing industrial enterprises of the Russian Federation until 2035 with justification of reference points and bifurcation zones, which helps to adjust the development option taking into account the comparison of resource projection and the projection of development results.
- Compliance-system of management of problems-calls of the industrial enterprises, allowing the companies to resist "the big calls" and to manage the risks inevitably arising at realization of breakthrough development.
- The procedure for the introduction of digital doubles integrated into the platform ecosystem and on their basis digital shadows in key industries as a priority direction of development under conditions of digital transformation that will allow consolidating the participants of industrial markets with the aim of introducing technological innovations.
- The program of digital transformation of industrial enterprises as a set of key initiatives, activities and their results, including the ways of strategic development on the basis of a combination of organizational forms of activity, increased activity, development of integration.
- Methodology for assessing KPI breakthrough development of fast-growing industrial enterprises, which allows you to measure the level of achievement of goals, identify weaknesses, conduct benchmarking at the global level.

- Develop a structure and form an analytical review of the research problem. The analytical review should contain:
 - a. Theme, subject, object, nature, purpose and objectives of the work;
 - b. Systematization of information about the problem under study (key tasks, known positions, theories, premises, etc.) from the standpoint of reliability, doubtfulness, controversy;
 - c. Review of scientific information sources on the subject of the problem under study;
 - d. A description of the methods of performing the work;
 - e. An analytical reference on the results of a review of scientific information sources on the subject of the problem under study, including at least 50 publications from domestic sources and 100 foreign publications, mostly published during the period 2013-2018.
- Identification and justification of digitalization trends for the period up to 2030, a list of end-to-end technologies for the potential for making a technological breakthrough.
- Determination of the rating positions of Russian industrial enterprises at the global level, global benchmarking, identification of best practices and best-in-class solutions.
- Research of fast-developing high-tech companies in Russia. Drawing up a portrait of the company - the national champion on the basis of the analysis of the rating, the identification of fast-growing industrial companies (gazelles).
- 13. Comparison of the contribution of small, medium and large businesses to the growth of the economy in the Russian Federation.
- Identification of drivers and inhibitors of breakthrough development in industrial companies.
- Research of world and Russian experience of development of corporate accelerators.
- Research of the best practices of innovation management in Russian companies.
- Analysis of the market for direct and venture angel investments in industrial companies in Russia.
- Research of behavioral and institutional preconditions of technological development.
- Investigation of the economy as a socio-economic phenomenon.
- Formation of the conceptual foundations for the creation of an enabling environment and a mature ecosystem for the purpose of breakthrough development and technological breakthrough by industrial companies.
- Research of global practices of commercialization of technologies at different stages.
- Development of a methodological approach to assessing the level of scientific and technological development of fast-growing industrial enterprises.
- Development of a methodology for assessing the global competitiveness of fast-growing industrial enterprises.
- Development of a methodological approach to assessing the potential for the formation of multinational Russian-based companies on the basis of fast-growing industrial enterprises.
- Development of the original author's concept of managing fast-growing industrial enterprises for the purposes of breakthrough development and accomplishment of a technological breakthrough, containing classification characteristics and content characteristics.
- Formation of a methodology for managing the breakthrough development of fast-growing industrial enterprises on the basis of laws and development principles, which includes a set of theoretical foundations in terms of hypotheses, applied theories and basic approaches, basic organizational and management mechanisms and basic efficiency assessments.
- Development of a conceptual model and management system for the development of fast-growing industrial enterprises at mega-, macro-, meso- and micro levels.

All the tasks we have solved are solved using digital avatars (Mkrttchian and Aleshina, 2017). Digital Mkrttchian's avatars, more precisely the expert knowledge generated by them, enable each member of the network, called a node, to contain a chain of blocks that makes up the history of transactions performed on the network. Each block contains a set of transactions, the size of which depends on how many banks and financial institutions do not actually have an API, or have a very truncated form. Also, any financial system faces the risk of non-fulfillment or disputing by the parties of the transaction of payments made. Avoid these risks can involve a qualified financial intermediary, which checks the transaction and takes some of the risks. To solve this problem, all kinds of organizations were created: banks, clearing systems, depositories, financial information transfer systems such as Reuters or SWIFT. However, the use of intermediaries leads to a significant increase in the cost and slowdown of calculations. International transactions on time can last up to seven days. In the banking sector, there are obvious serious contradictions between the established traditional business and modern innovative technologies. These contradictions in the very near future cardinally reformat the financial market. And expertise will replace the financial intermediary and create a transaction and transfer it to the network. the transaction message includes information on the public address of the recipient, the transaction value and the digital signature, which proves the authenticity of the transaction. Nodes (computers / users) of the network, after receiving the message, confirm the authenticity and validity of the message by decrypting the digital signature. An authenticated transaction is placed in the "pool" of pending transactions. Nodes (computers / users) of the network, after receiving the message, confirm the authenticity and validity of the message by decrypting the digital signature. An authenticated transaction is placed in the "pool" of pending transactions. The nodes of the network validator receive the proposed block and work on its verification through an iterative process, which requires consensus in most networks. If digital avatars are implemented, they ensure that each transaction is valid and fraudulent transactions are not possible. If all transactions are verified, the new block - the forming expert knowledge is "chained" to the block chain (block box), and the new current status of the registrar is transferred to the network. The entire process can be completed in 3-10 seconds. "

The developed system allows to solve the following tasks based on the use of expert knowledge:

- Assessment of the advantages and disadvantages of the institutional environment, the national economy and the legal system, and preparation of proposals on ways and mechanisms for improvement.
- Substantiation of benchmarks of breakthrough development of dynamic industrial enterprises of medium-sized businesses.
- Development of scenarios for the breakthrough development of fast-growing industrial enterprises. Implementation of the developed scenarios in the practice of dynamic industrial companies of medium business.
- Identification of problems-calls of industrial enterprises. Correction of the list of large calls from the Strategy of scientific and technological development of the Russian Federation.
- Formation of a compliance system for managing problems-calls of industrial enterprises in urban system.
- Carrying out of synergetic modeling of breakthrough scientific and technological development of companies - national champions.
- Formation of the concept of a communication campaign aimed at popularizing innovative activity and promoting success stories.

- Examination of the existing list of publicly accessible information resources for the purpose of breakthrough development of industrial enterprises.
- Development of a methodical approach to the evaluation of the startup cost index and the main characteristics of startups launched.
- Development and validation of the methodology for assessing innovative demand and innovative activity of dynamic medium-sized companies.
- Research of the dynamics of scientific communication in Russia.
- Processing the results of the development of fast-growing industrial enterprises according to the developed scenarios for the first year of observation.
- Development of the procedure for the introduction of digital counterparts and on their basis digital shadows in industrial enterprises.
- Formation of the program of digital transformation of industrial enterprises.
- Development and approbation of KPI evaluation methodology for breakthrough development of fast-growing industrial enterprises. The implementation is planned on the basis of the national champion.
- Modeling the process of creating an industrial-technological enclave as a kind of network structure of the cluster type.

The proposed block system can be successfully applied for Smart solutions in create sustainable urban systems. These solutions provide a massive increase in efficiency for decision-makers. This also provides a new platform for open innovation without permission. The proposed chain of blocks was successful because they did not ask for permission. They were built on an idea in which central authority and supervision should be avoided, and that the network itself must be resistant to all forms of censorship. At the same time, the network time should be open to everyone, and all members should be able to make any transactions that are Smart solutions in create sustainable urban systems. This meant that Mkrttchian's idea of technology was seen as too slow and too risky for Smart Solutions in creating sustainable urban systems. As the digital avatar technology matured, however, more and more people began to see the potential of distributed accounting technology, just in a more controlled setting. If distributed book technology can be adapted to existing laws and regulations, this can lead to the elimination of a large number of costly inefficiencies and replace the basic system for Smart Solutions in create sustainable urban systems.

FUTURE RESEARCH DIRECTIONS

Many developers are rushing to develop software that can use these precedents and act as the best solution provider, often in several markets at the same time. You can imagine the winner scenario - all this because of the effect of a strong network that the largest provider will like, but it's interesting that some signs indicate that this may not be a coincidence. Relying on the technological roots of the blockade created with open source and the ideals of an open network of digital avatars, developers focused their attention on solutions for compatible registers. This means that in the future, the data can be transferred between different registers and allows the trading of assets that are not currently considered commodity. The web of web values will facilitate the trade of all forms of assets, such as currencies, stocks, goods and gold, but this will require completely different digital avatars that will come from the supercomputer. Development of the theory of digital economic security and formation of new knowledge that adequately

describes emerging social threats in the digital economy and gives digital economic security the status of a scientific discipline. Digital economic security is understood by the scientific collective as an information model of synthetic knowledge, whose individual judgments, while within the boundaries of economic and information security, lose their former autonomy and, integrating with social security, become elements of a new system.

The specific fundamental task consists in the initial development of a number of new provisions derived from the theory of economic and information security theory on the basis of the hypothesis that the more the economy is digitized, the higher the level of ensuring its social security requires a person, society and the state. As such provisions the scientific team develops the following:

- The interests of the individual, society, state in the digital economy and the desired characteristics of the object of digital economic security;
- Mechanisms for ensuring digital economic security, based on effective analysis of large data for solving problems of the digital economy, including problem-oriented applied algorithms, machine learning systems and other methods of intellectual analysis;
- Coordination of new designs of digital economic security and showing links between the elements of these structures as part of a more complete system - the digital economy;
- The construction of derivative designs of digital economic security, combining approaches to ensuring the economic, information and social security of the individual, society, the state on the basis of effective analysis of large data for solving problems of the digital economy, including problem-oriented applied algorithms, machine learning systems and other methods of intellectual analysis.

CONCLUSION

- Digital avatars, as a tool of the digital economy, become more and more common. They situate in a new intermediary, located between a buyer and a seller, who seizes and uses virtually unused assets and valuables.
- Convergence with enabled blocking connection allows a seamless peer-to-peer node to exchange assets and cost, reducing the need for trust brokers as intermediaries and increasing the extracted market economic rent in a joint digital economy that.
- Convergence with enabled blocking connection converts the value creation chain. Autonomous robotics, AI, IoT and block systems will digitize logistics and distribution, reducing its importance and therefore increasing the ability of companies at this stage in the value chain to profit.
- Manufacturers can get more value they create, and consumers can pay less. In the long term, technical deflation will fall into the knee of an exponential curve, since most of the production with a 3D print, as well as a virtual and augmented reality, make it cheap for design and give the opportunity to print products at home. And it will also be some kind of new technology, but everything will be determined by economic benefits even then.
- The concept of managing fast-growing industrial enterprises, containing classification features and content characteristics of the development environment; A distinctive feature of the author's approach is the consideration of the environment from the standpoint of the system-synergetic approach as a continuum of framework conditions, including values, institutions, maturity of industries and markets, infrastructure, technology.

- Methodology for managing the breakthrough development of fast-growing industrial enterprises on the basis of laws and development principles, which includes a set of theoretical foundations in terms of hypotheses, applied theories and basic approaches, basic organizational and management mechanisms and basic efficiency assessments.
- Conceptual model and management system for the breakthrough development of fast-growing industrial enterprises, characterized by the allocation as vectors of decomposition of objects, management functions, directions of digitization at mega-, macro-, meso- and microlevels, as well as stages of innovative and production processes that allow achieving achievement global competitiveness, increasing labor productivity in industry and improving the quality of life.
- Methodological approach to the assessment of the level of technological development of industrial enterprises as an integral index with emergent properties, with the allocation of macroeconomic, investment, scientific, technological and innovative, stock, information and communication domains, which gives an idea of the influence of various factors on the change in the final indicator and build predictive estimates.

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KEY TERMS AND DEFINITIONS

Application of Blockchain Technology: Is application multifunctional and multilevel information technology designed to reliably record various assets in digital economy to help the technological challenges and created tools.

Avatar Model of High Technology: Is new model with natural intelligent for Avatar introduced in 2011 from Professor Vardan Mkrttchian.

Avatar-Based: Is a new term that describes the planning, search, production, distribution, and delivery of Mkrttchian's digital avatars from the place of origin to consumption.

Blockchain Technology: Is a multifunctional and multilevel information technology, designed to reliably record various assets in digital economy.

Digital Ecosystem: Is an independent group of actors (people, equipment, and organizations) that share the standardized digital platforms to communicate with each other to achieve commercial or social goal.

Expert Knowledge: Is a specific product-expert knowledge, which is created through electronic data distributed on the Internet between business partners and value-added service providers operating in a general digital economy paradigm using blockchain technologies.

Smart Solutions in Create Sustainable Urban System: Means that Mkrttchian's idea of technology was seen as too slow and too risky for Smart Solutions in creating sustainable urban systems. As the digital avatar technology matured, however, more and more people began to see the potential of distributed accounting technology, just in a more controlled setting. If distributed book technology can be adapted to existing laws and regulations, this can lead to the elimination of a large number of costly inefficiencies and replace the basic system for Smart Solutions in create sustainable urban systems.

Supply Chain Management: Is a formal term for managing the physical and information flow of materials and finished products and goods in the supply chain.

Augmenting Organizational Knowledge Management Using Geographic Information Systems

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INTRODUCTION

Knowledge is the fundamental factor of production, and knowledge assets within an organization are in knowledge bases, databases, people's heads and filing cabinets (Mohajan, 2017). These assets are supposed to be managed in effective and efficient ways (Faucher, 2010). Organizations must continually rely on decisions, such as deciding on long-term plans, and on tactical schemes to realize middle range ambitions (Sado, 2014). In today's competitive world of business, knowledge management (KM) is of paramount importance for the sustainable development of organizations (Mahdi et al., 2011). Through KM, organizations collect and store potentially important knowledge and manipulate it to realize the utmost effective usage in order to positively change organizational performance (Singh et al., 2006). Through the application of successful KM, organizations can advance their effectiveness and can gain a competitive advantage (Rahimli, 2012). Many firms are realizing that to thrive in complex and dynamic environments, they must be swift and flexible in their day-to-day operations (Bolisani & Bratianu, 2017). Key decisions are now becoming more dependent on understanding and coding complex information acquired from knowledge management systems, and GIS technology has the ability to incorporate this requirement (Satyanarayana et al., 2017). GIS offers a framework for planners to devise things more efficiently (Belsis et al., 2004). GIS is a computing application capable of creating, storing, manipulating, visualizing, analyzing and interpreting geographical data (Gürder & Yılmaz, 2013). GIS shows relationships (of proximity, connectivity, neighbourhood, and overlay), patterns, and trends in the form of maps, reports, and charts (ESRI, 2012). GIS is used for explaining events, predicting outcomes, and planning strategies (ESRI, 2000). Thus, GIS technology guarantees faster decision making (Al-Fareed et al., 2008). It can assist businesses to save time and money while improving access to information and realizing a tangible return on their GIS investment (Klimešová & Vostrovský, 2008).

BACKGROUND

The contemporary beginnings of KM can be traced back to the late 1980s, through to the 1990s (Edwards et al., 2009). The KM concept was first applied in fields, such as information systems, business administration, healthcare, public policy, and library and information sciences (Bennet & Bennet 2008). It is assumed that approximately 80 per cent of data employed in creating information and knowledge in

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organizations have spatial components (Fitzke & Greve, 2010). Thus, spatial-based information systems can significantly contribute to effective knowledge management activities (Gürder & Yılmaz, 2013). GIS technology can link geographical datasets by use of spatial references through a process known as geocoding (Gürder & Yılmaz, 2013). The spatial reference can be given by coordinates (Nikolli & Idrizi, 2010). Therefore, addresses can be correctly located on a map with the help of the address coordinates (Zandbergen, 2007). According to Strand (2016), “This kind of references allows the observations to be linked by location, providing for new approaches to data collection, new opportunities for data analysis and more use of maps as a visualization and communication tool.” Thus, by applying GIS-functions more information will be generated, information which will allow businesses to conduct analyses, and to carry out new queries and assessments on particular problems (Gürder & Yılmaz, 2013). Non-spatial (attribute) data describe the properties of spatial entities (Gürder & Yılmaz, 2013). The salary and/or age, for example, of a shopper living at a particular address, are attribute data. The address remains a geographical data. A geodatabase warrants that geographical data and attribute data are connected to each other (Gürder & Yılmaz, 2013). The GIS capability to perform spatial analysis can be considered to be the same as the decision capabilities of decision support systems (DSS) (Mennecke, 1996). This enhances their distinguished significance to support basic organizational tasks (Belsis et al., 2004). Thus, spatial-based information systems will contribute to operational knowledge management activities (Gürder & Yılmaz, 2013).

KNOWLEDGE AND KNOWLEDGE MANAGEMENT

Defining Knowledge and Knowledge Management

Knowledge is linked to human actions (Tsoukas & Vladimirou, 2001). It lives in people in terms of information, experiments, perceptiveness and qualifications, products/services, and as activities and processes (Chuang et al., 2013). According to Almashari et al. (2002), knowledge is the ability to act. Wang et al. (2007) defined knowledge as the capability to change information into actions and decisions. In organizations, there are two types of knowledge, namely explicit and tacit knowledge (Nonaka, 1991). Encoded, stored and disseminated data and information are regarded as a content component of the explicit knowledge (Mahmood et al. 2011). Tacit knowledge articulates itself in actions of humans as evaluations, attitudes, competencies, points of view, experiences and skills inside the worldview of an individual (Koskinen et al, 2003). Various definitions of KM exist. Druker (1999) defined knowledge management as “the coordination and exploitation of the cognitive resources of an organisation in order to create the benefit and competitive advantage.” Dalkir et al. (2007) define knowledge management as “Processes and activities which support and facilitate the development and the use of knowledge.” Knowledge management generally entails the planning, organizing, motivating, and controlling of people, processes and systems in an organization to guarantee that its knowledge-related assets are improved and effectively applied so as to attain efficiency, to gain competitive advantage and to guarantee innovation.

Knowledge Management Processes in an Organization

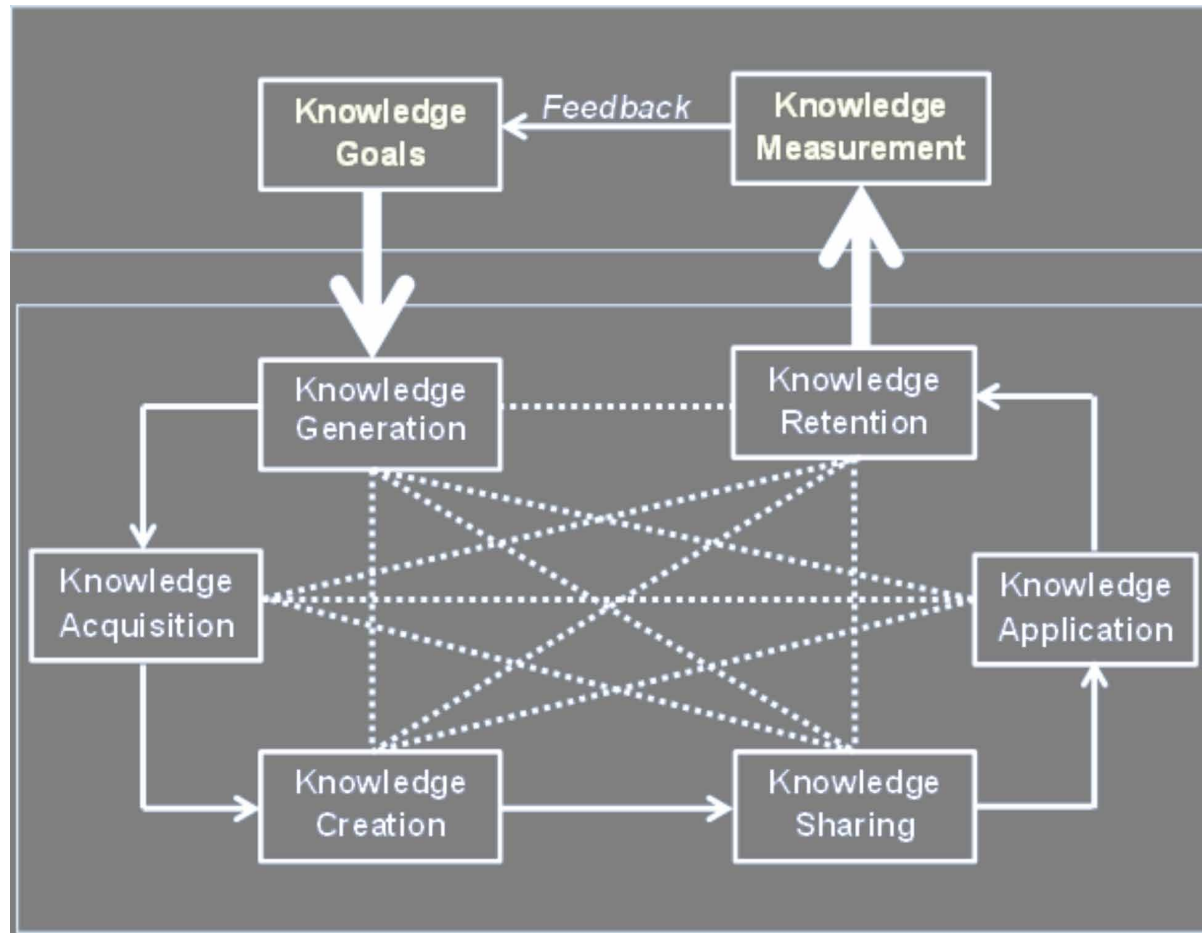
Probst et al. (1997) recognized eight processes in KM in an organization; these processes were regarded as “the building blocks of knowledge management”. Knowledge goals come first, and they pave the way for knowledge management activities. According to Probst et al. (1997), knowledge goals can be

categorized into three classes: *Normative knowledge goals* entail the development of a knowledge-sensitive corporate culture, where distribution and creation of know-how develop the prerequisites for operational knowledge management. *Strategic knowledge goals* outline the principal capabilities of an organization and define its future knowledge needs. *Operational knowledge goals* ascertain that both normative and strategic knowledge goals have largely been implemented as intended and that they are bearing fruit. The second building block is the knowledge generation, and Davenport & Prusak (1997) introduce five modes of knowledge generation. *The acquisition* consists of knowledge into an enterprise from external sources, for example, employing persons with knowledge or hired knowledge from experts. It is regarded by Probst et al. (1997) as the third building block of knowledge management. *Dedicated resources* entail the creation of specific groups, for example, research and development groups, with the aim of identifying and acquiring knowledge. *Fusion* is the creation of new knowledge in business: by drawing together individuals with various points of view, experiences, and skills so as to stimulate new thinking. *Adaptation* can be termed as being open to accommodate recently acquired innovations and also aggressively ready to incorporate new knowledge and skills. *Knowledge networking* involves the sharing of information, formally or otherwise, by people and/or organizations. Knowledge creation, the fourth building block, denotes the continuous bringing together, transfer, and conversion of different kinds of knowledge. Knowledge codification, a process in the creation of knowledge, transforms knowledge into a code that can be understood by people (Mohajan, 2017). Knowledge sharing is the next building block of knowledge management. It is through the sharing of knowledge that individuals and organizations exchange knowledge (Mohajan, 2017). Knowledge application is the use of knowledge for decision-making and executing tasks, and this promotes the overall performance of an organization (Becerra-Fernandez et al., 2004). Knowledge retention is the accumulation and storing of a wealth of knowledge into knowledge database within an agency, it averts loss of the acquired knowledge, and according to Alegbeleye (2010), the ideas of knowledge retention in a database is for easy retrieval of information in the future. The measurement of organizational knowledge constitutes the last building block in the knowledge management process. Knowledge measurement forms an integral part of strategic management (Bolisani & Bratianu, 2018).

ROLE OF KNOWLEDGE MANAGEMENT FOR DEVELOPMENT OF ORGANIZATIONS

According to Payne and Sheen (2004), establishing effective KM in organizations provides a variety of benefits. Epetimehin & Ekundayo (2011) point out that KM effort assist agencies through sharing of valuable organizational insights, lessening redundant work which minimizes company profits, avoiding wastage of time and/or effort in developing something that is already in existence, reducing the time it takes to train employees, retaining intellectual capital as employees' turnover and adjusting to change in environments and markets. This enhances service delivery and preserves knowledge (Dubois & Wilkerson, 2008). According to Mohajan (2017), easy access to accurate information will allow employees to get required information faster. Thus, workers use less time responding to repetitive questions. This will save them time to concentrate on main-and more profitable-work. Employees are prone to doing the same mistakes previously done by others if they are not sharing information (Kayani & Zia 2012). When employees share information, others can have access to it and evaluate that information so as to think carefully before making informed decisions (Siemieniuch & Sinclair, 1999). A major benefit of KM is that information is shared with ease between staff members, and that knowledge is not lost if someone

Figure 1. The Building blocks of knowledge management (modified from Probst et al., 1998 by Gürder & Yilmaz, 2013).



goes on vacation, gets sick, or leaves the company (Martin, 2003). In the era of the knowledge-based economy, businesses must rely more on their knowledge-based resources to thrive (Kim & Gong, 2009) and to cope with the changes.

KNOWLEDGE MANAGEMENT ISSUES AND STRATEGIES

Issues of Knowledge Management

Davenport (1998) highlights the following issues of knowledge management:

- (a) KM is an asset whose effective management requires an investment of other assets.
- (b) In order to achieve effective KM, there is need to have hybrid KM environments since it requires integration of people and technology.
- (c) Since KM is highly political, knowledge managers are required to lobby for the importance and application of knowledge.

- (d) Knowledge will not be well managed unless a group within an enterprise is tasked with the responsibility for KM.
- (e) Organizations should allow the knowledge market to operate, and simply avail and map the knowledge that is really required.
- (f) Knowledge sharing and retrieval should be very simple and straightforward and never be blurred by cryptic interfaces that are not easy to interpret and use.
- (g) People naturally have a tendency of hoarding their knowledge; people should be enticed to shear information by offering them incentives that are too good to ignore.
- (h) Special attention must be dedicated to processes where knowledge is produced, applied and shared.
- (i) Various types of knowledge call for diverse approaches of information engagement.
- (j) Mapping a given knowledge environment should not be unreasonably extensive and time-consuming.
- (k) There should be policies and/or at least some kind of contract between the employee and the enterprise to oversee the preservation and application of knowledge.
- (l) Employees may fear that a newly introduced system will waste their time, or that sharing their knowledge will make them be declared redundant.

Strategies to Govern Efficient and Effective Knowledge Management

Alignment of corporate and knowledge management strategies are the number one success factor in all knowledge management activities (Earl, 2001). This is because strategy:

- (a) Oversees the distribution of money to resources.
- (b) Offers hybrid solutions.
- (c) Is high-order politics.
- (d) Is the point at which knowledge, skills and information offer their optimal value.
- (e) Is vital in setting a vision, architecture and a technology plan to administer developments in intellectual assets and knowledge management processes.
- (f) Is never-ending, for it requires a steady knowledge supply.

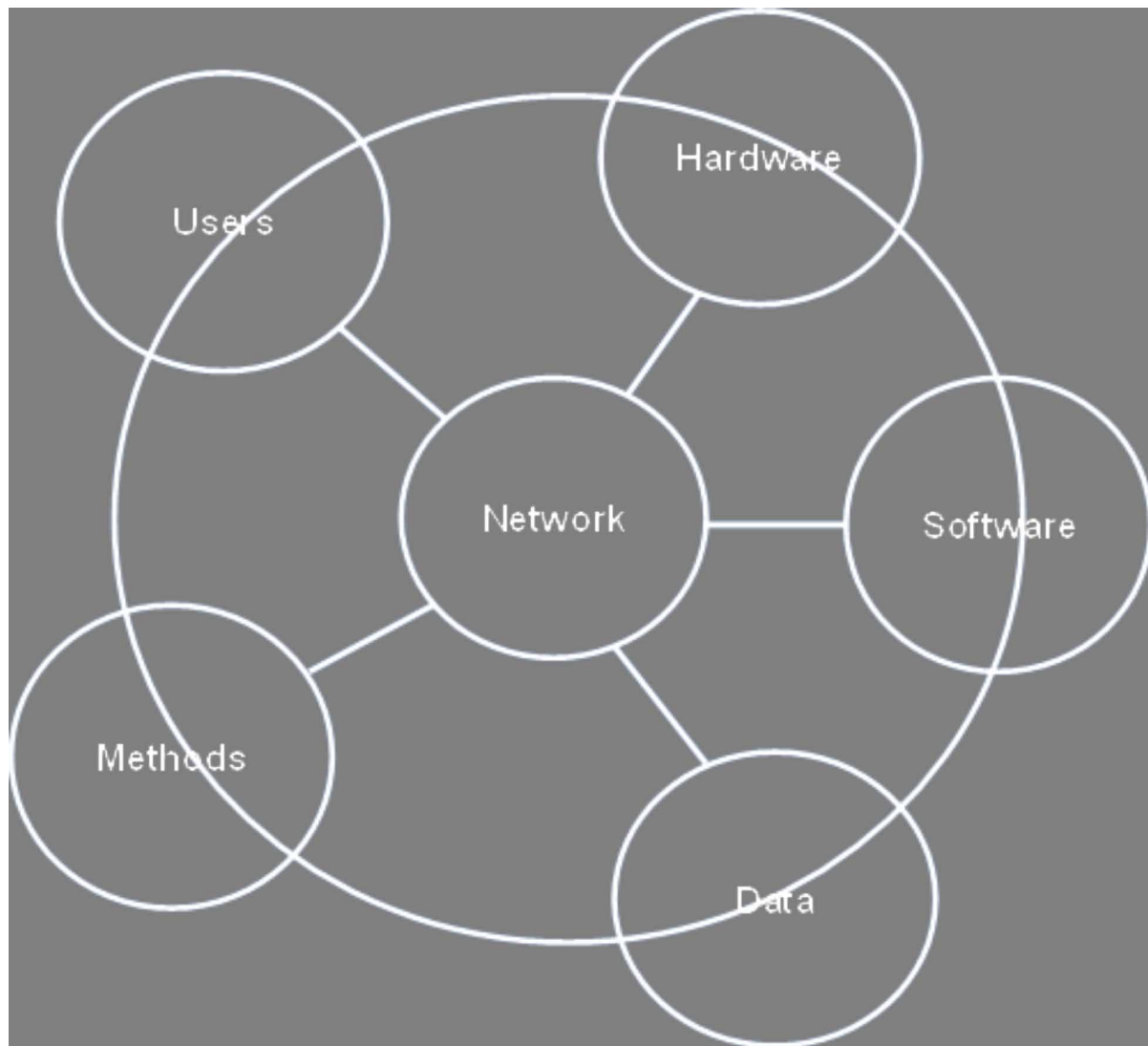
These issues underscore the fact that for knowledge to have optimal value, it must be aligned with the future targets of the organization (Tiwana, 2000). An agency must first outline what it is actually doing (and what it is capable of doing), and relate this to what must be done in order to sustain its competitive advantage (Snyman and Kruger, 2004). According to Laudon and Laudon (2004), knowledge management strategies result in the development of information system applications.

GIS AND ORGANIZATIONAL KNOWLEDGE MANAGEMENT

Components of GIS

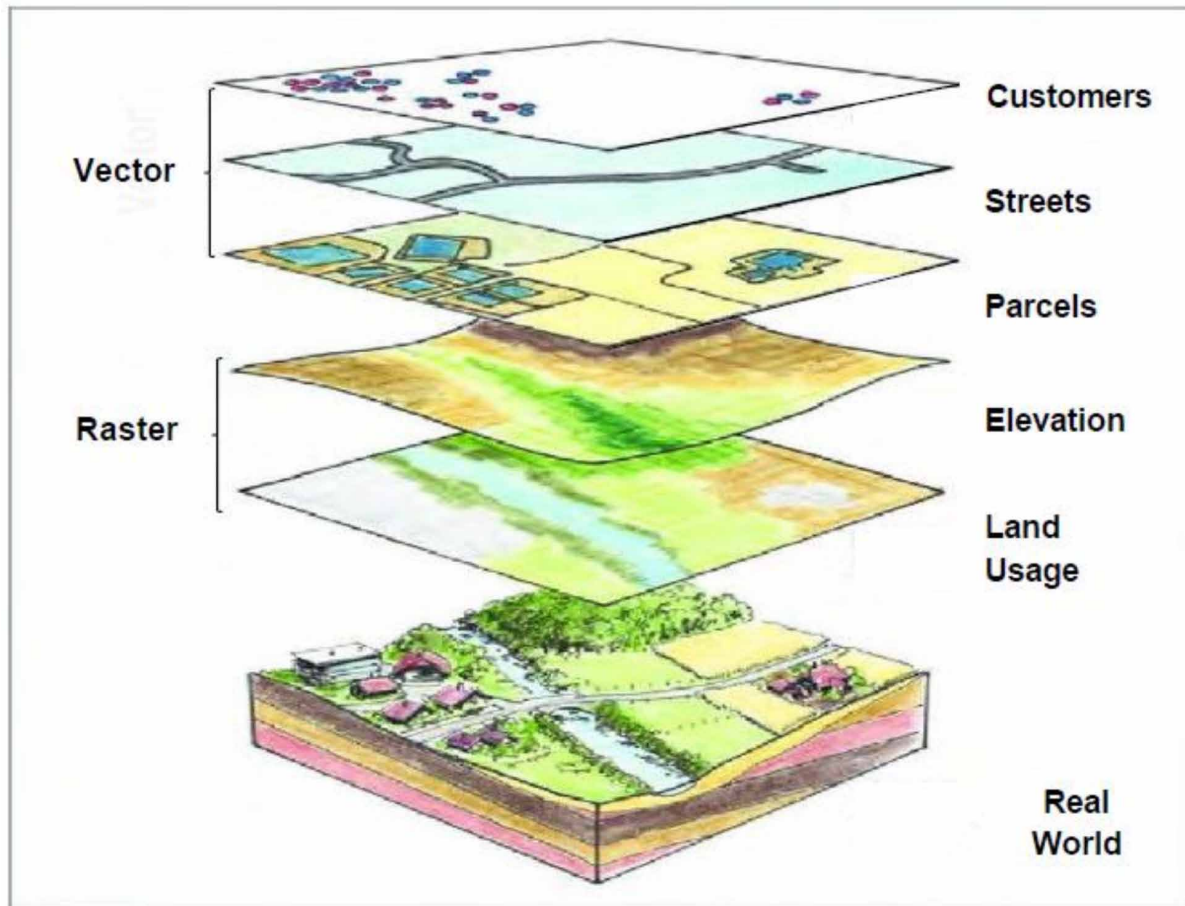
GIS has wide applicability, and GIS tools are applied by different organizations to access and maintain datasets of spatially related information (Venigalla & Casey, 2006). GIS is a computer system that is able to assemble, store, manipulate and display geographically referenced data and information (Gürder & Yılmaz, 2013). The six major basic components that define the architecture of a GIS are hardware, software, data, methods, network and users (Eldrandaly, 2007).

Figure 2. The Components of a geographic information system



Hardware is the equipment used to support many activities of a GIS. It could be a stand-alone architecture (computer and peripherals) with a central workstation or network-based (client/server) architecture, digitizer, Scanners, GIS receivers, plotters, and printers. *Software* is the application programs that provide the functions and tools needed to store, analyse, and display geographic information. *Methods* are the user-oriented and well defined standard procedures or even software routine, built to help users to efficiently use some GIS functions so that humans can turn that information into knowledge. *Data* is normally stored in a database; spatial data can be kept in a geodatabase while attribute data can be kept, for example, in a relational database. *Users* are the people who could formulate the human problem and analyse geographic information and data, and they range from technical specialists who create and manage the system to those who use it. *Network* refers to both the computer, and social network. Both of these networks assist in the distribution of data. As well, these networks allow for the display of information in the form of web applications, web maps, or even analogue maps using our social network. The GIS system architecture which most of the recent applications is based on enables users to create

Figure 3. Displaying multiple stacked GIS layers (Gabathuler et al., 2012)



and overlap several georeferenced maps on a computer screen, integrating different layers (themes) with different information and data (ESRI, 2012). The enormous amount of applications and services that GIS could cover make this technology a valuable tool for decision support (Adigun & Okubote, 2006).

Spatial Data Formats

GIS uses three formats of data which describe the basic ways on how to represent and store data in the computer; raster, vector, and TIN (Triangulated Irregular Networks) (Adigun & Okubote, 2006). *Vector models* represent geographical features in terms of points, lines and polygons. These models normally represent and store discrete data. They majorly represent features such as rivers, roads, buildings and other solid objects. *Raster* consists of a matrix of cells (or pixels) organized into rows and columns (or a grid) where each cell contains a value representing information. Thus, every single cell has an (x, y) coordinate. The referenced data are stored as pixel values, and this makes it easier to maintain and describe spatial data. The values may be representing elevation above sea level, type of land use, temperature, etc. Raster models are used to represent continuous surfaces or areas. *TIN models* use three coordinates (x, y and z) to represent a particular surface by building a network of triangles, and they are particularly helpful to show DEM (Digital Elevation Models).

Main Functions of GIS in Organizational Knowledge Management

The use of GIS in organizational knowledge management commonly takes place in three phases, namely data entry, data analysis and data presentation (Satyanarayana et al., 2017). Gürder and Yılmaz (2013) outline the main functions of GIS in organizations as follows:

- (a) To process enormous amounts of data.
- (b) To convert them into information.
- (c) To relate them with data belonging to different systems, for example, logistics tracking systems, customer information systems, market analysis systems, order tracking systems, etc.
- (d) To develop knowledge for enterprise strategies, tactical steps, marketing activities, logistics support and sales support.

The major characteristics defining a GIS are its functions for spatial analysis (Satyanarayana et al., 2017). The major objective of spatial data analysis is to transform and combine data from different sources into valuable information. The major spatial analysis functions that are possibly useful for organizational knowledge management are:

- (a) Retrieval functions for selective search and manipulation of data.
- (b) Measurement functions allow measuring distances, lengths or areas.
- (c) Overlay functions allow users to create and overlap several georeferenced maps (with different information and data) on a computer screen, so as to apply the set-theoretic operations of intersection, union, difference, and complement using sets of positions (geometric attribute values) as their arguments.
- (e) Search functions for the retrieval of features falling within a search window (which may be a rectangle, circle, or polygon).
- (f) Proximity (buffer zone generation) functions define an area within a specified distance around a feature (polygons, lines, points, or nodes).
- (g) Connectivity functions accumulate values as they traverse over a feature (s).
- (h) Network analysis is used to compute the shortest path (in terms of distance or travel time) between two points in a network (routing). Alternatively, it finds all points that can be reached within a given distance or duration from a centre (allocation).

Application of GIS in Organizational Knowledge Management

Linking location to information is a process that applies to many aspects of decision making, and for any organization trying to evaluate information, the most intuitive way to view it is on a map, made possible by GIS technology (ESRI, 2012). This is because maps and spatial analysis can reveal patterns, point out problems, and show connections that may not be apparent in tables or text (ESRI, 2012). GIS is a powerful decision support systems that help users in solving complex planning and management issues related to spatially referenced applications (Adigun & Okubote, 2006). A wide range of firms uses GIS for many applications such as selecting a site for a facility, targeting a market segment, and planning a distribution network (Adigun & Okubote, 2006). A truck driver, for example, needs a route of how to most efficiently visit each client. Banking and financial services is now a very competitive business, therefore, financial institutions are applying GIS to help them better understand their data (ESRI, 2012).

Location information is a basic factor in every insurance transaction, and thus insurance companies apply GIS to help build insurance pricing models (ESRI, 2012). GIS has the potential of helping real estate professionals in all segments of their business, from map-based content management to sophisticated investment analysis (Yiorkas & Dimopoulos, 2017). As far as retail services are concerned, using GIS to help to understand what is special about individual locations offers the mechanisms to improve retail operations (Trubint et al., 2006). Libraries, museums, schools, and universities are increasingly using GIS for knowledge management endeavours (Blišťan et al., 2015). Health and human services organizations apply GIS technology to leverage scarce resources and multiply the positive impact of benefits to individuals, families, and society (ESRI, 2012). Natural resource managers rely on the analytical power of GIS to help make critical decisions as they manage the earth's resources (Bussink, 2003). GIS offers public safety personnel the power to maintain and analyse large amounts of location-based information, including files from legacy systems, to visualize spatial interconnectedness and show trends critical to public safety response and planning (ESRI, 2012). Transportation professionals the world over have discovered and embraced GIS as an important tool in managing, planning, evaluating, and maintaining transportation systems (Gupta et al., 2003). GIS in utility and communication companies is a common platform to acquire business data, manage assets, update network information, integrate work orders, acquire customer information, and create reports (ESRI, 2012). Whether it is a non-profit organization, a for-profit corporation, or government, GIS has a special role to play.

GIS Issues and Strategies in Organizational Knowledge Management

The issues of knowledge management associated with the introduction and implementation of technology in an enterprise are often more critical to success than the technological issues (Somers, 1998). For some organizations, GIS may characterize a data and operational framework that affects and ties together most activities of the organization (Somers, 1998). In other organizations, GIS may comprise only of a simple tool applied to perform a particular task (Somers, 1998). The types of GIS implementations differ widely, consisting of diverse technology levels, numbers of users, and has an adverse effect on operational tasks and organizations themselves (Somers, 1998). An organization may employ different operational GIS models at different times which are suitable at different stages of the GIS life cycle (Adigun & Okubote, 2006). A GIS management approach in any organization comprises of proper integration of a GIS organizational model and distinct GIS management strategies (Croswell, 1991). Therefore, the role of GIS and the resultant GIS organization model must then be matched with appropriate GIS management strategies (Adigun & Okubote, 2006).

Application of GIS in the Knowledge Management Processes

Application of GIS in knowledge management can be effected through the knowledge management processes (Gürder & Yılmaz, 2013). Thus, the suitability of GIS in the knowledge management processes is evaluated on the basis of the model the building blocks of knowledge management by Probst et al. (1998). The model consists of six main building blocks of knowledge management, namely generation, acquisition, creation, sharing, application, and retention of knowledge. They form the inner part of the model. The outer part, knowledge goals and knowledge measurement blocks make the model into a management loop. Therefore, the application of GIS in knowledge management is discussed in relation to the six building blocks of knowledge management.

Knowledge Generation

An audit of internal and external organizational knowledge assets precedes any investment endeavours on knowledge management (Gürder & Yılmaz, 2013). Knowledge audit not only assesses what knowledge assets are possessed by a specific organization, but also who produces and use it, how frequent is the knowledge used, and where is the knowledge stored (Lauer & Tanniru, 2001). Thus, organizations should first know their existing internal and external capabilities. In order to do this, GIS offers important contributions (Gürder & Yılmaz, 2013). This contribution can be better understood by the following example: A factory making toys for kids want to design a new product to boost sales. At this instance, very critical questions will crop up, questions concerning the addresses of the targeted customers, their salary range, age, and so on. These questions can satisfactorily be answered after visualizing a map of the data stored in spatial databases of the organization, by use of GIS. By just clicking the right field on the map, one will be able to see the existing information on all customers in that field; information like fields a customer does not exist, the spatial distribution of customers within a particular range of income, and distribution of young families.

Knowledge Acquisition

Presently, technology is advancing very fast, and it can be applied in data acquisition (Cascio & Montealegre, 2016). Social networks and modern information technology systems facilitate communication and exchange of views on different issues among customers, suppliers, and employees (Gürder & Yılmaz, 2013). Thus, the communication process in an organization can be quite effective and efficient if organizations design platforms for corporate GIS. This will enable the organization to gather information on location-related concerns. Therefore, the organization can have a clear view of the unidentified and/or urgent issues, and customer expectations and requirements (Gürder and Yılmaz, 2013). The principle lying behind this concept is the idea that the customers, suppliers, and employees have valuable local information.

Knowledge Creation

GIS is a decision support system, and it enables organizations to transform and integrate spatial data and non-spatial data, to analyze them, and to display the analysis results through maps (Adigun & Okubote, 2006). Considering the example above of a factory producing toys for kids, its aim is to maximize revenue and profit. In its endeavour to target this objective, it aims to make toys for young, highly educated middle-income families. GIS technology will enable the factory to identify places where young, highly educated middle-income families are located. At this point, the enterprise will be knowledgeable about the market where the toys would fetch optimum sales. The map created by the analysis of target regional market comprises knowledge development (Gürder & Yılmaz, 2013). GIS technology is not only for the marketing department, but also for the logistics department through route planning, and for finance department through risk analysis, among other departments within an organization. The chances of developing new knowledge are very high, and especially when GIS is applied in the various departments within an organization (ESRI, 2012).

Knowledge Sharing

Nowadays, social networks and modern information technology systems are very reliable distribution tools (Cascio & Montealegre, 2016). People are no longer interested in reading long messages. They prefer short and straightforward messages. In this kind of communication environment, cartographic images are mostly preferred the same knowledge. Thematic maps as compared to voluminous statistical data allow people to comprehend the issue at a glance. Knowledge and maps created by GIS and archived data can be shared through social networks (Cascio & Montealegre, 2016). It is very possible using GIS to share knowledge assets with internal and external customers who are in need of them (Gürder & Yılmaz, 2013).

Knowledge Application

Geocoding is the process through which spatial data available in GIS are linked with each other through spatial references (Gürder & Yılmaz, 2013). When using GIS-functions, new knowledge can be developed from geographically coded spatial data, since it is very probable to generate new queries, analyses and evaluations by incorporating them again as information into the GIS (Gürder & Yılmaz, 2013). Thus, GIS is able to reuse the “intermediate knowledge” which it develops. Therefore, GIS technology can develop new information and knowledge in the process of its applicability. When GIS is at work, it assists in mashing up outwardly unrelated information, show hidden patterns, mine voluminous datasets, and repetitively applies models (Gürder & Yılmaz, 2013).

Knowledge Retention

Separate knowledge-related activities in organizations are done by different employees in associated departments. More than often, customer representatives are the first point of contact with customers. Also, other employees may come into contact with customers when working in after-sales services. In organizations where the circulation of personnel is high, or where the hierarchical structure is complex, all or part of the knowledge assets might easily be lost (Gürder & Yılmaz, 2013). As well, in the event that some employees resigned, then a considerable amount of valuable knowledge might disappear. This translates into a managerial crisis. A major advantage of the application of GIS technology in an organization is that knowledge assets can be retained and hence they can be inherited from one generation to another (Gürder & Yılmaz, 2013).

ESTABLISHING A GIS MODEL FOR KNOWLEDGE MANAGEMENT IN AN ORGANIZATION

GIS Organizational Models

The starting point in devising a GIS management strategy for an organization is the development of an appropriate organizational model, which establishes the basic character of GIS operations. According to Somer (1998), the appropriate GIS organizational model for any organization is based on its intended role. Other factors include:

- (a) The scope and extent of GIS operations; considering the number of users, applications, and GIS databases and their distribution in the organization.
- (b) The degree of GIS applicability.
- (c) How frequent GIS is used in the organization.
- (d) The complexity of GIS tools; which defines the size of the GIS resources attached to each organizational unit and the entire organization and also determines the sophistication of the operation and the skills and time needed to run GIS.
- (e) The operational structure of the organization; it determines the cost of coordination.

The GIS Implementation Process

GIS implementation involves designing, acquiring, installing, and operationalizing the essential components of data, software, hardware, methods, network, and people to attain GIS needs of an organization (Somers, 1998; Adigun & Okubote, 2006). The traditional process of GIS implementation comprises of a sequence of phases. The first step, project planning, encompasses instituting the scope of the GIS, creating the development team, obtaining the much-needed background information, and developing a preliminary implementation plan (Somers, 1998). The next step, requirements analysis, includes defining the functional and data requirements for the GIS applications and users and evaluating resources, opportunities, and challenges in the organizational and institutional setup (Somers, 1998). The design step necessitates creating a conceptual design for the system, database, applications, and organizational components and approving the design with respect to the requirements analysis results (Adigun & Okubote, 2006). The system acquisition and development phase involves developing software, hardware, and data specifications for system selection and acquisition and data acquisition or (Somers, 1998). Implementation entails installing software, hardware, and databases; developing applications; and carrying out the organizational development needed to support and apply the GIS (Somers, 1998). Finally, the operations and maintenance phase entails integrating GIS into the operating environment of the organization, supporting users, and managing the ongoing process of data and system maintenance (Adigun & Okubote, 2006). Although GIS development steps are generally carried out in sequence, many activities can be done concurrently (Somers, 1998). Other approaches that quicken the process of GIS implementation have many benefits. Provision of immediate products and applications to meet users' current demands, spreading out the expenditure schedule, applying particular expenditures directly to particular benefits, maximizing system utility, and sustaining user and management support are some of the benefits of faster GIS implementation initiative (Somers, 1998; Adigun & Okubote, 2006). Therefore, a variety of alternative approaches to GIS implementation are controlled by cost-benefit issues. What actually drives GIS in the first place is the cost reduction and cost-benefit rationale. GIS technology significantly lowers the time and costs put in certain activities, and data costs can be reduced by minimizing data duplication of data collection, maintenance, and output.

Numerous potential challenges are encountered in the process of deviating away from the standard development process. In their endeavour to implement GIS, the major concern for organizations is to identify which shortcuts are good enough to be taken; what data can be purchased rather than collected, which software can be purchased rather than developed, and which product and service vendors are qualified (Adigun & Okubote, 2006). With a good grasp on the long-term scope, design, and organizational integration of its GIS, organization's many short-term steps can be implemented. In most cases, low-initial-cost alternatives tend to erode the rationale and discipline behind the multipurpose methodology of GIS implementation (Somers, 1998). For alternative approaches to GIS development to succeed,

they must be based on solid planning, analyses, and design. Thus, the implementation approach must be carefully done, so that initial, opportunistic steps contribute to the final design. Flexibility is another key factor in GIS implementation management success since GIS implementation process normally takes a long time. The manager in charge of GIS implementation must be in a position to adjust to constraints and problems that arise and make use of new opportunities (Somers, 1998). Another critical, yet often neglected, factor in GIS implementation is the handling of the transitions between the phases of the development process (Somers, 1998). This can be more challenging and more critical to success than the steps of implementation themselves. Many GIS project managers are able to plan the technical tasks and transitions, but the organizational aspects are often ignored. A technical tool delivered to an organization that has not been adequately equipped can make a technically sound GIS to flop.

SOLUTIONS AND RECOMMENDATIONS

If only businesses build GIS, then they can ease their KM and organizational learning processes, and perform more effective activities both on an individual and collective level. According to Davenport (1998), before any agency can embark on knowledge management activities using GIS, the following should be in place:

- (a) A decision to invest in knowledge management must be taken.
- (b) Knowledge management activities must lead to growth and profitability.
- (c) There is a need for hybrid knowledge management environments due to the technological and human nature of resources.
- (d) There must be high-ranking knowledge champions, people who are familiar with the organization's politics.
- (e) There must be a high-ranking officer knowledgeable in the management function.
- (f) Only knowledge that is of strategic value must be mapped.
- (g) A working knowledge dictionary must be put in place, and it should have the capacity to link technical terms to terms used by knowledge requesters.
- (h) People should be motivated to share knowledge.
- (i) Knowledge work processes should be constantly improved.
- (j) All employees must get involved in knowledge sharing exercises.
- (k) The focus of knowledge management should be on quality, not quantity.
- (l) There should be a knowledge contract between the company and the employees.

Thus, by institutionalizing these issues, organizations will have created an organizational environment favourable for developing knowledge.

FUTURE RESEARCH DIRECTIONS

GIS applications in organizational management are advancing and it is expected that with more research, the GIS architecture will most likely be radically transformed as time progresses. A huge amount of knowledge may result in an unmanageable corpus of data. This could be challenging to the end user due to the technical problems of inserting and retrieving information from a geographical system. Thus, more

research should focus on the development of user-friendly interfaces and applications to close the gap between users and technology. Other problems that deter the integration of GIS into an organization's operation and require more attention include but not limited to lack of basic GIS knowledge, issues of data exchange and interoperability, low access to relevant data in digital format, high data costs and lack of standards, shared concepts and standardized data structures. Steps are required on a cultural as well as on a technical level to achieve seamless integration of GIS technology into the day-to-day habit. Understanding GIS, implementation principles, alternatives, needs of an organization, and how to incorporate these components together, remains the major knowledge management challenge.

CONCLUSION

Without a doubt, knowledge has become a key resource for organizations, as well as individuals. Thus, in order to increase individual and organizational performance, knowledge must be exploited by the use of technological means, and this must be supported with learning techniques to promote its distribution. GIS technology incorporates common database operations, for example, query and statistical analysis which go together with the unique visualization and geographic analysis advantages provided by maps. As well as GIS enables the modelling of spatial networks and offers various tools for the analysis of such networks. The integrated ability of GIS to execute spatial analysis can be thought of as similar to the decision capabilities of decision support systems. Therefore, this characteristic of GIS can contribute significantly to supporting basic organizational tasks.

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KEY TERMS AND DEFINITIONS

Database: A structured set of data stored in a computer, managed and maintained for the purpose of easy access to the desired information.

Decision Making: The process of choosing a reasonable alternative from the available options.

Decision Support System (DSS): A computer system that, collects, organizes, and analyzes data so as to promote quality decision-making within an organization.

Digital Elevation Model (DEM): A three-dimensional computer graphics representation of continuous elevation values over a terrain's surface.

Geocoding: The positioning of addresses or spatial objects on the map.

Geographic Information System (GIS): A computer system used in capturing, storing, manipulating, analyzing, managing, and visualizing geographical data.

Organization: A social unit of people that is structured and managed to achieve a particular need or to pursue collective goals.

Triangular Irregular Networks (TIN): They are a digital means to show surface morphology, and are constructed by triangulating a set of vertices.

Data Science for Business Analytics and Business Intelligence

3

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INTRODUCTION

In today's globalized world, companies are no longer competing solely on the basis of the classic production factors such as capital, land and labor. Competitive advantages of an organization are increasingly relying on data or further processed to knowledge (Woodside and Quaddus, 2015). Prominent examples of this shift are the digital players:

- Facebook uses the data to promote advertising campaigns more targeted than any other media company before.
- Amazon collects data from many areas of everyday life such as purchases and products (Amazon Shop), entertainment (Amazon Echo), external services (Amazon WebServices, AWS) and more recently health information (Amazon wants to venture into health services (Isidore, 2018)).

The combination of data results in a variety of application scenarios and new business models (McCallum and Gleason, 2013). They often have the potential to disrupt entire markets (Aluya, 2014). At the same time, many small and specific use cases exist in which companies use innovative methods of data collection and analysis:

- Millions of DNA samples are compared to detect the risk of cancer.
- Virtual agents (e.g., chatbots) can handle the semantics and syntax of input information and develop answers based on documents.

In summary, all of these examples use many digital data sources, process them and open up new information or even knowledge that is digitally available (Williams, 2017). The self-optimizing methods, tools and underlying techniques are typically subsumed under the term "Data Science" (McCallum and Gleason, 2013).

Applications of machine learning with corresponding predictions permeate nearly all areas (examples given with respective companies or institutions) (Siegel, 2013):

- Social (family and personal life): Prediction of future locations from position tracking (Nokia) and prediction of love from online messages (OkCupid).
- Marketing and advertising: Prediction of product choices from past purchases (Tesco) and prediction of cancellations (FedEx).

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- Financial and insurance: Algorithmic trading (London Stock Exchange) and prediction of loan defaults from past data (Citigroup).
- Healthcare: Prediction of clinical trial recruitment (GSK) and prediction of billing errors (Washington state hospitals).
- Fraud detection: Prediction of tax returns (IRS) and prediction of worker's compensation claims (U.S. Postal Service).
- Fault detection for efficiency and safety: Prediction of oil flow rate via neural networks (National Iranian South Oil Company) and prediction of travel time via traffic analysis (New South Wales, Australia).
- Human resources: Prediction of quitting (Hewlett-Packard) and prediction of job performance from fitness data (U.S. Special Forces).
- Public administration and education: Prediction of student performance (IBM) and prediction of student grading to enable automated grading (Hewlett-Packard).
- Psychology: Prediction of dissatisfaction (Citibank) from the use of certain words.

BACKGROUND

As it might already have become apparent from the introduction, a lot of benefits can be created from the application of data science. But this application requires a somewhat new approach which is connected very much to the idea of agile project management (of data science projects). All the examples given so far are assessed in greater depth by Cao via naming relevant success factors, in particular:

- appropriate thinking approach
- adequate assessment of the complexity of the problem
- adequate modeling
- evaluation of model outcomes
- business engagement.

Furthermore, a distinction between general vs. domain-specific algorithms as well as a distinction between vendor-dependent vs. independent solutions is helpful (chapter 9 of Cao, 2018).

FOCUS OF THE ARTICLE

After specific examples and their background have now been mentioned, this chapter explains stepwise and in much detail how nowadays the challenge of harnessing the abundant amount of existing data is addressed effectively. Thereby it adheres to the usual differentiation between business intelligence and business analytics. For business intelligence it describes in particular the generic process of modern data organization that most data science applications follow, whereas for data analytics it places emphasis on showing that there exist a lot of different approaches which can be used.

SOLUTION AND RECOMMENDATION

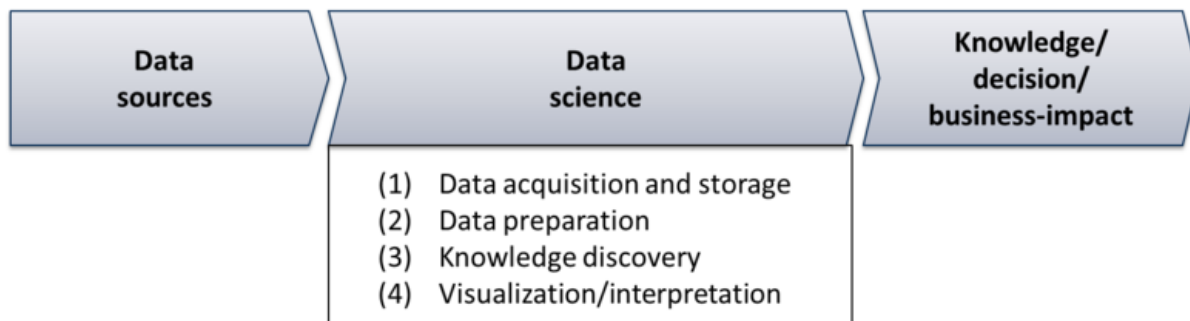
In the following, a very detailed outline is given how currently solutions to the data science challenge are found, thereby also pointing out best practices as recommendations.

DEFINITIONS

Modern work is undergoing a shift from an industrial economy that is primarily focused on commercial products towards a knowledge economy in which competitive power results from knowledge-intensive services and processes (Lederer and Riedl, 2018). Today, data is collected in companies from many peripheral devices (e.g., smartphones, scanners in a warehouse, production robots and transportation vehicles), transactions (e.g., EDI orders, online sales, value networks) as well as general business activities (e.g., trade show visits, web research, online reviews, portals). With the ongoing digitization of business results data is available for more and more decision-making situations.

At the same time, concepts and approaches to solve data-driven business situations are often discussed under unsystematic terms. North and Kumta (2014) have described the basic terminology for data and knowledge (see Figure 1) which is widely recognized today.

*Figure 1 The knowledge ladder
(North and Kumta, 2014)*



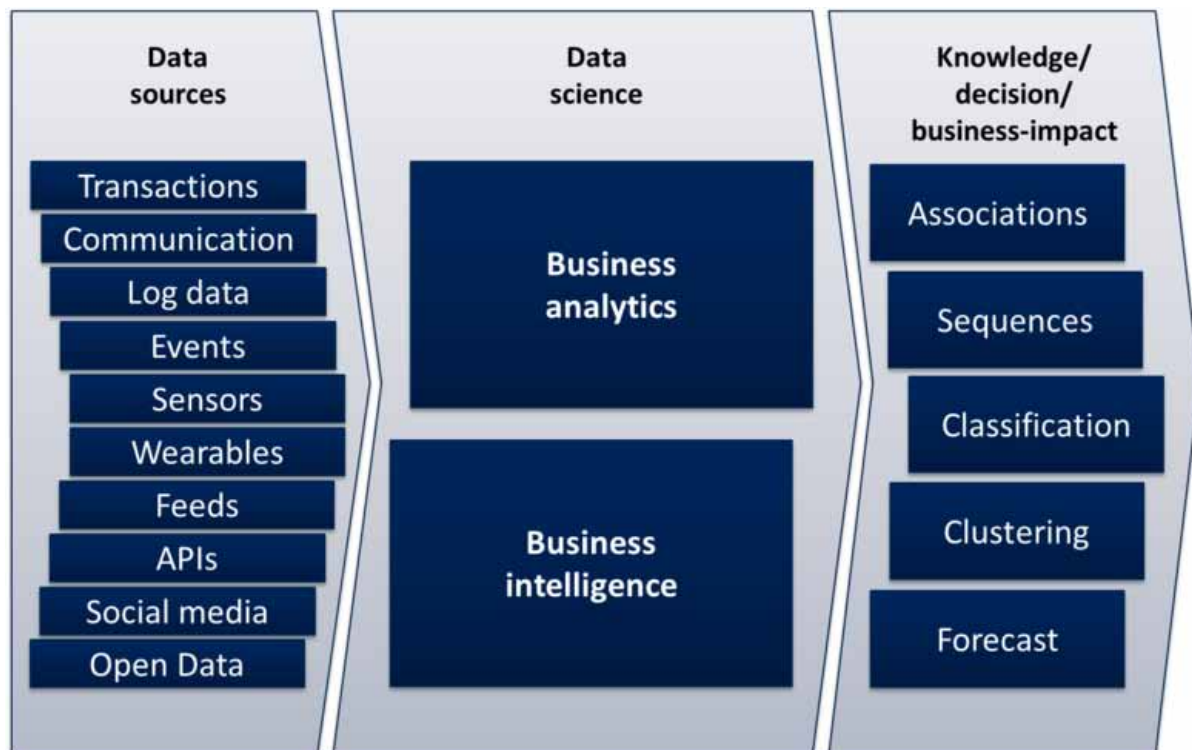
The bits (0 or 1) of a computer system are systematically linked to characters. Through a syntax (e.g., natural language rules or company codes) data (e.g., the words “UX-2002” or “Smith”) is created. If humans or IT systems can interpret the meaning of the data, this creates information (in the example: the number/name of a customer). Knowing the context of the information (for example, Mr. Smith is currently a B customer), knowledge becomes digitally available for analysis. If meaningful actions are taken (e.g., loyalty programs or cross-selling offers for Mr. Smith) a company makes use of its data-driven possibilities. In this case, a company has taken the steps further up in the knowledge staircase - based on a data analysis, it generated knowledge and applied it meaningfully in the corporate context. When it comes to special competencies, which are unique and valuable (e.g., Netflix collects and interprets the selection as well as in-video behavior like breaks of series to generate new entertainment content), a business case can result from data science applications. All of the concrete steps and techniques of data science involve either top-down (starting with the question which unique selling propositions are to be reached) or bottom-up (analyses based on available data) approaches. The evaluation techniques are often

different and, depending on the application in the company, sometimes very special. In general, data science as an increasing interdisciplinary field of extracting knowledge from data is becoming widespread in many industries (Grover and Kar, 2017). Especially in companies that already use digital workflows for process instances (being situated in branches of industry which heavily rely on data), the application of data science techniques leads to process excellence (Fosso Wamba and Mishra, 2017). Well-founded methods, processes and algorithms as well as supporting systems are already being used in many companies to generate knowledge from data. Various concrete techniques such as artificial neural networks and expert systems are discussed in science and practice (Gallant, 1993). In general, such techniques aim to support a company's strategy, its structures and processes so that lessons learned can be used to improve routine tasks (incremental innovation) or they might even lead to completely new business models (radical or disruptive innovations) (Vyas, 2016). By using data together with digital techniques smarter decisions can be codified and shared between employees, teams and even virtual agents. In a nutshell, with digital data science techniques organizations can create new value and innovation through knowledge (Berman, 2018).

The particular relevance of the topic of data science is reflected by the fact that it is not the pure acquisition of information that is at the center of attraction - due to globalization and the associated rapid growth of digital networks, smart business decisions are facilitated by enormous volume, speed and heterogeneity of data (sometimes discussed under the term "big data"). The main task for many companies, which are trying to improve their processes and business models in a data-driven way, is to use internal as well as external knowledge to make better decisions, thereby trying to increase their learning, adaptability and innovation capacity (Stairs and Reynolds, 2017). In some trend studies it

Figure 2. Generic sources and output types of data science approaches

(Laudon and Laudon 2016; Zolnowski and Böhm, 2013; Jänig, 2011; Botha, Kourie and Snyman 2014)



is predicted that knowledge in the form of assessments, expertise, ratings and recommendations will become a primary resource for successful companies within various branches of industry. This is due to an enormous variety of internal as well as external data which needs to be processed in order to derive intelligent business decisions (Soderborg, 2017). At the same time, many branches of industry are under high pressure through new digital business models (e.g. apps, startups, new platform models and decentralized technologies like the block chain). The intelligent application of data science techniques is currently discussed as a primary way to organize the knowledge resource best, hence allowing for a strategic distinction from the competition (Tapscott and Tapscott, 2016).

Typical data science techniques can be broken down into business intelligence and business analytics methods. Before specific concepts are explained in detail, the overall framework should first be defined (see Figure 2).

Due to the digitization of the economy and society, more and more data sources are available. Most companies internally collect data based on their running business (e.g., transactions, requests). This data may be automatically available in a system (e.g., logs in an Enterprise Resource Planning system) or may be explicitly captured (e.g., manual recording of customer communication history in a Customer Relationship Management system). Since sensors have become much cheaper, especially during this decade, companies tend to gather data in physical assets such as production machines and robots as well. Following the same trend, consumers often quantify themselves (for example with sports apps and other wearables). External data from proprietary providers can be accessed via interfaces for many questions and can thus be included in the internal analysis. At the same time, many organizations and institutions provide freely available data (e.g., open data).

To support business decisions, data science applications help with five fundamental outcomes (Laudon and Laudon 2016; Botha, Kourie and Snyman, 2014):

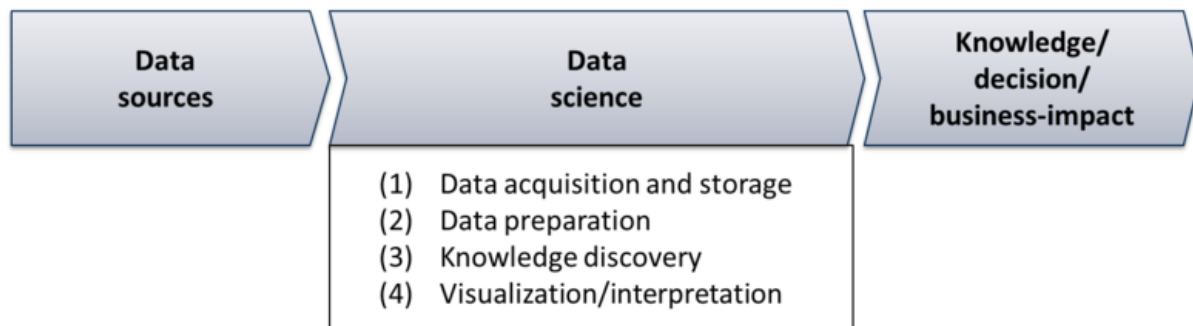
- **Associations** describe the discovery and quantification of dependencies. A classic example of this output is the basket analysis, which calculates the probability of sales of additional products in online stores. Data science applications that support this output often work with a statistical context analysis.
- **Sequences** evaluate regular historical data and show, for example, trends, cycles and other indirect dependencies. For example, based on the transaction history, the sales of weather-dependent products (e.g., ice cream) may be determined. For this, different forms of regression analyses are typically used.
- A **classification** assigns unclassified objects to already known classes. A typical example is the assignment of persons or companies to existing credit rating scales. Modern approaches for this use a variety of novel internal and external data to arrive at a comprehensive assessment of individuals. In many cases, artificial neural networks can be used to arrive at the classifications.
- **Clustering** describes processes for the building of groups due to similarities. For example, cluster analyses can be used to optimize advertisements because responses (e.g., conversion rates) can lead to an identification of previously unclear relationships (e.g., shared values related to an advertisement message).
- **Forecasts** provide calculations of future values from historical variables. For example, various forms of regression analyses are performed on historical data for prediction. Alternatively, artificial neural networks (with respective weights) can be used for the same purpose.

For considering, for example, the actual (financial) value of companies, many structured data points such as sales, number of employees, locations and products should be taken into account. At the same time, semi- or even unstructured data points such as social media reviews, buying recommendations or test portals results could be used. Going one step further, weak signals such as reviews on employer portals or even new categories of hard facts like production efficiency in a smart factory are nowadays often available for information processing (Viney and Phillips 2015; Fahami et al. 2015; Witkowska, 1999). The salient feature: There are innovative ideas for data usage available that bring new use cases with it. Furthermore, rigid systems and simple database queries need to be rethought in favor of flexible data science knowledge management techniques that make sense of linking internal with external data for good knowledge (Lederer and Riedl, 2018).

PROCESS

The typical process that underlies data science can broadly be organized in acquisition (including storage), preparation and usage (including visualization). Each of these parts may comprise several subparts (see Figure 3).

Figure 3. Data science process steps
(Morgan, 2018; De Mello and Ponti, 2018)



The initial step usually covers **data acquisition** and its respective **storage**. As already described, the number of sources that generate data has increased and still grows rapidly nowadays due to the use of computers in technical labs, scientific fieldwork, surveys in market research and sensors in IoT (Internet of Things) applications (e.g., smart factories). Not only does the number of sources increase, but also the quantity of data they generate does so due to enhanced processing capabilities of modern computers. Storage is done via database management systems that use standards such as SQL (Structured Query Language) (Morgan, 2018; De Mello and Ponti, 2018).

Secondly, we address **data preparation**. As we already mentioned, the typical amount of data that is stored is very large, so it is indispensable to further prepare or transform the raw data to facilitate meaningful analyses and usage procedures. This changes the structure (not the content) of the raw data, which is to a large extent determined by its emitting source. A simple example would be the appropriate alignment of survey data in a spreadsheet to directly facilitate a mixed-linear model analysis by means of a statistics software package. If the number of rows of a spreadsheet grows very large (several millions), this constitutes an incentive to use other means for data handling (data mining tools) as usual

spreadsheet tools (e.g., Microsoft Excel) cannot efficiently handle such amounts of data. Typically, the term “big data” is used, when standard software is not sufficient anymore to cover the intended purpose of data handling. Generally, the data preparation can also (case-dependently) include the step of data cleansing which comprises the filtering of reliable data points and non-observance of questionable values (Morgan, 2018; De Mello and Ponti, 2018).

Thirdly, after an appropriate preparation of the data, the next step covers its usage via **knowledge discovery in databases** (typically comprising modeling, simulation, optimization and prediction methods) together with respective visualization. Usually, the data is used as input for certain (mathematical) models which are implemented in suitable software packages. In the step of data usage most recent developments of “artificial intelligence” have added a lot of value. Very general, artificial intelligence can be defined as automated procedures for goal-oriented conclusions. As learning is a natural precondition for humans to solve problems, machine learning is an essential constituent of artificial intelligence. Within machine learning there is the distinction between supervised and unsupervised learning which differentiates whether training data is provided by human experts or not. Taking this analogy further, it may not be surprising that artificial intelligence is closely modeled with respect to biological standards as artificial neural networks (ANNs) which imitate biological neural nets. Such approaches have been developed since the mid of the twentieth century with “deep learning” via convolutional ANNs constituting the most advanced techniques today. Typically, input data is sent through several layers to “train” the ANN. With help of this training, which results in certain “weights” or, more colloquially, educated guesses, several conclusions can be derived. This approach displays the strength of an automated analysis: not only can large amounts of data be acquired, stored and transformed without human effort, but also sophisticated analyses can be performed after initial setup by humans which then ultimately lead to recommendations and insights that are handed over to humans again. Performing this procedure without the tools for big data analysis would take an enormous and impracticable amount of time (Ross, 2016; Morgan, 2018; De Mello and Ponti, 2018).

As already mentioned, **visualization** is also a major subpart of data usage which covers the creation of charts, plots and other visuals that make the “pure data” more understandable. Everything that can be discovered via such graphical methods can in principle be discovered by algorithms, however sometimes it is desired to provide a better understanding to the end user. This in particular involves a meaningful aggregation or clustering of the data. A simple example would again be a cluster analysis for large amounts of data (Morgan, 2018; De Mello and Ponti, 2018).

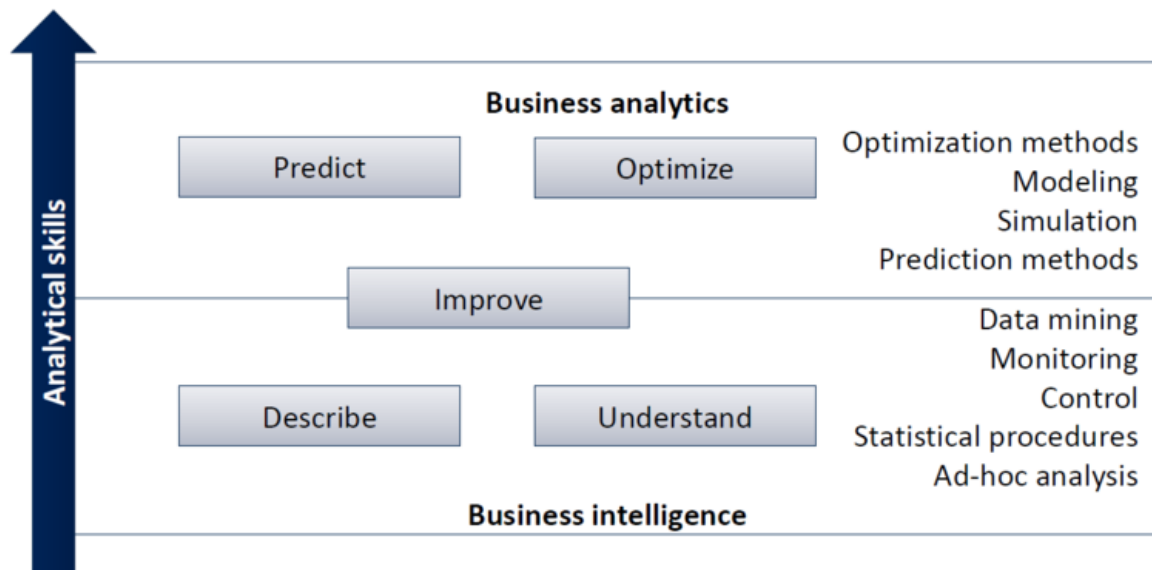
CONCEPTS

After describing the environment of data science with possible data sources, generic processes and typical outputs, the exact techniques will now be described. Figure 4 gives an overview of different concepts of data science that are known in the corporate context. As shown, business analytics require more resources and more complex procedures than business intelligence. The possible effects in the form of findings and their analytical validity also differ.

Business Intelligence

Business intelligence brings together such methods that are generally concerned with the collection and interpretation of data in electronic systems. It includes a set of different theories, methods and technolo-

Figure 4. Data science concepts
(Laudon and Laudon, 2016)



gies which transform raw data of different sources into information or knowledge relevant for business decisions. Compared to business analytics methods (see next section), they are more likely to have simple initial data and, in some cases, trivial processing logics (Gossmann and Rinderle-Ma, 2016).

For example, if a company uses a management information system (MIS) that collects data such as sales, transactions and costs, middle managers typically call **ad-hoc or standard queries**. These queries usually correlate (via **statistical procedures**) existing numbers (or numbers that can be calculated from available numbers by using simple operators) and show key performance indicators (e.g., revenue per country or revenue per unit of sales). Intelligence at this level is still predominantly human-based. Data analysts, for example, only develop standard queries to guide operational business. However, many skills are needed for customizing the supporting standard software in order to obtain efficient visualizations (Klein and Gräf, 2017). **Control** and **monitoring** are predominantly used to investigate and observe business processes (recurring instances of the same control flow model) or projects (one-time instances). According to set targets, indicators are measured and constantly monitored. Supporting systems offer these functions in a push or pull approach. Applications of business intelligence mostly make use of the efforts of many companies for general integration. According to Mertens (2015), in addition to data integration (for example, standardization of data formats or central storage of previously fragmented databases) multiple other forms of integration are useful (e.g. integration of functions, methods and processes). Monitoring and control can take place along the value generation of the enterprise if data has been integrated horizontally (e.g., in an Supply Chain Management system). Equally interesting and widely used in the company environment are analyses of vertical integration in which data from the operational level (e.g., business transactions) are, via the middle management (e.g., return from different countries), given to top management (e.g., EBIT calculation) (Haertzen, 2012). **Data mining** is on the threshold of business analytics because, unlike traditional analyses, much of the analysis expertise is transferred to the IT system. Rather than considering top-down issues (e.g., KPIs indicating that the strategic goals of the projects or processes are being achieved), data mining works bottom-up. This means

that it is not the manager or the data analyst who dictates the dimensions or criteria of the analysis (e.g., focus on time, cost or quality), but a system searches for patterns in existing data to achieve business impact and recommends dimensions to consider. As in the methods of business analytics, questions are no longer completely defined by the human user (“Which customers generate the most revenue?”), but the system takes over the direction of the business question (“Which customers should be targeted via a new advertising campaign?”).

Business Analytics

Business analytics, as can already be inferred by its name, considers the use of analytical procedures and methods to generate a value-add for business. It is also often referred to as “Operations Research” and hints at the fact that the methods applied here can also be used in a more broad sense for any type of “operational task”, for example logistics optimization. Business analytics has four major components which are modeling, simulation, optimization and prediction methods.

Appropriate **modeling** is a necessary precondition for simulation, optimization as well as prediction. Summarized in one sentence: a model is an abstract representation of a real-world object or phenomenon in all relevant aspects. Generally, one starts with real-world problems or challenges and tries to make progress on them or solve them via the use of data science. Usually, these real-world problems exhibit many characteristics that may not be relevant for the issue under consideration. That is why a model is built via abstraction: abstraction attempts to reduce things such that only the essential features remain. Hence, models are somehow simplified representations of real-world cases that are better suited for analytical problem solving. Sometimes, several features of a real-world object can be subsumed under a certain aspect for abstraction, but this is highly dependent on the specific situation. It may be that a specific model, although it has already been simplified, is still too complex to handle or solve analytically. Then an even more simplified version is needed. But as one might expect, the more simplified a model is (so-called “toy models”), the more limited are the conclusions that can be drawn from it. Nonetheless, these simple models often help to illuminate important aspects of interest. As models are typically used for computations or simulations, they are formalized via mathematical equations. To give an example: to handle certain problems via “linear programming”, all characterizing features of the model have to be expressed via linear equations. Models typically use the framework of statistics (modeling uncertainty and risk via random variables). There are several types of models which range from blueprints for buildings in architecture to equations for aerodynamic flows in physics. Even business plans can somehow be regarded as models (they take only the numbers into account and do not concentrate on emotional factors like brand, reputation etc.). But the common characteristic of all models that are used for simulation, optimization and prediction methods in physics or business is that they can be meaningfully reduced to certain logical relations. Models are typically labelled by their intended purpose: descriptive models analyze only existing data, predictive models try to predict future quantities and prescriptive models derive insights about certain options for action. Ideally, a good model can be used for all three purposes. Specific simulations using these models lend themselves to optimization and prediction purposes, that is why specific optimization and prediction techniques are usually used synonymously with the respective models (Ragsdale, 2014; Cottle and Mukund, 2017).

Models are then used in **simulations** to allow an investigation of how the real-world object would react or develop under certain conditions (in particular future development).

A typical example of a simulation would be a stress test where a model for the financial stability of a bank is subjected to certain testing conditions like the bursting of a bubble in the stock market. Simula-

tions have several advantages that make them attractive versus real-world experiments. They allow for the cheap testing of new strategies and approaches as costs occur only for computer usage but not for the use of real-world assets. Additionally, simulations are typically completed before some kind of real-world experiment can be fully finished. Therefore, they are helpful to early indicate risks or obstacles that might occur (take again the example of the stress test). The insights that are generated can be used to make more smart decisions and initiate counter-measures if necessary (simulations are often used in risk management). Sometimes simulations also give hints in what aspects a model should be simplified or enhanced. Optimization and prediction methods can be regarded as special instances of a simulation (Ragsdale, 2014; Knopf and Teall, 2015)

In the modeling step, goals are typically formalized via mathematical functions that are to be **optimized**. Optimization describes the process of finding the optimal solution for a certain problem that is characterized by a specific model and a corresponding objective. This means for example maximization of a revenue function or minimization of a cost function. The basic problem underlying optimization topics is rooted in the issue that for decision problems there is usually an exponentially large number of possible solutions (“exponential explosion”) so that raw computation is not a viable solution procedure. Therefore, smart approaches are required to perform an efficient optimization. Very broadly, there is a distinction between linear and non-linear optimization. The former, which can handle any type of problem that can be characterized via (mathematical) linear equations, has achieved widespread fame and is known as “linear programming”. The solution is found via the “simplex algorithm” which exploits geometrical properties of the high-dimensional solution space. An example would be the optimization of logistics (minimizing costs and time) by choosing the shortest subroutes and cleverly distributing the goods that are to be transported. Non-linear optimization, however, addresses all problems that cannot be described analytically via linear equations.

All optimization problems typically involve several constraints that are derived from the real-world cases. But even via sophisticated algorithms and procedures it cannot always be guaranteed that really the best solution is found, that is why “heuristics” are used which somehow represent smart guesses or intuitions. These heuristics also give no guarantee for the best solution, however they often yield better results than the standard algorithms. An example would be the application of statistical techniques to estimate which subparts of the big data set can be disregarded in the analysis. Non-linear optimization techniques together with heuristics constitute an important part of artificial intelligence routines (Ragsdale, 2014; Cottle and Mukund, 2017).

Predictive methods surely constitute the most interesting application of business analytics that can be used in various contexts. Formally, the predictive methods (each based on a specific model) are used to estimate how values of a certain quantity that occur in the future (for example demand for a certain product) differ from the values of the quantity that have been observed in the past (historical data). Prediction methods can be regarded as special cases of optimization methods as predictions are often made via insights that optimally explain past data. As one might expect, the conclusion of a prediction depends on the choice of the predictive method. This choice depends on the particular situation, for example exponential smoothing for short-term forecasts vs. linear regression for long-term forecasts. All methods are characterized by certain parameters that are adjusted via the collected data. Once the parameters have been fixed, the method can be used for specific predictions, for example the development of the Dow Jones. As the predictions will typically not be perfect, the new (differing) data is used for further adjustment of the parameters. This touches the topic of “in-sample risk” vs. “out-of-sample risk”. Reducing the in-sample risk means calibrating the parameters such that historical data is explained as good as possible. But strictly reducing the in-sample risk sometimes leaves more room

for the out-of-sample risk. This is for example the case for the optimal Markowitz portfolio in portfolio theory (which can be viewed as a prediction method for the development of stock prices): here a strict analysis of historical data leads to a concentration on very few assets, but broader distributions have proven to be more robust for future predictions (Meucci, 2009). Typical methods for prediction cover (there are various segmentations to be found in the literature as the topics presented below are intertwined and cannot be delimited clearly): “Exponential smoothing” with a varying number of parameters. The intuition is to “somehow” learn from errors of past predictions (by means of minimizing an error measure like the mean squared deviation). The idea behind “regression techniques” is to suitably fit a smooth relation (sometimes even linear) between the data points for explanation. Regression techniques are typically classified by the number of independent (explaining) variables and dependent (predicted) variables. If more than one independent variable is involved, one talks about “multivariate” regression. If more than one dependent variable is involved, one talks about “multilevel” regression. “Mixed-linear models” (sometimes also called “panel data models”) are a variant of multivariate regression where one independent variable measures time or differences of individuals in a group. Mixed-linear models are typically applied to socio-economic problems.

If instead of a linear relation a more sophisticated relation is used for regression, one talks about “non-linear” regression as then more complicated functions (for example polynomials of higher degree) are used. Furthermore, sometimes special functions are used for handling special types of variables: when it comes to the prediction of binary variables, a widely known example is the “logit regression” (using the logistic function in its model). “Time series” or “stochastic processes” constitute still another class of prediction techniques. Sometimes regression methods are also classified as time series, however we distinguish them as time series are formed by the intuition to explicitly model a following time step by consideration of selected features of its predecessor. The chosen features determine the class of the time series model. The listing below gives an overview of the most important models. Generally, they can be subdivided in discrete and continuous time series (or stochastic processes). Discrete processes consider clearly distinguished time steps, whereas continuous processes try to model processes “without gaps”.

Firstly, we consider discrete processes. When values of previous time steps are considered as input, one labels the process as “auto-regressive” (it can be chosen by parameters how many steps backwards are taken for the input). The opposite would be a “Markov process”: only the (current) starting point is relevant, but not time steps that are located further in the past. Due to their simplicity, Markov processes are widely used. The consideration of the moving average of previous error terms (error between past predictions and observations) is labeled “moving average” prediction. The order of integration characterizes “how far away” a process is from a stationary (“flat”) process. Dependent on the features that are used, one talks about AR, ARMA, or ARIMA processes (AR = auto-regressive, I = Integrated, MA = moving average). Such customized models are then used in the Box-Jenkins approach for prediction. The use of further independent variables to complement an ARIMA process leads to an ARIMAX process.

Secondly, we consider continuous processes which are sometimes also called “diffusion processes” as they originate from attempts to model physical diffusion processes of air molecules. These processes are now used in many different areas, especially in finance (for example calculation of prices for financial options via the Black-Scholes model which resembles a “geometric Brownian motion”). Diffusion processes are also used for heuristics like “simulated annealing” (Hox, 2010; Ragsdale, 2014; Pavliotis 2014; Knopf and Teall, 2015; Shumway and Stoffer, 2017; Morgan 2018).

Machine learning techniques (where learnings are directly applied to make predictions) are usually a combination of the aforementioned optimization and prediction methods. But they also use several new techniques like “decision trees”, “support vector machines” and “multi-layer perceptrons” with convo-

lutional artificial neural networks for deep learning being the latest state-of-the-art method (Ragsdale, 2014; Cao, 2018; Morgan 2018;).

FUTURE RESEARCH DIRECTION

The relatively new discipline of data science is just about to emerge in full force. However, even now several developments are already apparent on the horizon. They are very much the subject of ongoing research and expected to show themselves in the following areas which are supposed to be highly impacted by data science:

- breakthroughs in many fields where there is otherwise stagnating progress (for example in certain science and technology topics)
- disruption of current mechanisms and procedures (business and elsewhere)
- transformation of long practiced approaches (business and elsewhere)
- improvement of innovations.

Hence, data science is supposed to act as an accelerator in many fields. The most effective way of its application is still being searched for (Cao, 2018).

CONCLUSION

As mentioned, data is a somewhat new type of resource that, like every other resource, can be exploited to a varying degree. Great benefits can be created by the application of existing business intelligence / business analytics routines and advanced methods are currently being developed which promise an even more efficient use of data in particular concerning predictive power. The important precondition of having enough data for intelligence and analytics procedures (especially training data for machine learning procedures) is nowadays guaranteed automatically as more and more data is being generated and stored routinely. Surely, some methods are at the moment more successful than others, but one can expect a consequent rise in added value for the application areas mentioned here.

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KEY TERMS AND DEFINITIONS

Business Intelligence: Business intelligence includes a set of different theories, methods and technologies which transform raw data of different sources into information or knowledge relevant for business decisions.

Modeling: Modeling is the case-dependent reduction (abstraction) of a real-world problem to its relevant aspects.

Optimization: Optimization describes the process of finding the optimal solution for a certain problem that is characterized by a specific model and a corresponding objective (for example maximization of a quadratic revenue function).

Prediction: Prediction covers the use of historical data and a corresponding model to make conjectures about the future occurrence of a certain event.

Simulation: Simulation describes the (computational) use of a model for testing of its behavior under certain conditions (in particular future development).

Big Data, Data Management, and Business Intelligence

3

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INTRODUCTION

Big data is one of the most commonly written about topics in today's press. In fact, today it has become a ubiquitous term. It is continuously transforming business, finance, healthcare, medicine, engineering, science, and society itself. Routinely we are provided with new information telling us much more data there is, how much more is now able to be captured, how many new sources it comes from, new ways to process it, and how it can be used in new and novel for decision making. It is a topic that is regularly discussed in boardrooms, business publications, and the mainstream media, because big data provides new insights into everything. Big data encompasses traditional sources of structured transaction data that is now supplemented by mass quantities of unstructured data. This data is processed by new, inexpensive, and faster hardware that is then scrutinized by new and more advanced analytics that provide organizations with more in-depth insight into their operational environment than ever before. And now, role of decision maker is increasingly being assumed by smart machines.

The goal of business intelligence [BI] is to extract value from data to better inform decision making. BI combines text, video, voice, location data, social media, and any other new source of data with traditional data sets in order to learn about, interact with, and predict what is happening so that the organization can respond as fast as possible to whatever it perceives is the opportunity that the data reveals. BI deals with imperfect data that is oftentimes ambiguous, but which is available on a vast scale. As a result, Mayer-Shonberger and Cukier (2014) assert that the effect is that the extraction of value from big data is analogous to a treasure hunt. That is, organizations are scrutinizing big data to learn what is happening, without necessarily needing to understand why. They argue that in a big data world, correlations supersede causality, because the data is simply used to discover patterns and correlations in the data that offer novel and invaluable insights. The more data you have the better the insights. The underlying premise for BI then becomes this: the more data an organization can capture, the better the data-driven probability of understanding what is happening, and the faster you can respond to this insight. This means then that actions taken in BI are often based on an organizational confidence level in the analytic assessment of what the data suggests without the necessity of a clear understanding of the root cause.

Big data would appear to many to be more about systems, and less about people. Certainly, people are important because they are themselves a major source of big data fodder and it is oftentimes people's behavior that big data is trying to affect. Nevertheless, big data also is dependent on people because people must inevitably be responsible for how data is used, how it is managed, and for the consequences of the decisions made when using it.

This paper is intended then to remind us that big data is not simply something that data, systems, and analytics make happen and that we are somehow divorced from it and not responsible for unintended consequences. Instead, prudence would require that since we have unleashed big data, we have to somehow insure to the best of our ability that if we can't control big data, we can at least use com-

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mon sense in how we approach it and manage it. And, despite new technologies enabling machines to use big data to increasingly make decisions, people will not be able to divorce themselves from their decision-making responsibilities.

BACKGROUND

The amount of data in our world has exploded exponentially such that data, especially unstructured data, is now referred to as “big data”. Where measures of data were once gradually evolving from megabytes to terabytes, the sudden phenomena of big data accelerated these measures to volumes expressed in petabytes (1,024 terabytes) or exabytes (1,024 petabytes). The new influx of data is derived from billions to trillions of records of millions of people—all from different sources (e.g. Web, sales, customer contact center, social media, mobile data and so on). The data is typically loosely structured and often incomplete.

Petrov (2019) states that in 2019, the big data market is expected to grow by 20 percent, with every person generating 1.7 megabytes of data in just a second. By 2020, he claims, there will be approximately 40 trillion gigabytes of data. He notes that 97.2 percent of organizations are investing in big data and artificial intelligence (AI), because automated analytics will become increasingly vital to big data by 2020.

Big Data is the natural result of four major global trends:

1. Mobile computing
2. Social networking
3. Cloud computing
4. Moore’s Law [processing power doubles every 2 years]

A lot of big data is derived from cell phone traffic and social networks, with much of it being stored in the cloud. The amount of this information grows almost exponentially as people routinely interact with companies and each other via wireless and wired networks as a matter of course.

The data being transmitted and captured from these transactions has become a key basis of competition, underpinning new waves of productivity growth, innovation, and consumer surplus, according to research by MGI and McKinsey’s Business Technology Office (Manyika, Chui, Brown, Bughin, Dobbs, Roxburgh, Hung Byers, 2011). From the standpoint of competitiveness and the potential capture of value, big data has had a substantial impact. Today, organizations leverage data-driven strategies to innovate, compete, and capture value from deep and up-to-real-time information. Hence, leaders in every sector are confronted with the need to grapple with the implications of big data in a quest to capture and harness its potential value.

The significance of big data to an organization falls into two categories: analytical use, and enabling new products. Big data analytics can reveal insights hidden previously by data too costly to process, such as peer influence among customers, revealed by analyzing shoppers’ transactions, social and geographical data. Being able to process every item of data in reasonable time removes the troublesome need for sampling and promotes an investigative approach to data, in contrast to the somewhat static nature of running predetermined reports. Hence, big data expands BI’s data-driven decision-making opportunities.

BIG DATA

In their book, “Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today’s Business”, Minelli, Chambers, and Dhiraj (2013) present significant evidence supporting the value and justification for businesses to be ‘big data-driven’. Minelli et al. define big data as data that goes beyond the traditional limits of data along three dimensions: volume, variety, and velocity. Volume is important because in the past, business use cases and predictive analyses were restricted because the data volume utilized was limited due to storage or computational processing constraints. However, with big data technology removing these constraints and allowing the use of unstructured data and more transaction data for larger data sets, Minelli et al., assert that organizations can now discover more subtle patterns that can lead to targeted actionable decisions, or allow them to factor in more observations or variables captured over a longer period of time into predictive models. Variety of data refers to the different types of data now available for analyses. Instead of simply using structured text or numbers, unstructured text, audio, images, geospatial information, and internet data are now captured and able to be analyzed. Velocity is about the speed at which data is created, accumulated, ingested, and processed. Minelli et al., state that since this data is now readily available, organizations pursue technologies to help them immediately process this information for real-time analytics-based decision-making.

IBM’s Institute for Business Value (2013) added a fourth dimension to describe big data called *veracity*, or the uncertainty of data. They argue that the need to acknowledge and plan for uncertainty is a dimension of big data that has been introduced as executives seek to better understand the world around them. With data types changing constantly, and data collection increasing in quantity and speed, the quality of the data is a concern to be managed.

SAS Institute (2015) proposes two more dimensions as important to the understanding of big data:

1. **Variability.** In addition to the increasing velocities and varieties of data, data flows can be highly inconsistent with periodic peaks. Daily, seasonal and event-triggered peak data loads can be challenging to manage, but they are even more so with unstructured data involved.
2. **Complexity.** Data now comes from multiple sources. And it is still an undertaking to link, match, cleanse and transform data across systems. This requires that organizations increasingly focus on connecting and correlating relationships, hierarchies and multiple data linkages or data can quickly spiral out of control (SAS Institute, 2015).

In essence, big data has now become a new kind of capital. Because of its breadth, volume, richness, and timeliness, many firms see it as an important asset that when harnessed, can be used for creating new products and services. It is a capital on par with financial capital. Oracle (2015) asserts that for CEOs to realize its potential, they must secure access to big data and then increasingly exploit its use before their competition can.

Issues, Controversies, Problems

The rapid rise of the big data phenomena presents a plethora of new challenges for CEOs and their organizations. For example, IDG Enterprise Big Data research (IDG, 2014) conducted a survey with the goal of gaining a better understanding of organizations’ big data initiatives, investments and strategies. Their key finding included the following:

- Organizations are seeing exponential growth in the amount of data managed.
- Companies are intensifying their efforts to derive value through big data initiatives.
- CEOs are focused on the value of big data and are partnering with IT executives who will purchase/manage/execute the strategies.
- Organizations are investing in developing or buying software applications, additional server hardware, and hiring staff with analytics skills for big data initiatives.
- Organizations are facing numerous challenges with big data initiatives, especially the limited availability of skilled employees to analyze and manage data.
- Half of respondents indicated there is no clear thought leader in the big data solution space (IDG, 2014).

Today, big data is getting everyone's attention. That said, many firms are struggling to manage to manage it in order to harness its value.

Some of the challenges they face have been unanticipated. For example, access to mobile data, social media content, and location services information means that businesses are collecting an extensive amount of personal information about their customers. This means that:

- Businesses now have the capacity to leverage more personally identifiable and sensitive information for competitive advantage.
- There is a dramatic surge in identity theft that has the potential to compromise secure transactions.
- Firms must address the development of sophisticated technology to exploit data security vulnerabilities.
- Consumers are increasingly aware and concerned about the collection, use, and disclosure of personal information.
- Legislators are responding to consumer concerns by restricting access to and the use of personal information. Europe's adoption of the General Data Protection Regulation (GDPR) is the best-known example of this. (Palmer, 2018).

An obvious conclusion is that big data can become a liability for organizations if they don't have a demonstrably effective plan to manage it. And, to enable this, firms will not be able to simply rely simply on software solutions, hardware fixes, or other IT initiatives. Instead, management will have to pursue organizational solutions that are designed to insure both data integrity and regulatory compliance.

SOLUTIONS AND RECOMMENDATIONS

To determine how well organizations were taking advantage of big data, the IBM Institute for Business Value (Balboni, Finch, Rodenbeck Reese, & Shockley, 2013) surveyed 900 business and IT executives from 70 countries. Their analysis of the survey results enabled them to establish nine levers that differentiated companies who are best able to derive value from big data from those who were not:

1. *Culture*: Availability and use of data and analytics within an organization
2. *Data*: Structure and formality of the organization's data governance process and the security of its data
3. *Expertise*: Development of and access to data management and analytic skills and capabilities

4. *Funding*: Financial rigor in the analytics funding process
5. *Measurement*: Evaluating the impact on business outcomes
6. *Platform*: Integrated capabilities delivered by hardware and software
7. *Source of value*: Actions and decisions that generate results
8. *Sponsorship*: Executive support and involvement
9. *Trust*: Organizational confidence (Balboni, Finch, Rodenbeck Reese, & Shockley, 2013).

This list affirmed that many of the issues surrounding big data are issues of organizational management. That is, organizational culture, expertise, finance, performance measurement, value creation, leadership, and trust are all traditional management concerns that affect value creation with big data as well.

What surprised management is the tension created from the sheer volume and availability of big data, the new technologies that are being created to acquire and process it, and the stress it is creating for firms to manage and react to it in an effective and timely manner. In essence, big data has become an aggressive, persistent, and pervasive irritant that is able to expose organizational data management limitations. Therefore, one of the easiest ways to understand an organization's shortcomings in the handling of big data would be to examine how capable they currently are in dealing with data management - period.

In his book on data management, Tony Fisher (2009) argues that data governance programs are essential for enterprises to experience success with business intelligence initiatives. As companies grow and look to incorporate additional data sources such as big data it is vital that they have an effective data governance processes in place. To assess this, Fisher created the Data Governance Maturity Model that encompasses four phases: Undisciplined, Reactive, Proactive, and Governed. Each phase represents a different risk versus reward profile and as a company progresses through the model, they increase their ROI for business intelligence while simultaneously reducing risk for the company. Each of these stages is defined below:

- **Undisciplined**: At the initial stage of the Data Governance Maturity Model, an organization has few defined rules and policies regarding data quality and data integration. The same data may exist in multiple applications, and redundant data is often found in different sources, formats and records. Companies in this stage have little or no executive-level insight into the costs of bad or poorly integrated data. About one-third of all organizations are at the Undisciplined stage.
- **Reactive**: A Reactive organization locates and confronts data-centric problems only after they occur. Enterprise resource planning (ERP) or Customer Relationship Management (CRM) applications perform specific tasks, and organizations experience varied levels of data quality. While certain employees understand the importance of high-quality information, corporate management support is lacking. Studies show that the largest share of all organizations – 45 to 50 percent – fall into this stage.
- **Proactive**: Less than 10% of all companies have reached this level. The Proactive organization adopts a more unified enterprise view of data, implementing and using customer data integration and product data management solutions. In this stage, management understands and appreciates the role of data governance and data is seen as a strategic asset. Here data stewards emerge as the primary implementers of data management strategy and work directly with cross-functional teams to enact data quality standards.
- **Governed**: At the Governed stage, an organization has a unified data governance strategy throughout the enterprise. Data quality, data integration and data synchronization are integral parts of all business processes. The organization has a comprehensive program that elevates the process of managing business-critical data (Dataflux, 2015).

These stages provide a framework for organizations to gauge how well they are progressing with their data governance, data quality, and data management efforts while also providing information as to how they can progress to improve to a higher level of Master Data Management [MDM] – a term commonly used in the marketplace to describe this framework. Informatica (2015) defines MDM this way:

Master data management (MDM) in effect turns the Data Governance Maturity Model from a framework to a methodology for improving data management. MDM, like the Maturity Model, has the goal of helping organizations to attain:

- **A single view of the data**—Creating a single, authoritative view of business-critical data from disparate, duplicate, and conflicting information.
- **A 360-degree view of the relationships**—establishing business rules that let firms identify the relationships among the data.
- **A complete view of all interactions**—Integrating the transactions and social interactions that have occurred with a product, customer, channel partner, or other data element to give the organization a complete view of that customer (Informatica, 2015).

Ali (2014) states that organizations who are able to effectively manage their data are better equipped to make time sensitive decisions, monitor emerging trends, react quickly to new business opportunities, and ultimately, maximize the ROI of real-time data better than ever before. If data is being dispersed throughout the enterprise, the ability to discover or to fully leverage analytics tools to gain value and insight from data is cumbersome and inaccurate. Employing an MDM provides a framework for better ensuring that the big data being employed in business intelligence analytics is relevant, timely and accurate. Inevitably then, executive support of MDM should be essential if the organization is going to employ big data for data-driven decision-making.

Eckerson (2014) argues that effective data governance programs must be enterprise-wide with effective programs combining both a top-down and bottom-up approach to data management. He argues that organizations must have a data governance methodology like MDM in place to enable this. Moreover, he recommends that senior management establish a data governance office (DGO) with a full-time staff and a data governance officer. Eckerson proposes that the DGO should work with a data governance steering committee and data stewards to manage and monitor the organization's data governance program. Data stewards are employees with specific subject matter expertise who assume responsibility for certifying data, managing exceptions, and applying controls to safeguard data and individual privacy. Their role is to ensure that the data management, data governance, and business and quality rules definitions are appropriate for different lines of business. Each data steward provides critical input into cross-enterprise data management policies and ensures that these policies are appropriate for the business processes and applications that support the specific lines of business that they represent. Because of the necessity for these interactions, Eckerson believes that data governance is mostly about communications and change management where many conversations are routinely occurring among many people in different parts of the organization to ensure that business processes flow smoothly and efficiently.

Brown, Court, and Willmott (2013) state that effective data management requires executive buy-in for data governance efforts to succeed, because capturing the potential of data analytics requires a clear plan that establishes priorities and well-defined pathways to business results and developing that plan requires leadership. This presumes that executives clearly understand and endorse the use of big data, that they comprehend what data governance is and how important their role is to ensure its adoption and

diffusion, and that they fully comprehend that effective data governance comes at a cost: organizational change. This means that senior management must be intimately involved in crafting the blueprint that encompasses the vision, strategy and requirements for the organization's big data journey. This blueprint should define the scope of big data utilization and management within the organization, prioritize the key business challenges that big data will address, provide a schedule for dealing with these challenges, and provide a plan for developing or acquiring the people and technology resources needed to get the job done (Balboni, Finch, Rodenbeck Reese, & Shockley, 2013).

To be effective, big data solutions must be based on business requirements and address the infrastructure, processes, data sources, and skills required to support this business opportunity. To accomplish this, senior management must establish a plan and process that is consistent with the organization's culture and guiding principles such that these are subsequently reflected in the organizational data governance activities. Management must ensure that data governance is viewed as a continuous and systemic endeavor that is woven into the fabric of the organization's structure and processes.

Executive understanding and support of MDM-type big data governance processes should reflect the conscious realization that they will need to develop, acquire, and retain a strong core of human capital. Qualified data stewards, for example, must be identified and selected. These individuals, through their actions, reflect the values, policies, and procedural requirements that are derived from senior management. In a big data world, executive leadership is also needed to find, develop, and retain strong analytical talent. Analysts with strong mathematical, statistical and computer science roots, as well as familiarity or expertise in areas such as data mining, data visualization, optimization and simulation, text analytics, and predictive analytics are going to be required to harvest meaning and value from big data. The problem is that there is a severe shortage of this talent. Holak (2019) finds that because of big data and artificial intelligence (AI), demand for data science analytical skills is growing exponentially. He provides information showing a 29% increase in demand for data scientists year over year and a 344 percent increase since 2013. Clearly leadership is required to find creative means for acquiring the requisite BI talent that organizations need.

Dyché and Nevala (2015) assert that there are key issues where executives have to be careful in addressing big data and data management issues. These issues include failing to define what data governance is, not approaching big data and data management in a progressive and systematic manner, failing to design data governance teams properly, treating data management as a project, and overlooking organizational cultural issues. They note that issues needing to be addressed by data governance and big data are far-flung and pervasive, ranging from arbitration of cross-functional data usage to information privacy, security, and access policies. As a result, executives need to understand that if they look to implement data governance and other big data initiatives too quickly, the intended results may well be stymied quickly by role confusion, prioritization debates, project development problems, and resistance from the incumbent culture. And with new legislation like the EU's GDPR, executives can ill afford any mistakes or delays.

Whitler (2018) notes that without effective data governance, organizations will be overwhelmed by big data. Indeed, she notes, organizations are suffering from data saturation. The rapid rise in the ability to collect data hasn't been matched by the ability of many organizations to support, filter, and manage this data. Their data management infrastructure and processes are unable to keep up with the continuous deluge of big data. To deal with this issue, she reinforces the importance of effective data governance practices. She asserts that organizations need to:

- focus on identifying and understanding the key questions that you want to employ big data to help you to address,
- identify measures that will address these questions,
- develop a data governance council,
- map out a complete view of the data that identifies what data exists and who has rights to it, and
- identify the business intelligence tools that are best suited to analyzing the data for the issue being addressed.

Partner (2019) warns that the overall importance of data and information within organizations will continue to grow as will the demand for effective data management practices. She reports that there will be more than 20 billion connected sensors by 2020 that will only further aggravate the vast volume of big data. To compound this issue further, she states that organizations must also address the opportunity to take advantage of their other captured, but untapped information assets as well as new opportunities to analyze newly digitized analog assets.

FUTURE RESEARCH DIRECTIONS

Research into the impact of big data needs to expand its focus to explore in more depth how BI is affected by management's ability to cope with data governance, analytics talent recruitment, and other peripheral issues. MDM and data governance activities appear to be sensible techniques for managing data, but it is clear from statistics that not all of these practices are being effectively adopted and deployed. Understanding the rationale for the adoption and leveraging of data management techniques as well as its ability to affect business intelligence and decision making provides meaningful insight into management's competence in exploiting big data.

Managing big data requires common sense. Common sense is derived from thought, intuition, and experience. It incorporates such attributes as the ability to think rationally, to act purposefully, and to deal effectively with your environment. Common sense dictates that firms need to be conscientious with big data so as not to compromise BI efforts and data-driven decision-making. At the same time, however, common sense dictates that there are clear opportunity costs when business intelligence efforts are compromised because of poor big data management practices.

And data management acumen is only going to become more important. Foote (2018) reports that the accessibility of big data has provided a new generation of technology that enables businesses to focus even more on data-driven decision making. Foote believes that the continuous growth of the Internet of Things (IoT) will provide several new resources for big data, including the ability to combine streaming analytics with machine learning and the ability of artificial intelligence (AI) to process big data, thereby improving the efficiency of business intelligence.

CONCLUSION

Big data presents opportunity, but it is inherently filled with noise and uncertainty. It has tremendous potential if people approach it in the right way. It requires effective management, especially competent data management. What it offers is the prospect of gaining better business intelligence for decision making.

Ironically, there is the real potential that people may soon become less involved in business intelligence processes. Ramasamy (2019) predicts that in the next few years artificial intelligence, data analytics, and machine learning embedded in applications will become the primary consumers of data. That is, these technologies will replace people-oriented output such as reports and dashboards, because software will assume the burden of consuming and analyzing data.

This prediction poses the prospect of a fundamental challenge to our understanding about organizational decision making. Traditionally, decision making processes and procedures are assigned to specific individuals. Decisions are made by people. If machines assume these responsibilities, this perspective will necessarily have to shift. Analytics become a surrogate for human reasoning and the machine essentially becomes the decision maker. The problem, however, will be that people will probably remain accountable for the quality of the machine's decisions. In this scenario, it makes sense that one should control what they can control. They should implement effective big data management techniques that ensure data quality and they should employ business intelligence techniques that are grounded in sound reasoning relative to the issue being addressed. Hence, management's role should become one where they necessarily focus on data quality, the appropriateness of the analytics used to gain business intelligence, and the viability of both relative to the resultant decision-making outcomes.

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KEY TERMS AND DEFINITIONS

Artificial Intelligence (AI): Is a wide-ranging branch of computer science concerned with building smart machines capable of performing tasks that traditionally required human intelligence.

Big Data: Is a popular term used to describe the exponential growth and availability of data, both structured and unstructured.

Business Intelligence (BI): Is a business management term which refers to applications and technologies which are used to gather, provide access to, and analyze data and information about their company operations.

Data Governance: Is a combination of people, processes and technology that drives high-quality, high-value information. The technology portion of data governance combines data quality, data integration and master data management to ensure that data, processes, and people can be trusted and accountable, and that accurate information flows through the enterprise driving business efficiency.

Data Steward: A data steward is a job role that involves planning, implementing and managing the sourcing, use and maintenance of data assets in an organization. Data stewards enable an organization to take control and govern all the types and forms of data and their associated libraries or repositories.

General Data Protection Regulation (GDPR): Is legislation designed to give European Union citizens more control over their personal data. It dictates laws that organizations must abide by in their acquisition and management of personal information.

Internet of Things (IoT): Refers to the billions of physical devices around the world that are connected to the internet, collecting, and sharing data.

Master Data Management (MDM): Is a technology-enabled discipline in which business and IT work together to ensure the uniformity, accuracy, stewardship, semantic consistency, and accountability of the enterprise's official shared master data assets. Master data is the consistent and uniform set of identifiers and extended attributes that describes the core entities of the enterprise including customers, prospects, citizens, suppliers, sites, hierarchies, and chart of accounts.

Unstructured Data: Unstructured data (or unstructured information) refers to information that either does not have a pre-defined data model or is not organized in a pre-defined manner. Unstructured information is typically text-heavy, but may contain data such as dates, numbers, facts, or video content as well.

Human Face to Data as a Contemporary Approach to Decision Making in the Development Sector

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INTRODUCTION

The need to ensure transparency and accountability of development aid has become a global topic of discussion. There is a growing body of literature that looks into the effectiveness and impact of development aid and identifies that many development projects current and past have not met their stated goals (Cronin & Regan, 2002; Wenar, 2006; Leve, 2007; Panday, 2009; Williamson, 2009; Eneh, 2011). In response to such critique, development projects more than ever are faced with the need to incorporate effective, meaningful, and innovative monitoring and evaluation mechanisms to ensure progress is tracked throughout the program cycle (Bamberger, Rao & Woolcock, 2010). On the other hand, it is important to consider that despite having these mechanisms in place, the reliability of the data can still be questioned (Quibria and Islam, 2015). This book chapter offers evidence from a development project in the global south that effectively managed and applied data to inform decision making and therefore enhancing its chances to achieve its goals.

Bangladesh, a South Asian country, joined the global cohort of lower-middle-income countries in 2018 (World Bank, 2019). The country has recorded robust economic growth in recent years, which reached a new peak with about 8.1 percent GDP growth rate in 2018 (Centre for Policy Dialogue, 2019). Since its liberation in 1971, foreign aid has remained crucial to the socio-economic development of this country. Bangladesh received about US\$132,060.6 million of foreign aid (Economic Relations Division, 2019) up to 2017. In 2018, foreign aid accounted for about 16 percent of the national revenue of Bangladesh (Chattopadhyay, 2018). In the 2017-18 fiscal year, the third-highest amount of the external grant (excluding loan) came from the United States and was worth US\$2,796 million (Economic Relations Division, 2019).

Strengthening Household Ability to Respond to Development Opportunities (SHOUHARDO) is a food security program funded by the United States government and the Government of Bangladesh (CARE Bangladesh, 2019a). The program is implemented by an international non-governmental organization, CARE Bangladesh, in eight northern districts of Bangladesh that fall under char (riverine islands) and haor (natural depression) regions (Ibid). Both char and haor are prone to natural disasters, and people suffer from multiple vulnerabilities caused by seasonal flash floods, river, and wave erosion that affect

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their agriculture, fisheries, livestock, and wage labor livelihoods. The program interventions are geared at addressing livelihood challenges, namely- food insecurity, malnutrition, inadequate public service provision, gender inequality, and disaster-related vulnerabilities for 384,000 ultra-poor people (Ibid).

To achieve its goal, SHOUHARDO III has put significant efforts into ensuring a robust monitoring mechanism (CARE Bangladesh, 2019b). One of the refinement approaches that the program has been using to monitor its results is a longitudinal study. The longitudinal study was designed to track progress on several indicators in 680 randomly selected households that were surveyed every six months. Drawing inference from the quantitative longitudinal study findings was difficult for the program management as some of the trends and changes in some variables were inexplicable; therefore, the program commissioned separate qualitative research to deconstruct and interpret findings from the longitudinal study. The program applied an inductive ethnography to interpret quantitative results by confronting these with data obtained from the qualitative research. The application of this research findings helped the program to make adjustments in the design and implementation.

This chapter begins with the background and methodology for initiating an inductive ethnography and poses descriptive narrative on the findings, and finally, argues that research of this kind can be of significant value if the findings are taken into account while making decisions in the development program. It also delves into implications of this research for program management and puts forth the case of similar research at large scale.

BACKGROUND

Many development projects present their results mostly in the forms of numbers, figures, and graphs. Bamberger, Rao & Woolcock (2010) criticized reporting numbers only as of the result of development projects and referred to this as a partial-approach. One of the ways to go beyond this critique is to conduct rigorous evaluation; however, assessment of that kind usually takes place at the end of a project (Ibid). More recent attention has focused on the provision of mixed-method monitoring as a good practice as it provides real-time feedback and allows the space for development programs to review and adjust project design while it is ongoing (Cronin & Regan, 2002; Ibid).

One of the approaches promoted by the United States Agency for International Development (USAID) and Technical Assistance to NGOs (TANGO) is known as ‘Recurrent Monitoring Survey (RMS)’ which is characterized by real-time and high-frequency panel data collection, and small sample size (Frankenberger, Smith & Griffin, 2017). SHOUHARDO III has been conducting a hybrid RMS called, ‘Fostering Learning and Adaptation in Resilience Building (FLAIRb)’ since July 2017. FLAIRb is designed to track the interplay between the program interventions and household level results; identify activities that are making limited progress and troubleshoot at the household level what the gaps are for appropriate program activities; and, determine resilience progress and identify the areas of refinement in implementation.

After four rounds of the survey, the program sought to review its outcomes at the program and individual household level. The program realized that FLAIRb findings spotted gap areas and progress that can be taken for scaling up within the program and beyond. The quantitative data pieces from FLAIRb were useful, but it did not offer the depth in understanding of the contextual factors and changes at the household level. To address this particular gap, the program conducted small-scale qualitative research, which is the basis of this chapter.

The main objective of this research was to effectively interrogate the data (from the longitudinal research) and build a link between numbers and the people, termed here as ‘human face.’ The program purposively selected eight respondents in haor and char regions, four in each area, and analyzed their responses. A detail explanation of this process is provided in the methodology section.

METHODOLOGY

This research was intended to uncover the meaning of results derived from the longitudinal study. In the process of deconstructing those results, it applied an inductive ethnography and relied on the inductive reasoning process to derive meaning, interpret, and analyze data from another quantitative study (the longitudinal study). Though this research applied an adaptive inductive process to aid an understanding of meaning in complex data (Thomas, 2006), it did not follow the full process of inductive research design as its objective was heavily influenced by another study (Jain & Ogden, 1999; Marshall, 1999).

This research was designed to follow the iterative process in an inductive ethnography that allows the researcher to get back to research locations and subjects to obtain a deeper understanding of contextual factors influencing program implementation (Bamberger et al., 2010). The program explores real-life stories behind the numbers. Both the quantitative longitudinal study and the inductive ethnography have their unique strengths as the quantitative data from the longitudinal study offered an understanding of the magnitude, whereas the qualitative data from the latter provided comprehensive and nuanced perspectives.

The program adopted the extreme sampling technique, which was inspired by Fry, Chantavanich & Chantavanich (1981), who sampled extreme cases from a survey and demographic analysis for an in-depth ethnography (Ibid). In ‘extreme case sampling,’ the researcher purposively selects a sample based on extreme characteristics (Creswell, 2018). For this research the researchers purposively chose a total of eight sample respondents (out of 680 quantitative survey respondents) based on the respondents that had scored the highest absorptive resilience capacity score constructed from eight indicators, which included social capital, access to cash savings, household asset, productive asset, livestock asset, informal safety net, shock preparedness and mitigation, and access to financial institutions.

Before commencing the qualitative research, the program generated individual graphs for each of the eight respondents based on six indicators, including livestock asset, hand washing, income, household dietary diversity, women’s decision making, and resilience capacity. Indicator values in these graphs were derived from all four rounds’ of the longitudinal study. Then, the program developed a semi-structured checklist based on key trends and gaps in those graphs (Rossman and Wilson, 1985). Although the research adopted six variables to synthesize data from the longitudinal study, key themes in the findings narrative were based on unstructured data (Thomas, 2006). Each case is illustrated using ‘thick description’ (detailed contextual information) considering the interwoven parts of qualitative data (Mason, 2002; Skovdal & Cornish, 2015). Of the eight respondents, the researcher chose four diverse cases to portray variation at the individual household level for this chapter, namely that of (i) Salma, (ii) Jakia, (iii) Jarina, and (iv) Monowara from northern Bangladesh.

This research adopted an analysis in which contextual components are documented and reflected (Thorne, 2000). The analysis detected and thematic categories, however, in an unstructured way and included thorough descriptions of socio-economic and cultural factors, program interventions, and other factors that influenced individuals’ lives (Creswell, 2012; Skovdal & Cornish, 2015). The rationale for applying this process was to make a better interpretation of quantitative for the program and to inform decision making at the management level (Fry et al., 1981; Rossman and Wilson, 1985).

FINDINGS

The first case story is about a 25-year old program participant named Zakia, who lives in Malamara village in Jamalpur district. Over the four rounds (between July 2017 and December 2018), there has been an increase in Jakia's resilience capacity. All tracked indicators, except for her livestock assets, showed remarkable improvement.

Salma is a 29-year old woman from Madarer char, also in Jamalpur district. She is one of the participants whose resilience capacity remained stagnant throughout 2017 and 2018. The amount of Salma's loan increased during the fourth round of the study (December 2018) as she underwent an eye operation, which cost US\$ 366. Her dietary diversity, decision-making capacities, and handwashing practices improved.

The third case story focuses on Jarina's household, which seemed to have gradually increased income following an initial fall. Jarina is a 51-year old program participant from Itnakhani village in Habiganj district. Her interview revealed that her livestock assets, household dietary diversity, and handwashing practices progressed notably, even though her income and decision-making capacity remained unstable.

Lastly, Monowara is a 36 years old woman from Horipodo Nagor village in Sunamganj district. Her story shows satisfactory progress in most of the livelihood indicators. Her income, dietary diversity, and handwashing practices improved significantly, as was found in round four. However, Monowara's decision making seemed to decrease during the same period. An on-going court case besides gender-based violence within the household has challenged her otherwise positive livelihood trajectory.

In summary, the four participants could explicitly identify the program's contribution to the changes in their livelihoods. Overall, there have been improvements in areas of income, household decision making, dietary diversity, and handwashing practice. However, each household had unique challenges in pursuit of their livelihoods that affected household incomes such as debts, disease, and health costs. The data collected over the four rounds on each of the women are provided in their respective graphs below. See table 1 for details on how the indicators were developed for each result area.

Table 1. Summary of how indicators were constructed for each result area

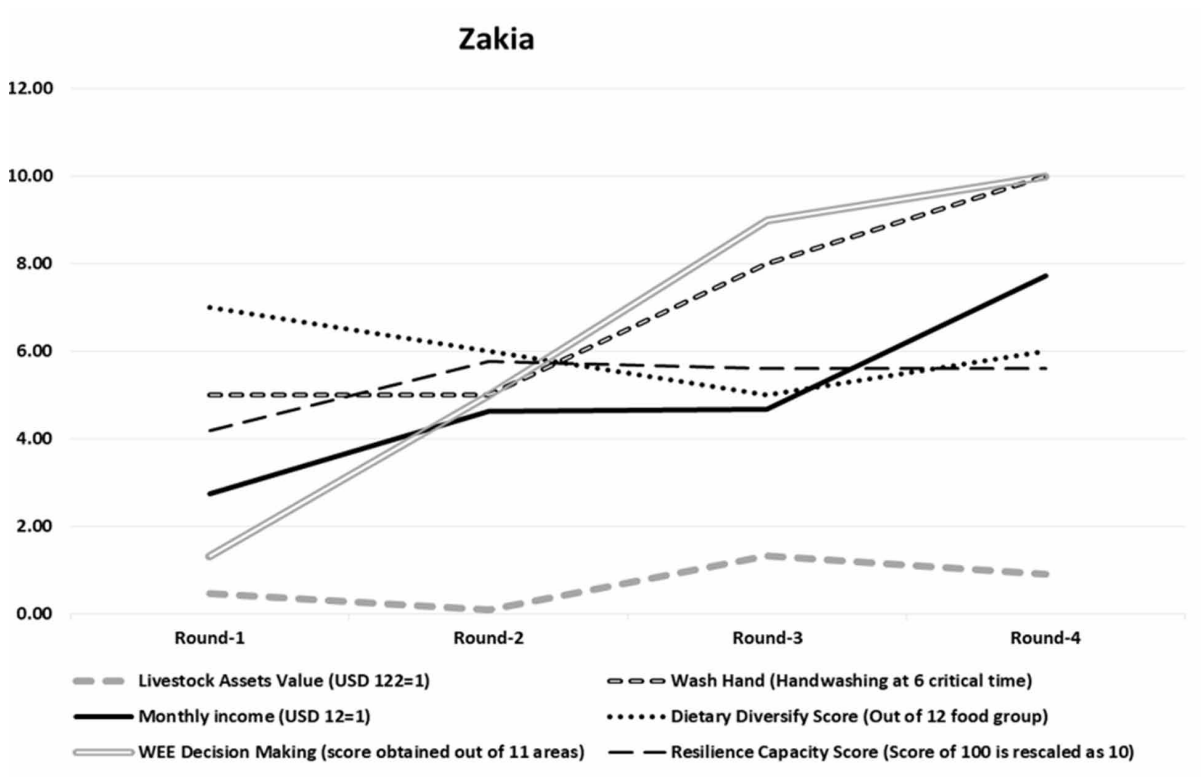
Analytics Process Adopted in order to standardize the scale of variables

1. **Livestock asset:** Calculates the current market price of livestock assets (shared or owned) that households had during the survey period. The livestock asset price is reflected in the graph scale as Livestock Assets value US\$122 = 1
2. **Hand Washing:** Six distinct handwashing practices (before food preparation, before eating, before feeding children, after defecation, after cleaning baby's defecation, and after cleaning animal/bird's feces) are considered for critical handwashing behavior. A score of 10 is given when all 6 handwashing practices are used, and the scale in the graphs reflect this.
3. **Income:** Households' monthly income includes both cash income and income from selling household products. The graph is scaled as follows: a monthly household income of US\$12 = 1.
4. **Household Dietary Diversity Score (HDDS):** Household diet diversity includes 12 types of food groups. In the graph, 12 food groups are given a score of 10 and equivalently assigned values.
5. **Women's Economic Empowerment (WEE) Decision Making:** A total of 11 decision areas are considered in household-level decision making for women. If the decision is made by a female respondent or jointly by husband/family members, then the decision-making area is counted. In the graph, a score of 10 is given for all 11 decision areas, and participants' responses are plotted accordingly.
6. **Resilience Capacity Score:** The absorptive capacity indices are constructed from eight indicators: Bonding social capital, Access to cash savings, Household assets, Productive assets, Livestock assets, Informal safety nets (ISN), Shock preparedness and mitigation, and Access to financial institutions. In the graph, a total absorptive Capacity score of 100 is rescaled as 10, and participants' responses are plotted accordingly.

Case One: Zakia

Figure 1 illustrates livelihood outcomes for Zakia, who lived in Malamara village in Jamalpur. In the first round, her resilience capacity initially increased and steadied at the new level over the next three rounds. Zakia's story is a narrative of a woman who was in sixth grade when she got married at aged 14. During the household qualitative interview, she shared that she has two children - one aged 10 years and the other 23 months.

Figure 1. The trend of key variables changes in Zakia's life across the four rounds)



The line graph shows that her livestock holding increased until around three and then declined to the near baseline level. Zakia explained that she had two cows and three goats a year ago, which she sold to buy 0.035 acres of land valued at US\$854. She obtained US\$549 from her livestock sales and added US\$305 from family savings. The source of this family savings was mainly generated from their farming activities, livestock assets, and her husband's non-farm income.

This household stopped agricultural farming two years ago due to their extended family's internal conflicts over land. While the farming activity and livestock assets of this family decreased, the graph shows that their income increased. Zakia's family mostly depended on her husband, a wage laborer, and also a part-time electrical house wiring professional. His monthly income was US\$122. To increase their income, they also planted lumber trees in the newly-purchased land as a long-term investment. On top of that, they invested US\$98 in a rice trade business.

A sharp rise can also be noticed in Zakia's decision making which she confirmed by explaining that she was making more decisions in how as she played a role in ensuring that her family spends within its means. She and her husband made decisions based on joint consultation in most cases, starting from purchasing an asset to her children's education, buying clothes, and buying groceries. Reflecting upon her past, she said her husband's cooperation improved after attending the couple's dialogue sessions. Her husband was a male champion, hence, a promoter of positive male attributes.

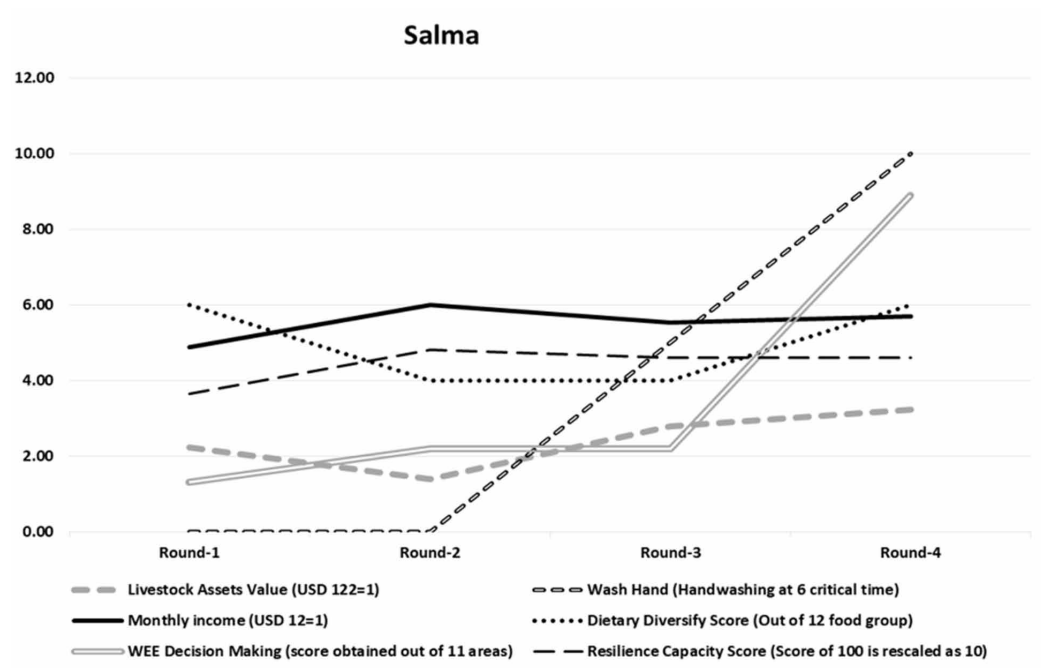
The program promoted improved handwashing behavior in the courtyard session, which was further strengthened by household-level counseling. The interview provided additional insight that an improvement in her children's health was a great motivation to adopt better handwashing practices that increased steadily over the last three rounds. She recalled the benefits and said, *I have learned about handwashing from the courtyard sessions and started practicing in my household. I can see the differences between the growths of my two children. My elder son used to fall sick very frequently, but my younger one does not. I also do not have to visit a doctor frequently for my younger son.*

Zakia shared that increasing income had led to positive growth in her household dietary diversity score. Besides, she had a homestead garden where she was growing vegetables, including spinach and red amaranth which was mostly consumed by her family. She fed her children with eggs from the chicken and ducks.

Case Two: Salma

Figure 2 exhibits the changes in livelihood outcomes of Salma, a female program participant household over the four rounds. It shows that her resilience capacity remained mostly stagnant since the second round of the study. Salma's family comprised five members, and she was eight months pregnant during the interview.

Figure 2. The trend of key variables changes in Salma's life across four rounds)



Salma's family income steadily increased from the second round and will most likely keep growing, as her husband took over a salaried job as a security guard with a private company in February 2019 (two months after the quantitative survey was completed). He was earning US\$146 monthly. Previously, her husband worked as a daily wage laborer, and his income was often inadequate for the family. Salma had an eye operation after the third round, which cost them US\$366. US\$244 came from their savings, and they took a loan of US\$122 from *Prodipon* (a local Microfinance Institution). Even though all the savings were spent on the surgery, Salma was confident that in the case of a new crisis or emergency, she could get financial help from her relatives and neighbors, which was indicative of her strong social capital.

Overall, there is a clear upward trend in her decision-making capacity; but this must be understood in the context that her husband lived away from home for work, which allowed her to make decisions on household issues. Sometimes Salma went to the nearest market alone to purchase necessary items, such as dresses for children and groceries. When asked what she would do if any of her children fell sick, she responded, *If any of my children fall sick, I'll take him to a doctor; it does not matter if somebody is accompanying me, or not.* In spite of this confidence, she intimated that the majority of the time, she was accompanied by her brother-in-law, challenging her response on being able to move around alone.

Salma alluded to having a more diverse diet for her household, the pregnancy may have played a role in that, but consistency will be tested as the expected child turns to eat solid food after seven months. The graph also suggests a rising trend for her handwashing behavior that changed from a minimum of three to six critical times. When asked about her handwashing practices, she referred to washing hands before and after eating, before feeding her children, before cooking, after defecation, and after cleaning her child that has defecated. She mentioned learning about this from the courtyard sessions.

The graph shows a declining trend in Salma's livestock during the second round. Her household was affected by a flood in 2017; her family lost two goats and suffered some loss in the rice field. It is noticeable that between July and December 2018, there was little change in her livestock asset. A more recent visit to her household for this qualitative research in April 2019 found that Salma had eight goats and three cows, mostly from shared ownership.

Case Three: Jarina

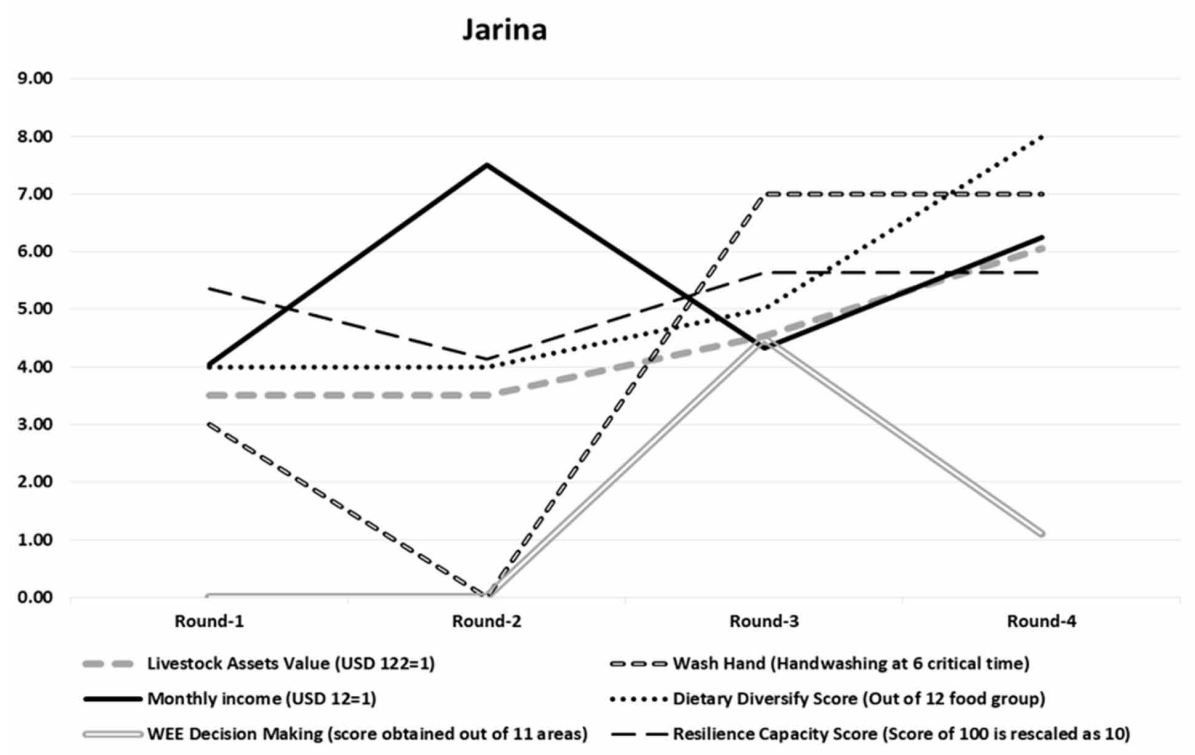
Figure 3 shows significantly rising trends in several livelihood outcomes for Jarina's household. It suggests that after an initial fall, her resilience capacity gradually increased. Jarina is a 51-year old woman from Itnakhani village in Habiganj district with a family of six – a husband and four children.

From the line graph, it is clear that the livestock assets of Jarina's household grew strikingly over the four rounds. She had only one cow in July 2017, and the number grew to three in December 2018. She spent US\$37, which she received as a monetary input (in 2017) from the program to buy ten hens. The family has consumed some of them and added ducks to the flock from own savings.

Eggs from her chicken alongside the vegetables that she grew in their courtyard, was a major source of nutritious food for this household. She received training from the program on comprehensive homestead development and improved agricultural technologies. She said, *I did not apply Mada (an improved pit technology used in homestead gardening) while growing vegetables previously. From the Farmers Field Business School, I learned improved technology (Mada) and applied in vegetable cultivation, which resulted in better production.* This quotation is in line with the graph, as it shows an upward trajectory in household dietary diversity.

As is illustrated in the graph, their handwashing behavior increased from two critical times per day to four crucial times in between December 2017 and December 2018. During the interview, Jarina could

Figure 3. The trend of key variables changes in Jarina's life across four rounds)

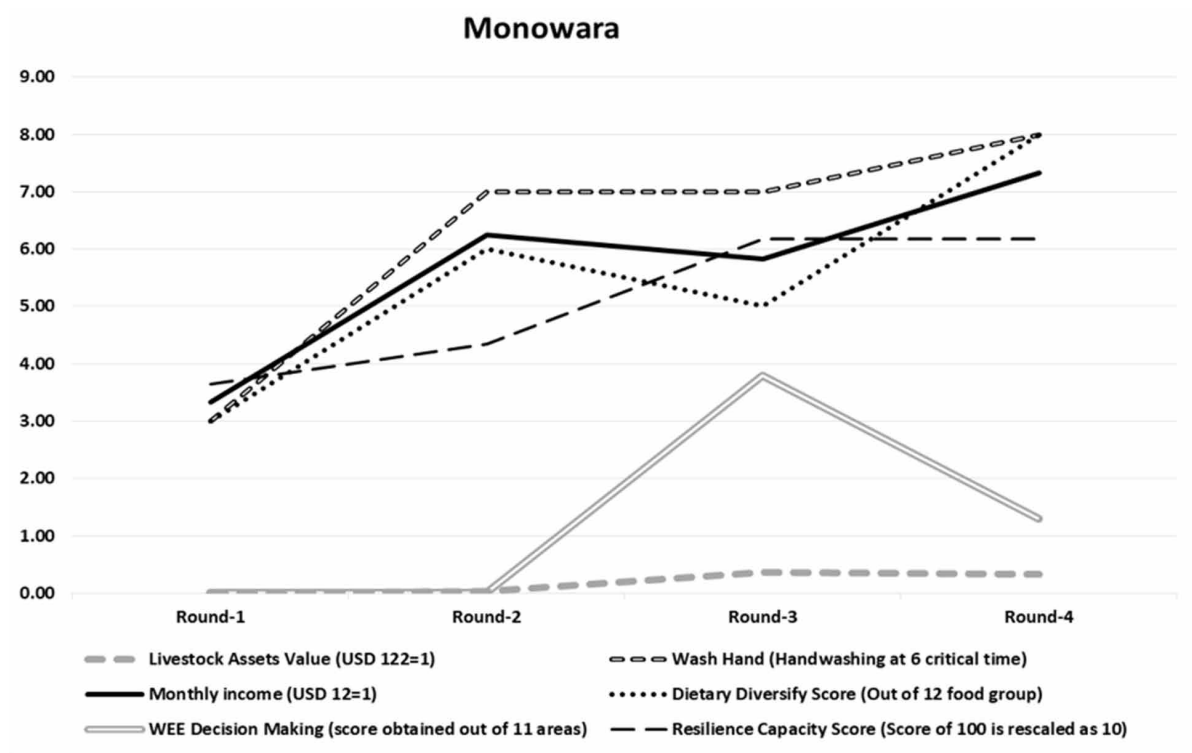


clearly identify critical times of handwashing and some health benefits of such improved behavior (e.g., her children suffered no more from diarrhea, which was fairly common before practicing handwashing; there was a reduction in medicine intake, and the household benefitted monetarily from not having to spend money on medical costs). Observations during the visit to her house revealed that they had a clean toilet with a bar of soap available beside the tube well. She also made a separate shelter for livestock to keep her children away from animal feces, and the shade appeared to be very clean.

Jarina's graph reveals a rather uncommon trend in income levels over the four rounds. With an initial upsurge followed by a fall and then another considerable rise, which indicates a certain level of income instability. During the interview, Jarina indicated that their income was heavily intertwined with seasonality in haor, which is reflected in the graph. The primary source of cash income was her husband's work as a mason both within and outside their locality. During the wet season (June to November), the demand for a mason was higher as the volume construction work increases. He also worked as a sharecropper in the last two years on 0.44 acre of land; they successfully harvested around 0.8 MT rice in year one and 1.6MT in year two. Jarina added to the family income by producing and selling *Chota* (made with cow dung and straws and is used as fuel in villages), rearing livestock, and yielding vegetables. She indicated that the sell spiked up during the rainy season because it was more difficult for people to dry their own *Chota* due to scarce space, leaving them with the only option of buying it.

Jarina's family was saving US\$2.4 every month; however, they used up their savings worth US\$305 being conned by a middleman who promised her husband an overseas job. Further, in November 2017, Jarina's eldest son was wounded by a bamboo stick, which led to surgery at Hobiganj District Hospital, costing them an additional US\$183. Initially, this money was borrowed from Jarina's father, who lived

Figure 4. The trend of key variables changes in Monowara's life across four rounds)



in the same village, but they were able to refund the money within a few days. These shocks severely influenced their family income over the last two years.

The graph shows a somewhat contradictory relation between income and household decision making which can be attributed to Jarina's husband's work pattern. Generally, her husband was the primary buyer of necessary items for the family, but this responsibility fell on Jarina when her husband worked outside their village. Nevertheless, during the interview, Jarina asserted that she and her husband made joint decisions when it came to different family issues.

Case Four: Monowara

Figure 4 illustrates the vital livelihood outcomes of Monowara's household. An overall understanding suggests that her household demonstrated satisfactory progress in most of the indicators. Monowara, a female program participant from Horipodo Nagor village in Sunamganj district, was 36 years old and had a four-year-old son and was six months pregnant during the time of the interview.

One of the notable features in this graph was the upward trajectory of several indicators, including income, household dietary diversity, and handwashing practice. Monowara's family was solely reliant on her husband's income, who was a wage laborer. He worked as a sharecropper during the rice planting seasons (twice a year) and sold stones (collected from the river to construction companies during the monsoon season (from June to November). Between round one and four, their monthly income increased from US\$41 to US\$89. This was largely driven by Monowara and her husband's aspiration to seek alternative livelihoods and acted on available opportunities. The graph showed that her livestock

asset did not increase across the four rounds of the study. It speaks the reality as Monowara owned 18 chicks and five hens, which was not significant in monetary value.

The household's dietary diversity pattern seemed to be correlated with their income. The graph depicts an initial rise and then a fall, followed by a gradual upswing when it comes to this household's nutritional diversity. There was a clear indication that this is directly associated with seasonality (cropping time). In round three, the household dietary diversity score was lower compared to the previous round, as her husband could not work due to his sickness (flu), which negatively affected their food consumption.

Since the second round (December 2017), Monowara's household demonstrated a quick adoption of handwashing practices, which continued through the fourth round. This household settled in a new place in January 2019, as their previous house was falling apart. One of their distant relatives provided a house to four families, including her own as in-kind support.

As the graph presents, Monowara's decision-making capacity began to climb from flat growth in round three, followed by a sharp fall in the next round. This pattern is in line with her narrative, as she was only able to make decisions when her husband was away collecting stones from the river. She mentioned visiting the local market to buy medicine and other daily necessities with her husband's consent. During the interview, it became apparent that gender-based violence was a common phenomenon in their household. Monowara shared that her husband assaulted her for doing anything that he did not approve of.

One other thing the graph could not capture was that her husband was accused of illegal gambling two years ago. To date, the family spent approximately US\$ 1,220 on the court case, requiring them to sell all of their belongings, including furniture and other assets. Monowara and her family not only suffered from financial losses but also lost dignity in their community as a result of her husbands' actions. Monowara said, *Our life would be much better if we did not have to deal with the court case and the cost incurred in this.* This likely hindered their potential growth; however, despite this shock, the family still managed to maintain relatively higher growth in most of their livelihood outcomes.

FUTURE RESEARCH DIRECTIONS: IMPLICATIONS OF THE HUMAN FACE IN DEVELOPMENT PROGRAM

The potential application of data in informed decision making is gradually being realized by policy-makers. This can work as leverage for both government and development organizations to identify need and provide service to the low-income population in a concerted manner (The World Economic Forum, 2012). Insights gained from interrogating data in this way can be leveraged for program management in making informed decisions (Provost and Fawcett, 2013). The key here was to obtain a holistic analysis of the program's evidence and impact in order to boost the overall performance and effectiveness. Tailoring the program's knowledge management strategy to adopt comprehensive data to follow the process of refining and implementation is crucial in this aspect (Kabir & Carayannis, 2013). Findings obtained from this ethnographic research stretched the typical way of interpreting data in the program by offering rich insights from the ground.

Qualitative research in a development program has the potential to give voice to the most marginalized people in a way that they have opportunities for participatory decision making (Skovdal and Cornish, 2016). It is important to ensure that the insights of the community participants' are articulated through the qualitative research influence decision making (Ibid). This research enabled the program to tap into the subjective insights from the respondents, which added to the tacit knowledge base of the program. Tacit knowledge is invaluable for the program as it often dwells in participants' mind and hard to capture

and share which is quite the opposite to the results that come in the form of number and figures from more structured studies and easy to capture, document, and share (Polayni, 1958; Nonaka, 1995; Kabir & Carayannis, 2013). Furthermore, the program is now capable of meaningfully applying tacit knowledge to prioritizing one intervention over another (Skovdal and Cornish, 2016).

SHOUHARDO III intervened in the communities to increase the adoption of improved agricultural technology, ensure participants' income growth, access to health care information and services, household and community awareness on shock preparedness, encourage savings, raise awareness and action to address gender-based violence. Taken together, the results of the longitudinal study suggested significant changes in resilience capacities, women's participation in program groups, and women's decision-making power, and their control over cash income. However, underlying this overall progress, there were areas identified by the ethnography that the program needs to take into account. In this case, SHOUHARDO III will apply knowledge gained from this in three particular areas, including idiosyncratic shocks, women's decision making, and adaptive inquiry methods.

Firstly, each of the respondents from the qualitative research experienced different types of shocks in their day-to-day life, including massive medical costs, losing money in the process of availing better employment opportunities, and court case. The longitudinal study identified the extent of program participants' resilience capacities but could hardly explain why and how changes took place in their lives. The program needs to find strategies to reduce their vulnerabilities from this kind of shock.

The ethnography identified another hidden fact that suggested that women did not necessarily have better decision-making outcomes when more substantial assets were procured. The example given by most women was decision making power over the small purchase, like chickens or ducks, but when it came to cattle, they had to consult with men. The research also revealed that their decision-making capacity was highly influenced by their husbands' seasonal migration. They were more likely to make more decisions during monsoon when husbands were working away from home. The program will require to review its women empowerment interventions to address this issue.

This research required the researcher to adopt an innovating inquiry method. For example, one of the respondents chose not to speak to the researcher in front of her in-laws; therefore, the researcher did the interview in a place that she perceived as safe. This data collection process took into consideration a deeper engagement of the researcher and prioritizing the need and safety of the respondent for ensuring quality as well as accuracy. It is unlikely for a quantitative process to ensure such engagement and gain insights that are required. The program will need to replicate this process at a large scale for future research.

The stories of these four women do not authoritatively represent the entire program. However, their personal stories in relation to the quantitative numbers provide SHOUHARDO III with compelling evidence of the changes in people's lives, issues they must deal with, and areas of limited, unexpected, or negative results that need some program recalibration. These issues will be prioritized in the remaining one year of implementation.

As next steps, a more extensive review will be done in the areas of limited progress to identify coherent actions, while simultaneously ensuring that the excellent progress is being felt across the entire program. This process will focus not only on numbers, figures, and graphs but also in gaining deep insight on social, economic, cultural factors. As SHOUHARDO III moves into the phase-out stage, the purpose of potential future inquiries and analysis will shift from providing information to support adaptive management decisions, to uncover lessons learned about how the implementation strategy helped to enhance resilience capacities, and to assess how the program's close-out strategy will help to sustain the improvements in such capacities

CONCLUSION

There is a positive link between data-driven decision-making and organizational performance. For a development organization, like CARE, it is likely to be associated with the performance of the development programs implemented by it. SHOUHARDO III, as a development program, is still evolving to meaningful capture, share, and use knowledge where needed. This ethnography helped the program to realize that an influential way of generating knowledge can be commissioning need-based research on emerging areas and gaps rather than on structured and overarching agenda (Jones, 2012).

This chapter commenced with the importance of ensuring accountability and effectiveness in development programming. In doing so, it argued that reporting numbers as results are barely useful. It suggested that the program can apply the innovative approach that can address this challenge. Based on the experience of one of the US government and Bangladesh government-funded projects, it showed how a development program could obtain a better and more in-depth understanding of individual lessons at the household level by using a mix of studies including structured and unstructured ones and eventually make adjustment in program design for achieving its goal.

The knowledge generated by the ethnographic research was important for a relatively large project like SHOUHARDO III, which has several focus areas. The program could not detect the gaps that were identified from the qualitative findings earlier through the regular quantitative studies and data analysis. The process explained in this chapter can be expensive as it included a large scale longitudinal study followed by a qualitative one, but it's probably costlier to run a five-year program and end it with no idea on what else could have been done. This chapter concludes with the intention of promoting similar in-depth and rigorous research process and a wide sharing of this practice with other development projects through cross-learning for ensuring the best and effective use of development aid.

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KEY TERMS AND DEFINITIONS

Absorptive Capacity: Absorptive capacity is the ability of social systems to absorb and cope with the impacts of climate variability and extremes. The absorptive capacity indices is constructed from eight indicators, which include Bonding social capital, Access to cash savings, Household assets, Productive assets, Livestock assets, Informal safety nets (ISN), Shock preparedness and mitigation and Access to financial institution.

Adaptive Capacity: Adaptive capacity is the ability of social systems to adapt to multiple, long-term, and future climate change risks, and also to learn and adjust after a disaster. The adaptive capacity includes Bridging social capital, Linking social capital, Human capital, Livelihood diversification, Access to financial services, Asset ownership, and Exposure to information.

Char: ‘Char,’ a Bengali term, refers to Mid-channel Island that arises periodically from the river bed due to sediment accretion.

Couple’s Dialogue: Couple dialogue was facilitated at both village and union level, where several couples interact with each other on benefits of improved relationship that leads to nutritional outcome, mutual decision making, and preventing domestic violence.

Courtyard Session: The program disseminated information on dietary diversity, intra-household food equity, Infant and Young Child Feeding (IYCF) counseling focusing on exclusive breastfeeding, promotion of handwashing at critical times, maternal and adolescent nutrition including Iron and Folic Acid (IFA) promotion, separating children from animal feces, hygiene and promotion of sanitation behavior through regular courtyard sessions with pregnant women and lactating mothers.

Farmers’ Field Business School: Farmer Field Business School (FFBS) was an informal platform for local farmers to share knowledge on agricultural production as well as to buy inputs/sell crops collectively.

GDP: Gross domestic product (GDP) represents the monetary value of all final goods and services produced within a nations’ geographic border in a given time.

Haor: Haors are bowl-shaped natural depression lying between the natural banks of rivers or high lands, mostly seen in northeastern Bangladesh.

Idiosyncratic Shocks: Idiosyncratic shocks are a type of shocks that are unique to an individual or family. Loss of jobs, loss of livestock, excessive medical treatment treated under such category of shocks

Longitudinal Study: Longitudinal study is an observational research method that employs continuous or repeated measures to follow particular individuals over prolonged period of time – years or decades.

Male Champion: This refers to men and boys who raised awareness in communities on norms and practices that hinder women’s empowerment.

Recurrent Monitoring Survey (RMS): The regular RMS method is triggered after a shock. FLAIRb was set to be conducted with or without a shock with a bigger time gap in between data collection periods; it was also expanded to include non-traditional indicators such as women empowerment, health, and agricultural practices.

Thick Description: An inherent part of descriptive case study analysis that includes not only describing and observation (usually of human behavior) but also the context in which that behavior occurs.

Transformative Capacity: Transformative capacity requires engagement with issues of power at two levels: changes in the social structures that influence decision-making and changes in individual values, capabilities, and choices.

Data Discovery Systems for Not-for-Profit Organizations

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1. INTRODUCTION

Contemporary society is an information society characterized by a high level of technological advancement, where information management, the quality of information and the speed of information transfer are major competitive advantage factors in both industry and service sectors (Hiranya,2017). Modern techniques for information gathering, processing, transfer and utilization are in widespread use. In a society like that, information constitutes a significant part of the added value of most goods and services, and information-intensive activities are pursued by households and citizens alike. Information has joined the classical triad of production factors (Zbroińska,2012), and has been recognized as a dominant resource of contemporary organizations and one of the major drivers of the socio-economic development (Makulska,2017; Toffler,1985). Also, recent years have witnessed a growing interest in the idea of civil society and a rise in the socio-economic potential of the third sector and its role in social services and social capital creation (Edwards,2012). The study is aimed at the not-for-profit organizations which belong to the third sector organizations. Third sector organizations function in a specific way – they are established as a result of social initiative, and are motivated not by a desire to make a profit, but a wish to serve people by satisfying their needs (Defourny,2014). In many respects, however, they are not properly adjusted to the current situation. They are in need of organizational, financial and technological changes in order to fulfil their mission and build their potential effectively. Under existing circumstances organizations are forced to efficiently use data and information in resource management. They have to understand/acknowledge that modern information and communications technologies bring internal benefits and contribute to higher efficiency as well as enhanced quality of the services they provide. The aim of the study is to verify a hypothesis that Data Discovery Systems (DD) are one of the modern technologies which help in achieving these goals, and to present the possibility of using DD systems in effective resource management of not-for-profit organizations. The chapter is structured as follows: Section 1 is an introduction to the subject, based on literature review. Section 2 looks at the characteristics of the third sector organizations (especially not-for-profit organizations) and their operating rules. It also presents Data Discovery systems as a new generation of Business Intelligence systems, which support business analytics, and help in building visualizations and dashboards that show insights for the donor, beneficiary and society. They are self-service IT tools which can be used by employees lacking specialized IT knowledge. Section 3 describes the research methodology. Section 4 discusses the findings of the study on the possibilities of using DD systems in resource management of selected not-for-profit organizations. There is also a presentation of a resource management dashboard designed for Volunteer Fire Departments. The analysis of the data on the physical, human and financial resources proved the DD systems to be the tools that can effectively support efficient¹ resource management in this group of

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organizations. The chapter concludes with discussion of the research findings, implications and limitations of this research, and avenues for further studies.

2. BACKGROUND

2.1. Characteristics of the Third Sector Organizations

The concept of the division of the socio-economic activity of modern democratic countries assumes the existence of three sectors of the national economy (Defourny,2014; NGO,2017; Palonka,2016):

- the first sector is the state sector, which includes institutions making up the state agencies and offices, i.e. public administration,
- the second sector is the private sector, which comprises institutions and organizations operating for profit, i.e. for-profit entities,
- the third sector is made up of organizations that neither operate for profit nor are part of the state institutional structure, which are social, not economic, in nature, and independent of state, i.e. non-profit entities.

The subject literature review (Evers,Laville,2004; Salamon,Sokolowski,2014) does not allow for clear identification of entities belonging to the third sector because this sector's scope is deeply rooted in the institutional and socio-cultural contexts specific for a particular country or region (Dudzik, Hausner, Izdebski, Kucharski, Laurisz,2008; Skrzypiec,2015).

In Poland, it encompasses, i.a. (Palonka,2018): foundations; associations and their unions; political parties; organizations regulated by separate legal acts, including hunting clubs (Polish Hunting Association), Polish Red Cross, volunteer fire departments, social committees (e.g. social committees for the construction of roads and waterpipe networks); labour unions; employers' organizations, employers' associations; faith-based organizations; groups, such as community clubs, support groups or self-help groups, etc.

In the EU, the third sector is predominantly perceived as the social economy, which comprises both non-profit organizations and social enterprises (GUS,2014; Defourny,2014; Skrzypiec,2015). In broad terms, these organizations can be divided into two categories (Rachunkowość non-profit i not-for-profit,2017):

- non-profit organizations - they must not conduct any economic activity, which results either directly from the legal regulations or the organization's statute, and their assets come from donations, legacies, grants and bequests,
- not-for-profit organizations (NFP) - they can carry economic activity, but all the proceeds generated during its course must serve the organization's statutory goals; the organization's statute should spell out the possibility of conducting economic activity and specify its scope.

The classification indicates that some entities can conduct both statutory and economic activities; the former, however, should not be profit-oriented, while the latter should exclusively serve fulfilling the needs arising from the statute. Organizations operating in the third sector of the national economy (except political parties) can conduct economic activity as long as there are relevant provisions in their statutes. An important point is that not-for-profit entities commencing their economic activity are not

allowed to apply simplified accounting methods, but have to fully comply with the requirements of the Accounting Act. Thus, it is advisable for them to keep separate records of the statutory and economic activities. Also, they have to set out the rules for the division of the administrative expenses into expenses related to the statutory activities and those related to the economic activity (Cebrowska,2010).

In Poland, organizations of the third sector of the national economy operate across sectors (Klon-Jawor,2015), and consequently experience a variety of management problems. There are diverse causal factors behind them, including financing methods, ensuring physical resources, fundraising and financial settlement, securing funding or equipment indispensable for running/supporting the organization's operations, excessive or complicated formalities regarding the use of funds obtained from donors, sponsors or the European Union funding programmes, varied physical facilities, or personnel capabilities of the organization (Klon-Jawor,2015). The organizations' leaders have to ensure that they operate in compliance with the civil, accounting, labour, etc. law. They are obliged to effectively manage the organizations' resources (tangible and intangible), administer their operations, settle projects, and discharge financial liabilities. They make major decisions in the organization, represent it (e.g. contacts with administration officials, sponsors, media, etc.), raise money for the organization and manage its funds (Klon-Jawor,2015).

Today, not-for-profit organizations are working in an era of heightened scrutiny, greater demands, fewer resources, and increased competition. They have to understand how data and information can best serve their purpose. The deployment of modern IT tools for analysis should allow not-for-profits to utilize data and information for internal efficiency gains and better service delivery.

2.2. Classic Business Intelligence Systems

Competition, globalization, and information and communications technologies change the rules for the functioning and management of contemporary organizations (Pomykalski,2017), and force organizations to acquire or develop skills in optimizing their resources and resource utilization in almost every aspect of their work (Griffin,2017). As a result, it is extremely difficult for organizations to solve a problem, and next – to choose the best operational variant unless they possess data and information on their resources, markets, clients, strengths and weaknesses, and the potential conditions for future activity. They also need information that allows skillful coordination of managerial activities in all functional areas, i.e. the management of fixed assets, finance, human resources, production and service provision processes, supply chain and distribution logistics, sales, and customer relations (Walczak,2012). Due to the abundance and diversity of the available data, the organization's activity in this sphere has to be supported by ICT solutions. The software market offers a variety of information systems that can assist in the management of all kinds of organizations (Decyzje,2018). These are often tools with a wide range of functionalities which enable the management of different organization resources and support decision-making in different areas. Research shows that both public sector organizations (GUS,2015) and private sector organizations (GUS,2016) commonly adopt these solutions, while not-for-profits make poor use of ICT and information systems (IS) to support their operations and management (GUS,2014; Palonka, Begovic,2016). The reasons for this limited utilization still remain unexplained. It can be noticed, however, that changes in the conditions under which these organizations operate necessitate the implementation of IS, or the restructuring and expansion of the existing IS and the adaptation of the existing information and communications architecture. This kind of investment is both costly and time-consuming, it requires a massive financial outlay (Computerworld,2015; Iwaniuk,2011) as well as personnel's up-to-date knowledge of ICT and IS and relevant skills (Computerworld,2015).

For many years organizations have been using Business Intelligence systems to support management processes. The systems assist in the analysis of a decision situation and provide users with information indispensable for conducting activity and making business decisions. They are an information platform enabling analysis of the data stored in databases. They can be employed in various domain areas, and the analyzed data can describe both internal and external processes. They can be used to assess the current state of processes and to predict significant phenomena (Bojar, Rostek, Knopik, 2014). Modern managers, however, demand easy-to-use tools to simulate events by means of the “what-if ” analysis, predict trends and make forecasts. These are complex tasks as one has to „know” the dependencies between the variables describing the organization’s structure and the processes taking place within the organization and in its environment. Users, on the other hand, would like to have a support system that would be automated, simple and that would not require hiring a specialist (an analyst or an IT specialist) (GUS, 2014; Computerworld, 2015).

There are some core platform attributes to consider when selecting a modern BI platform (Sadiq, 2013; Yeoh, Koronios, 2010):

- Platform integration and accessibility
 - Can all of the steps of the modern analytics workflow be executed seamlessly within the platform without the need to move between modules/products in a disconnected manner?
 - Can all of the steps of the modern analytics workflow be executed without IT involvement or specialized skills?
- Ease of use
 - Is it easy for BI platform administrators to install, configure, and manage the platform?
 - Is it easy for content creators to prepare data and curate data sources without upfront or on-going assistance from IT?
 - Is it easy for content creators to author content and access the analytic capabilities of the platform without upfront or ongoing assistance from IT?
 - Is it easy for non-technical content consumers to find, view and interact with available analytic content?
 - Is it easy for non-technical content consumers to ask deeper questions autonomously and customize existing published content to suit their specific needs?
- User enablement
 - Is role-specific training available and accessible to all users?
 - Are there self-paced tutorials and/or online webinars that users can access?
 - Is it easy for users to search and find answers to product-specific questions?
 - Is there a robust and active user community accessible to share and learn best practices, tips & tricks, etc.?
 - What is the platform vendor’s reputation for resolving technical support issues?
 - Are professional services (through vendor or partners) readily available?
 - What is the platform vendor’s reputation for ensuring customer success and ongoing engagement with customers?
- Deployment flexibility
 - Does the platform offer flexible deployment options (e.g. SaaS, public/private cloud deployment, on-premises, etc.)?
 - Does the platform offer flexible data storage options (e.g. in-DB vs. platform storage (in-memory))?

- Does the platform support hybrid connectivity of on-premises and cloud data sources?
- Is the platform scalable to accommodate increasing data volumes and additional users over time?
- Can the platform easily scale up and out depending on the needs of the organization?
- Pricing and packaging
 - Is the product packaging easy to understand?
 - Are the available licensing options clear and transparent?
 - Do the licensing options offer the right features and value for the price?
 - Is the pricing model for the platform easy to understand?
 - Is the pricing model for the platform flexible and scalable?

Analysis of BI platform attributes directs attention to modern BI systems. In recent years organizations begin the transition from a traditional top-down approach driven by IT to one based on self-service. The traditional approach to BI is becoming less and less relevant as the business demands the agility that comes with self-service to drive adoption and improve organization outcomes. This, paired with the continued exponential growth in data volume and complexity, presents IT with an important choice. The Data Discovery approach is becoming popular because DD systems are able to meet the information requirements of managers in the current socio-economic environment. The chapter attempts to present the possibilities of using Data Discovery Systems in not-for-profit organizations.

2.3. Data Discovery Systems as a Modern Business Intelligence System

One of the directions that modern management support information systems evolve in is the development of modules which enable users (managers, leaders) to utilize the collected information/data on their own, without the help of IT specialists. This kind of solutions are called Data Discovery or Business Discovery, i.e. self-service Business Intelligence (Waszczuk,2014). The aim of self-service is to facilitate access to source data for reporting and analysis, and to provide easier and enhanced access to data analysis features through simpler, configurable and collaborative end-users' interfaces. Since DD systems use technologies that allow large volumes of information to be processed fast, their analytics features are part of the visualization layer. Users have the possibility and powers to satisfy their information needs *ad hoc*, by single-handedly generating reports, formulating queries and performing analyses due to the access to multi-dimensional and multi-directional data exploration. There is no necessity to create views, use OLAP cubes or data warehouse beforehand (they can, however, be a source of the data). Users can also configure the appearance of the executive dashboards so that they meet their preferences (Waszczuk,2014). The self-service BI systems differ from the classic BI systems in several respects (Blitz,2017); they (Łada, Burnet-Wyrwa,2015):

- put business requirements of an organization and user value, not the information system, first;
- offer greater possibilities for the introduction of changes to the organization and improvement of its outcomes based on the analysis, integration, transformation and interpretation of data from multiple external and internal sources;
- enable managers to make decisions based on the information from the reports that they have generated themselves, using data which has been transformed, supplemented with additional measures and dimensions, and appropriately presented;

- track programs monitoring organizational changes, in various views on managerial dashboards individually configured by the users;
- allow data to be updated in real time, which results in instant modelling of relationships, measures, hierarchies and indicators;
- promote active selection of a wide variety of data, to be analysed from various perspectives, instead of storing fixed datasets;
- facilitate information sharing and collaboration of managerial teams and analysts, as well as offer opportunities for exchange of ideas and joint creation of new solutions for the organization;
- „bring data to life” by means of interactive graph analytics, i.e. data visualization and presentation, leading to the discovery of the hidden relationships between data items.

The users of self-service BI systems can perform complex analytics tasks even if they lack strong analytical skills or knowledge of programming languages, or they do not engage software developers familiar with SQL. All the users in a given organization can create personalized insights that meet their unique information needs (Datatechnology,2017), and the data sorted this way can be accessed by and shared with other members of the organization. The solutions are built on an open platform, which enables integration of social media data and business data. The systems can provide live data and analyses, so users can respond to each situation/query no matter what mobile devices they use at a particular moment (Qlikview,2018). Taking into consideration these attributes of the DD systems, it can be stated that they satisfy the demands of the managers of modern organizations (including not-for-profits). However, using them in organizations requires a new framework and overall strategy. This means that past decisions supporting the core foundational components of a BI system (people, process, and platform) must be revisited (Yeoh, Koronios,2010):

- **People** – a successful transition to self-service business analytics begins with people. A BI model that embraces self-service puts business users and analysts first and allows them to explore, discover, and build content that they will ultimately use to make better business decisions and transform business processes. Collaboration between the business and IT is critical to the success of the implementation as IT knows how to manage data and the business knows how to interpret and use data within the business processes they support. They have the context within which analytics and the insight derived from it will be used to make better business decisions and ultimately improve outcomes. This collaboration of the groups early on will lead to the deployment of a platform that meets the needs of the business.
- **Process** – a modern analytics solution requires new processes and newly-defined organizational roles and responsibilities to truly enable a collaborative self-service-based development process. Modern BI requires updated processes to support self-service analytics across the organization. It also requires the definition of new success metrics that IT and the business are jointly accountable for.
- **Platform** – a modern platform must address a wide range of needs and different personas as well as the increased pace of business and the exponential growth in data volume and complexity. IT requires that the chosen platform enables governance and security while end users require easy access to content and the ability to explore and discovery in a safe environment. The chosen platform must also be able to evolve with the landscape and integrate easily with other systems within an organization. The most critical aspect is the ability to meet these diverse needs in an integrated

and intuitive way without having to introduce separate products or modules to execute specific tasks throughout the process.

Leaders of not-for-profit organizations should capitalize on this market shift and seize the opportunity to redefine the role of BI and analytics as a far more strategic one, critical to the future success of the organization. However, the selection of an appropriate system may prove difficult due to great functional and technological differences between the solutions available in the market. The Gartner report evaluating Business Intelligence and analytics platforms recognizes Qlik, Tableau and Microsoft as leaders (Coughlan,2018). In 2018, Tableau was rated among the top solutions for the sixth straight year. Compared to the competitors, it still offers the broadest range of functionalities and the most attractive pricing model. This explains why Tableau was chosen to conduct the study verifying the research hypothesis..

3. SOLUTIONS AND RECOMMENDATIONS

The aim of this chapter is to present the possibility of using DD systems in effective resource management of not-for-profit organizations based on the case study of a selected organization. The work towards the goal involved forming a research hypothesis and then an attempt In the pursuit of the goal, a research hypothesis was formed and then an effort was made to verify it in the course of a study which followed a research procedure developed by the author.

3.1. Research Hypothesis

The research hypothesis to be verified was:

Data Discovery Systems bring not-for-profits internal benefits, contribute to higher resource efficiency as well as enhanced quality of the services provided by these organizations.

3.2. Research Procedure

Research methods included a critical review of literature, documentation review, analysis and synthesis, statistical analysis, induction and deduction, case study.

The following steps were taken in the research project on the possibility of using Data Discovery systems for resource management in not-for-profit organizations:

1. Pertinent literature was reviewed and the characteristics specific to the functioning of the organizations belonging to the third sector of the national economy, particularly not-for-profit organizations, were identified and described.
2. The research object – the Volunteer Fire Department (OSP) operating in Wyszaków district in Mazowieckie province was selected. The research data was extracted from the activity report and financial statement of the Volunteer Fire Department in Zabrodzie for the year 2015 (Zabrodzie,2017).
3. The users of the executive dashboard that was to be designed – the Board of the OSP in Zawodzie – were identified, and their expectations and information needs were defined.
4. The data was organized and entered into an MS Excel spreadsheet database – the dimensions and measures necessary for the analysis were established and calculated.

5. The analysis and visualization of the collected data were performed by means of the Data Discovery system – Tableau 2018.3 (Hi5data,2017).

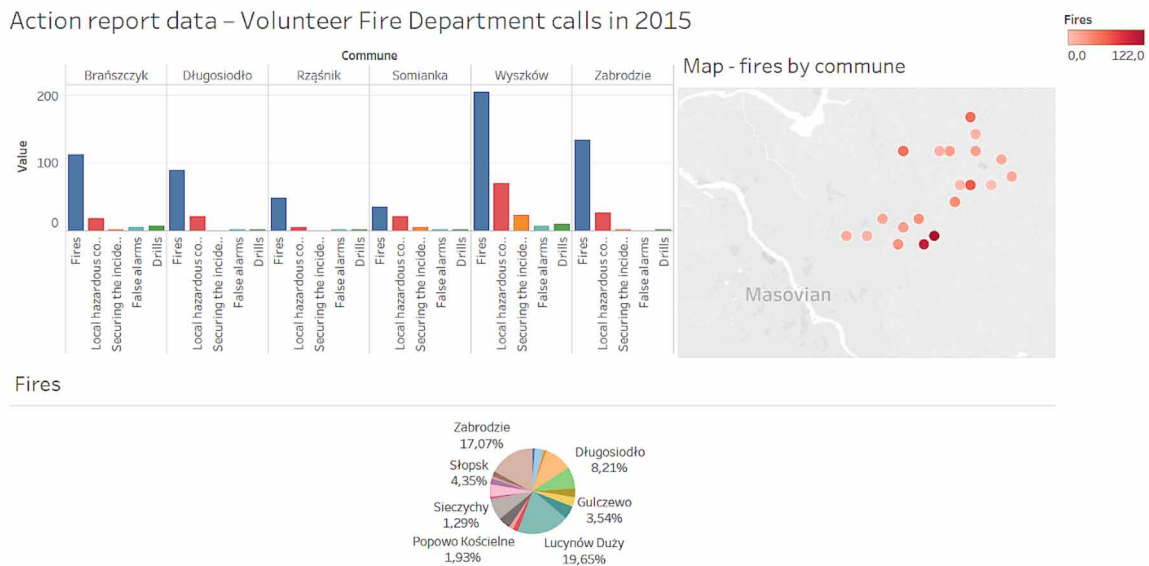
3.3. Research Findings

The study led to the development of a resource management dashboard in the Data Discovery system – Tableau 2018.3. The dashboard consists of three parts:

- part one includes information about the activities of the Volunteer Fire Department in Zabrodzie against a backdrop of the other Volunteer Fire Departments operating in particular communes of Wyszaków district (Figure 1.);
- part two presents data regarding the personnel resources of the Volunteer Fire Department in Zabrodzie;
- part three comprises information on the revenues and expenditures, and their breakdown, of the Volunteer Fire Department in Zabrodzie for the year 2015.

Figure 1. Action report data – Volunteer Fire Department calls in 2015

Source: own elaboration



Data was visualized as: horizontal bars, pie bars, symbol maps, treemaps, etc., depending on the selected dimensions and measures.

The analysis of the dashboard data enables fulfilling the users' information needs by providing information on:

- the incidents, and the frequency of the incidents, occurring in the towns and villages located in the district,

- the most/the least common incidents happening in the towns, villages and communes of the district,
- the number of particular incidents where particular Volunteer Fire Departments intervened expressed as a percentage of the total number of incidents occurring in the district,
- the lacking equipment and gear needed for the most common incidents,
- the time spent by firefighters on rescue operations,
- the dynamics of the membership increase (active, honorary and supporting members),
- the increase in the firefighters' competence,
- the amount of remunerations paid to the firefighters for their participation in rescue operations from the Commune's budget,
- the amount of the Volunteer Fire Department's revenues and expenditures and their breakdown.

The information enables managers to efficiently manage the organization by optimizing the utilization of the resources it has at its disposal. They can make operational and strategic decisions regarding, for example:

- the development of the firefighters' competencies by their participation in refresher courses and training adapted to the requirements of the most common rescue operations,
- the purchase of the equipment and gear the organization lacks,
- an increase in the receipts obtained from, e.g. the Provincial Fund for Environmental Protection and Water Management, or in business revenue,
- the management of the firefighters' working time;
- expenditure control, etc.

Summing up, the validation of the dashboard showed that its information content satisfies the demands of a not-for-profit's managers. The results of the research confirm the hypothesis that Data Discovery Systems bring not-for-profit organizations internal benefits, contribute to higher resource efficiency as well as enhanced quality of the services provided by these organizations. However, in order to achieve maximum efficiency, it is necessary to obtain more detailed data on the operational activities of the Volunteer Fire Department in Zabrodzie and other volunteer fire departments from Wyszaków district. Consequently, the organization will gain access to coherent and comprehensive information on what is happening. The dashboard user can single-handedly perform analyses and create visualizations in accordance with his/her current needs and make them available to other interested parties no matter where they are and what device they use. Detailed data collected in the data source (e.g. MS Excel, MS Access), text files (.csv, .pdf), or files from web analytics platform (Google Analytics, etc.) can be accessed any time. The cost of Tableau implementation is lower than the cost of a classic Business Intelligence system (Tableau, 2018). Moreover, the organization does not need expert IT knowledge or the latest computer set (a Windows 7 operating system will suffice) to use this software.

4. FUTURE RESEARCH DIRECTIONS

Recently, we have witnessed extreme technological advancement, which determines the daily functioning of society in various spheres of its activity as well as that of organizations, no matter what their size and industry they operate in are. There has been a growing interest in the civil society. New business needs

have arisen and new processes have occurred, whose implementation requires access to data obtained from various sources. Data analytics and visualization systems, Big Data, mobility and cloud computing – these are business technologies and models that affect and determine the direction for the ICT development. Encyclopedia of Organizational Knowledge, Administration, and Technologies, 1st Edition, will be comprised of content that highlights major breakthroughs, discoveries, and authoritative research results as they pertain to all aspects of organizational growth and development. The chapter focuses on the new generation of Business Intelligence systems, i.e. self-service analytics and data visualization systems – Data Discovery, where data is primarily used for the reporting purpose, answering the question “what happened”. An executive dashboard developed in Tableau served as an example of the possible employment of this type of software in resource management of a selected not-for-profit organization.

Future research studies into the problems covered in the chapter may deal with the implementation of the DD systems in other organizations of the third sector of the national economy, or move on to the next step of the analysis, which helps to discover “why did it happen?”. Other issues worth further investigation include mobile business analytics systems and the adaptation of cloud-based business analytics. Today, research on the deployment of such technologies in this group of organizations is severely hindered by a lack of technological competence necessary to carry out the adaptations and high implementation costs.

5. CONCLUSION

The observation of transformations taking place in the economy and the ability to spot real problems pose a huge challenge for not-for-profit organizations. They necessitate organizations improving their operational as well as strategic performance. A good example is already set by state and private organizations, which widely adopt modern analytics methods, controlling tools and IT solutions for management purposes. They have developed capacity to make decisions due to perceptive diagnosis of the existing situation and thorough analysis of high-quality data derived from within the organization and from its environment. Data Discovery Systems mirror modern approach to data analytics, improve management and thus increase the benefits gained through better access to information and proactive response to the threats that organizations face in the daily performance of principal processes (incident handling) and in the management of other resources, indispensable for the implementation of these processes (human, financial and physical resources). Due to the ever-growing interest in civil society and the necessity for not-for-profit organizations to improve their operations so that they resemble commercial companies, an attempt was made to develop a managerial dashboard for these organizations. The dashboard, which was built in Tableau, a Data Discovery system, was designed for the Volunteer Fire Department. It focuses on the management of operational activities, human resources and finance. The dashboard had to be designed as the market does not offer any IT solutions that allow efficient management of this type of organizations. The dashboard validation proves that it facilitates access to the data the organization needs, information is generated in real time, and dashboard deployment does not require that the users be IT experts and the organization have complex IT infrastructure.

Obviously, the dashboard implementation falls at some hurdles. One of them is lack of awareness that data collection and data utilization are of vital importance in the management of this type of organizations, and that today no effective decisions can be made unless they are data-based. Another one is a low level of modern ICT usage in these organizations.

It was noticed that the dashboard can be expanded by adding analyses regarding e.g. the organization's fixed tangible assets. The improvements are planned to be made in the next stages of the research project.

The research methodology can be deployed in studies into other organizations of the third sector of the national economy in Poland, and their findings can be used to compare Polish organizations with their counterparts in other countries.

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KEY TERMS AND DEFINITIONS

Asset: Something that has potential or actual value to an organization.

Business Intelligence System: A set of technologies, applications and practices related to the collection, integration, analysis, and presentation of business information to support business decision making processes.

Data Discovery (DD) System: A self-service Business Intelligence system.

Executive Dashboard: A computer interface that organizes and presents information for managers in a format that is easy to read and interpret; helps in effective management of an organization.

Information and Communication Technology (ICT): Information systems and technologies for the processing and communication of information.

Information System (IS): A computer program; enables and facilitates computer users to solve their problems.

Intangible Assets: Non-physical assets such as intellectual property.

Physical (Tangible) Assets: Within a business context, a physical asset might include a company's production equipment, its liquid funds, its product stock, and any property it owns.

Third Sector Organizations: Organizations established as a result of social initiative, motivated by a wish to serve people by satisfying their needs rather than a desire to make a profit.

ENDNOTE

¹ Efficiency refers to the relationship between the outcome, and the resources consumed and costs incurred to achieve it.

Agile Stage–Gate Hybrid Framework for New Product Development

3

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INTRODUCTION

Since 1990, New Product Development (NPD) theory has considerably evolved distinct new practices, tools, techniques, and management frameworks (Cooper, 2019; Summers & Scherpereel, 2008). New products screening models have been developed such as a study that compared US and UK manufacturing firms and which depends on the type of product (old or new). This approach was used by Xin et al., (2008) so as to compare British and German machine tool manufacturers. This discriminating method was used in the field of NPD and especially in Phases I and II of Project SAPPHO and Project NewProd Phases I and II in order to compare new products in different industries. However, a complete 100% implementation of a product development process might be a misnomer as all processes are to be both flexible and situational so that they could match the dynamics of technologies, markets, and organizations (Biemans et al., 2015). Thus the search for appropriate NPD models or different approaches has become a new emerging topic both for scholars and practitioners resulting from the new disruptive innovation environment which has challenged NPD theory and practice in recent years (Cooper, 2017; Summers & Scherpereel, 2008).

As many companies have no formal NPD systems yet, ad hoc systems provide decision makers with too many discretion which leads to mistakes. So, some companies have opted for managing NPD within a formal system in an attempt to avoid those mistakes. Yet, a need to adapt Stage-Gate models is pointed out so that higher levels of flexibility and agility can be achieved (Conforto & Amaral, 2016; Ettlie & Elsenbach, 2007). The Stage-Gate model is the world's most widely benchmarked, referenced and implemented innovation management model which has been used by companies of all sizes and it has adopted in many industries. This model is used in order to help companies to develop and launch successful new products. Despite the positive effects that this model had in many companies, Stage-Gate has attracted a number of criticisms. It focuses on the financial perspective of NPD process, it is rigid and linear and it cannot handle innovative projects (Cooper, 2014).

One of the latest results of these researches on NPD management is agile NPD, which has recently, in the early 10's emerged in an attempt to manage the increasing complexity of the NPD process. The agile methods originate from the software development industry and are being increasingly adapted by research and development industrial companies, amongst others. Software development is almost infinitely divisible and consists of million lines of code that can be broken down into one hundred increments of approximately 10.000 lines, each increment yielding a working product. It is more than obvious, that

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physical product development is something much different. The development of a new machine for example, or a new food product, or a polymer cannot be incrementalized. In such a way, therefore the concept of short time-boxed sprints cannot be applied as well (Cooper, 2014).

Recent academic findings show that agile methods are applied within the context of existing Stage-Gate NPD models. Also, what is indicated by the findings is that NPD performance is significantly improved after the implementation though rather than replacing the existing NPD standards, the agile framework is just emerged into them (Sommer et al., 2014). But studies regarding the transformation of the product development process and the integration of agile systems in the NPD process are limited. To this view, the main research questions are: Can agile be integrated with a traditional Stage-Gate model? And can the resulting hybrid model also be used for the development of physical products? (Cooper, 2017; 2016; Cooper & Sommer, 2016).

Thus, the purpose of this chapter is to provide a systematic approach regarding the implementation of the Stage-Gate model and agile software in NPD process. Authors derived recommendations for practitioners who want to study Stage-Gate and agile methods in NPD and a research agenda for academics that highlights the need for further research in this area. In addition, the resulting systematic overview is useful as a reference work for researchers in the field of NPD and helps them identify both related work and new research opportunities in this field.

The reminder of the chapter has been structured as follows: The next section describes the theoretical background regarding Stage-Gate and agile manufacturing. Then, solutions and recommendations for practitioners are discussed in next sections. Finally, conclusion and suggestions for future research conclude the chapter.

BACKGROUND

Stage-Gate Models

The NPD process is usually described as a complex set of activities taken up with a view to reduce the uncertainty regarding market needs and product process technological choices (Biazzo, 2009; Van Oorschot et al., 2010). Specific challenges that industry usually faces can be the dynamic volatile and unpredictable nature of demand, short life cycles of products, high levels of product variety and frequent product range changes and complex extended global supply chains requiring quick responsiveness to trends. Another not only significant but also gradually challenge for the industry is cost of excessive and underperforming innovation, though, that does not enhance performance and hence is superfluous rather than functional. This can be caused either by excessive NPD that dilutes overall profit margins or by design and development costs that exceed the product margin. A large number of low volume product can also be a factor since this can significantly damage relationships with vendors (Baker & Bourne, 2014; Ettlie & Elsenbach, 2007; Gunasekaran, 1999; Kettunen, 2009; Leite & Braz, 2016; Sommer et al., 2015).

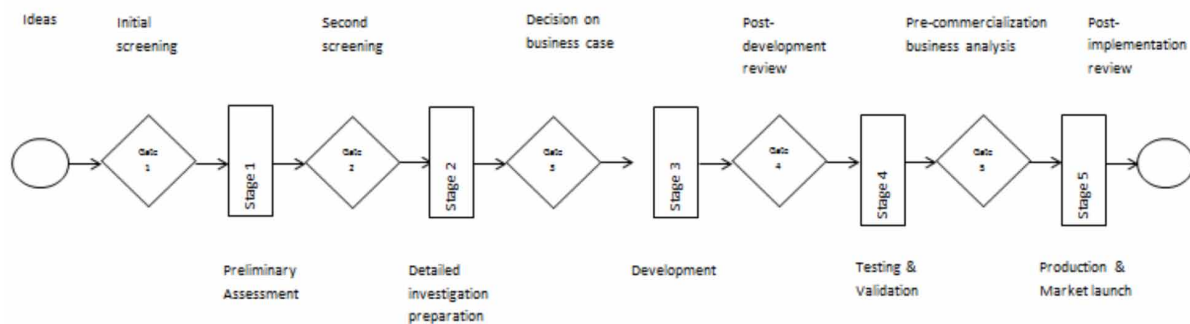
Strategically, what provides real competitive advantages for a firm drew new products well attuned to the voice of the customer, with perceived technical superiority and developed within budget while launched ahead of the competition. If managers want to increase the success rate of their new product efforts, they have to master techniques for planning, development, evaluation and control of necessary competencies throughout the NPD process, literally speaking from the generation of the new idea to launch of the product at the marketplace (Fredberg & Piller, 2011; Tzokas et al., 2004). Implementing formal processes in NPD improves teamwork communication. It also has a positive impact on new

product success rate, on its better launch and earlier detection of failures as it improves time efficiency that is shorter elapsed time to launch (Cooper, 2008).

In actual fact the element of risk of high failure rate is embedded in NPD process, so it has been acknowledged by managers that effective product evaluation is a critical factor in successful new product programs. A method of managing the risks of new products is to introduce the evaluation gate that takes place between each development stage. Using the evaluation criteria within the gate managers can assess performance from corresponding development stage in order to determine the go/no-go decision and boost the accuracy of the project (Boly et al., 2015; Chao et al., 2014; de Brentani, 2001; Onarheim & Christensen, 2012; Schultz et al., 2013; Tzokas et al., 2004; Van Oorschot et al., 2010; Wang & Lee, 2011; Wang et al., 2012).

In this view, a Stage-Gate NPD process need to find the balance between innovation and control in order to grow profits and avoid underperforming NPD striking the correct balance is crucial to drive portfolio productivity as well as to improve the financial returns on investments made to build the portfolio (Baker & Bourne, 2014). A great deal for firms that currently develop new products using the Stage-Gate or any other similar process is to improve and control NPD (Sethi et al., 2012). The Stage-Gate model is the world's most widely benchmarked, referenced and implemented innovation management model which has been used by companies of all sizes and it has adopted in many industries. This model is used in order to help companies to develop and launch successful new products. It was designed including stages and gates that provide a holistic view of the idea to launch process that allow rapid, profitable and successful NPD (Stage-Gate International, 2019). Figure 1 presents the Stage-Gate model.

Figure 1. Stage-Gate Model



Each stage includes unique activities that can be implemented cross-functionally and iteratively in order to measure the business impact through the product design activities. Seasonal strategy planning, concept development, product specification development, physical prototype development, final range review and launch at the market are the typical key stages in product development. What is dictated by a systems approach is that there must be input and output as well as feedback and feedforward loops at each stage of the process (Bendoly & Chao, 2015; Baker & Bourne, 2014; Cooper, 2008; 2006; de Brentani, 2001; Karlstrom & Runeson, 2006; Sethi et al., 2012; Wang & Lee, 2011; Wang et al., 2012). Strategic goals, quality/value, people, process, customer and revenues/costs are included in the dimensions of metrics in gates. Only if the evaluation is completed and meet the criteria a project pass into the next stage. The process is controlled by many gates that include quality control checkpoints in order to assess the production process (Wang & Lee, 2011; Wang et al., 2012).

A set of criteria are used in gates in order to evaluate the process. More specifically, in the idea of screening gate managers have to evaluate the technical feasibility and uniqueness of the product idea concerning the market potential and perceived customer acceptance. The aim of this gate is to select the “right” ideas for further exploration. In the concept-testing gate, the idea is assessed according to customer acceptance and technical feasibility to decide whether to proceed with a formal business analysis of the product concept or not. In this stage, managers aim to collect more information regarding the technical characteristics of the idea. Next, in the business analysis gate managers have to decide if the project is going to be continued or not, so they focus on criteria such as sales objectives, sales in units, margin, and profit objectives set by management. In the product testing gate, managers evaluate the developed product according to the quality, the performance of the new product and its technical feasibility. This stage is crucial because managers have spent a part of the initial budget and the available resources which will be reduced in the launch stage. So they have to think if they have to decide on continuing the project or not. In the test market gate, the prototype of the product is available to the potential customers who give feedback to managers according to the product. The most frequently used criteria are the performance of the product, its quality, the customer acceptance and satisfaction. In the launch gate, managers consider of customer satisfaction in the long term, so the criteria used are customer satisfaction, sales objectives and market profit (Carbonell-Foulquié et al., 2004; Tzokas et al., 2014; Wang & Lee, 2011).

The last decades, next-generation of Stage-Gate model was developed in order to fluid requirements and to provide the right level of control. The next-generation of Stage-Gate is adaptive and it aims to be more agile, vibrant, dynamic, flexible gating process that is leaner, faster, and more adaptive and risk-based. It includes spiral or iterative development in order to produce new products that are based on customers’ requirements. Furthermore, this system is more flexible because it adopts market needs. Managers try to identify the risk in the beginning of the process. The next-generation idea-to-launch system is also agile because it produces deliverables that can be demonstrated to stakeholders. Finally, this system is focused on accelerating the development process. Employees for different business functions of a company participate in order to increase the speed of product development. In this system the stages are replaced by the fuzzy front end approach (Cooper, 2017; 2014).

Agility Software Development and Principles

In an attempts to define Agile Manufacturing (AM) researchers could state that it is a production model aiming at responding to changes of the environment with a view to providing flexibility, speed, quality, service and efficiency via the combination of high tech; highly qualified human resources and organization (Eklund et al., 2014; Gunasekaran, 1999; Karlström & Runeson, 2006; Leite & Braz, 2016). Electronics and software have been introduced into many products for the last two decades. More often, these products are developed in large, sometimes very complex, industrial projects with a more or less, elaborated R&D process which is governed by a Stage-Gate model in order to arrive at the finished design of the product (Eklund et al., 2014). This philosophy have profoundly affected companies as it can be seen from many perspectives: the one on companies that follow AM and have highly customized products that configure to one another; the one on companies that form relationships with long term customers that contribute to the development of products, also on those that have multidisciplinary teams capable of simultaneously developing product and production design. Other companies appeal to scientific knowledge and take support from production technologies, those who have modular production equipment and flexible and reconfigurable processes, on those that present strategic partnerships and

focus on customer satisfaction and finally those that have the ability to obtain and share inter-company and information quickly (Leite & Braz, 2016).

AM could be described as an integrated business concept consisting not only of the actual business planning and control but also of areas as business interfaces, supply chains and workforce factors. New product design is one particular part of it (Kettunen, 2009).

Nevertheless, what companies must be able to achieve, is to compete in sustainable ways. So, bearing in mind the considerations mentioned in the previous section the concept of AM was conceived in the early 90's so that it could address them. Many of the AM principles are of general purpose and technologically independent by nature. Software product development and software production both have certain unique properties and profound difference in comparison with typical manufacturing operations. But how exactly these two fields are related how much cross-domain know edge could be shared is not obvious to a great extent (Kettunen, 2009; Leite & Braz, 2016).

Agility is not unique when it comes to manufacturing. Neither is NPD nor software development. Many industries need more adaptive operative capabilities when they face unpredictable changes in product demands and customer needs. These adaptations are the key driver to flexible manufacturing systems. So, eventually the entire value network of the company, including the NPD function and the software development, can be viewed with respect to agility by following that line of strategic thinking (Kettunen, 2009). Software production has certain intrinsic characteristics traits when compared to manufacturing and NPD in general. Those are the potentially very fast (order of hours) development cycles (time of change), the fact that there are usually no physical rework constraints (cost of change) that radical redesigns are possible even at a late stage (magnitude of change). As a result, some of the limitations of traditional (hardware oriented) product development can fundamentally wait around, thus enabling a radical NPD process along with the accompanying management principles. This is where the current agile software development model basically stems from (Kettunen, 2009).

What determines the overall mode of operation of a manufacturing company is its strategy. This strategy should be shaped according to the competitive environment drivers by an intelligent agile manufacturer. Then, the strategic mode of operation could be set along with the dimension of "change proficiency" and "speed to customers" (Kettunen, 2009; Leite & Braz, 2016). Seeing agility from the company's wide strategic point of view is the key to truly mastering it both in manufacturing and NPD software development. The net-effect of the whole value chain is the flexibility (agility) of the company product creation and manufacturing. The overall company strategy consists of a hierarchy of sub strategies which are the function one. It is the function strategy that determines how the manufacturing part operates. In the same way there should be a function that defines how the software product development operates, bearing in mind through that it is important to understand the nature of that software development (Schuh et al., 2018).

A company's strategy based on added value so as to satisfy the customer with highly customized products of high quality is linked with the principles of AM. These principles require flexible processes, speed of response from suppliers, reduced life cycle of processes, business corporation within the supply chain, use of high tech and highly qualified human resources. So, briefly, the company with the most favorable condition for the application of AM is the one that differentiates the product offering in contrast with the competition. Such a company operating under the AM is one with a competitive strategy based on differentiation, which can be achieved by product development teams. It is their work which will be the key to the success of this strategy (Chuang et al., 2014; Leite & Braz, 2016).

FOCUS OF THE ARTICLE

Agile Manufacturing and Stage Gate Integration

The importance of adapting and combining AM practices with more traditional NPD processes (e.g. Stage-Gate) so as to improve flexibility and response to changes in uncertain and dynamic project management has been shown by recent studies. By eliminating activities that add no value to the product development and by using a minimal set of rules, agile methods can be focused on flexibility. These methods are based on a series of iterative development cycles, promoting self-management and self-discipline attitudes, so as to help the team to be readily responsive to changes. Different approaches, such as iterative development, should be considered by managers so that they could deal with different types of projects. It can be seen from this perspective that the combination of AM and Stage-Gate approaches could be explored as alternatives when dealing with the challenges of managing product development projects in highly dynamic business environments (Ciric et al., 2018; Conforto & Amaral, 2016).

NPD for manufacturers cannot be sufficiently supported only by agile. This is may a great deal of manufacturers of products from food to machinery are becoming more and more interested in hybrid development processes that combine agile with Stage-Gate, even IT development is not involved. Some of the early adopters of this method have already found out that the benefits of adopting such a hybrid approach are significant. This approach contributes to flexibility in product development, to high level of differentiation, to high customization levels in some product lines and to the involvement of different teams depending on project (Cooper, 2017; 2016; Cooper & Sommer, 2016).

The idea-to-launch process is broken into a series of five or six discrete stages by the Stage-Gate. These stages begin with the “idea generation” and more to “product launch” and beyond. Stage-Gate model is cross-functional and it involves people from marketing, sales and operations as well as the technical personnel but when the fact that each stage is a gate where decisions to invest or Go/Kill are made by analyzing whether managers are doing the right, proceeds then such a model is seen as being to linear, too rigid and too planned. For all these reasons is concerned to be unsuitable to deal with today’s fast-paced and, more often than not, quickly changing worlds (Cooper, 2016). So questions such as how reductions in particular stage times impact value or whether time reduction efforts should focus on particular stages in the process have to be answered (Bendoly & Chao, 2015). Early commitments to large features, long schedules, long feedback loops and the replanning, which are inherent to traditional product development processes, create inefficiencies and slow the development cycles. Agile methods offers both greater efficiency and focus, and Stage-Gate provides with a means of coordinating with other development teams and with a communication with functions such as marketing and senior management

Table 1. Comparison between Stage Gate and Agile method

	Stage-Gate	Agile
Type	Macroplanning	Microplanning, project management
Scope	Idea to launch	Development and testing, can be expanded to pre-development
Organization	Cross-functional team (R&D, marketing, sales, operations)	Technical team (software developers, engineers)
Decision model	Investment model—go/kill decisions involve a senior governance group	Tactical model—decisions about actions for next sprint made largely by self-managed team

are of great importance (Cooper, 2016). In Table 1 a comparison between Stage-Gate and agile method is presented (Cooper, 2017; 2016; Cooper & Sommer, 2016; Prebble et al., 2008).

The Hybrid Model

Models combining the two processes have already been presented by researchers. These models are framework comprising the Stage-Gate model and five dimensions. These dimensions are: (1) phase and project deliverable model (PPDM); (2) project planning and controlling white board (PPCW); (3) weekly activity planning white board (WAPW); (4) project management software (PMS); and (5) simplified performance indicator system (SPIS). With intent to satisfy the requirements of each phase-review milestone (or phase gate) of the product development process, each project phase can have as many iterations as necessary.

The levels of this hybrid model are three. The first one is the Stage-Gate model, represented by for the entire project by the PPDM, its phases, milestones, and macro-deliverables related to the product and technology development phases. The second level refers to the iterative development, also called “sprints” in the Scrum agile method in which the deliverables from the product back login are break down (by the team) into smaller ones, or into tasks and also the order of development is both prioritized and defined during the iterative planning meeting (or sprint planning). There are time-boxed iterations, usually of a 15-day length, during which these tasks are performed. The general set of deliverables and tasks to be performed in each phase are represented by the PPCW which is a physical visual board that evolves during the project life cycle. PPCW could be compared with the product back log described in the Scrum Agile method. As for the third level, this is performed either on a weekly or on daily basis and it bears similarities to the iteration plan or the sprint back log. It is called WAPW and deals with the assignment and performance of daily or weekly tasks. All these three levels provide with information that can be registered in the PMS.

As soon as a new project has begun, the iteration cycles guided by the PPDM (Stage 1) starts by defining the main phases as well as the project deliverables. This is an important element as it aims at guiding the team into the main phases of the product development process. This is why all the main deliverables and documents that are considered as key outputs as for the product and the project that is executed are included in the PPDM. Needless to say that the previously mentioned elements have to be specifically related to the type of project and the particular industry sector.

After the definition of the PPDM and once the team has acquired a broader view of the macro-deliverables in terms of the project, the iterations are collaboratively defined by both the project manager and the team members. At this stage the iteration length, is defined. This length usually is a period of two weeks, that is to say 15 days but that is something basically dependent on the type of project so it can be different when necessary. According to this model the phase length that reflects the characteristics of the project type and of the industry sector is usually longer compared to the iteration length. The PMD is used in the IVPM2 so that project data and information regarding cost, schedule and progress can be documented and also registered, in order to help the team generate reports. These are useful for both the evaluation of the phase review meeting and the iteration performance.

After the PMS (Stage 3) is over, the deliverables must be broken down into activities and tasks that are to be executed during the iteration (sprint). They also have to be placed in the WAPW (Stage 4) so that the work that has to be performed on a weekly basis can be illustrated. During the fifth stage, the performance can be on a weekly or sometimes on a daily basis and this procedure is supported by rapid, focused team meeting which are called “stand-ups” or “daily Scrum”. In other words, what members

need to deliver and what the issues or challenges are, are regularly discussed by the team so that the project manager can proactively address these problems. So, at the next stage (Stage 6) with the help of the PMS the project manager is able to generate performance reports and provide the team with an overview of the project progress. Finally, based on this information, decisions considering the improvement of the process are made, both by the project team and the manager. They also discuss upcoming risks and obstacles in order to plan for the next iteration cycle (Stage 7) (Conforto & Amaral, 2016).

Cooper & Sommer (2016) conducted a case study in order to validate the Agile Stage-Gate model in LEGO. LEGO started an innovative new-product project, Story Starter which was an educational solution that aimed to create confident writers and readers in elementary schools. The product was digital so managers could not use the traditional Stage-Gate model and they need a hybrid development method. This method would increase customer interactions and improve project productivity. As the product was digital, the digital solutions group used agile methods for software development. The benefits were significant, so they decided to use these methods for the entire project. Managers decided to keep the strategic benefits of their Stage-Gate model, so they incorporate these systems. The team used sprints and scrums to develop the project. Sprint reviews were important in order to identify customers' requirements. The AM was incorporated into the project during the development phase and continued into the implementation phase in their Stage-Gate model. The team communication, the productivity were increased and problems were reduced.

What was found by the researchers though, was not only that integration did work, with both models having indeed been compatible but also that several major payoffs were yielded by this hybrid approach. The advantages of Stage-Gate and AM have been both well researched and documented. In this hybrid model customer feedback and unfinished product features are prioritized and drive the sprint circle. Sprint planning produces a realistic and achievable action plan for the sprint. Daily scrums ensure constant team communication as the team implements the planned tasks, and produces the next product increment. Finally, team empowerment is a side benefit of the daily scrums. Some challenges regarding the Agile Stage-Gate model is the poor of knowledge management across functions, resource allocation delays and the bureaucratic project documentation. Furthermore, the financial and business analysis should be done in the same way with the traditional Stage-Gate model and product requirements should be defined at the beginning of the process in order to reduce risks (Cooper, 2016; Cooper & Sommer, 2018; 2016; Sommer et al., 2015).

SOLUTIONS AND RECOMMENDATIONS

Although the benefits of the Agile-Stage-Gate hybrid development model are defined, hardware developers and manufacturers are not informed about the importance this new approach. What is required by this hybrid method is that the project team should early and cheaply develop a physical or visual project and quickly present it to the customers to get feedback. In contrast, the traditional Stage-Gate methods require that before development begins the problem should be both identified and defined by conducting investigators. So during these early stages, or "homework phases" the project team has to undertake all markets, technical and business assessments so as to be able to define the product and to justify the project financially, while in an agile or hybrid approach requirement do not have to be defined before development but they are gradually established being a part of the solution-finding process. An advantage of this method is that teams are forced to focus on large-finalised lists of requirements or features. Time-boxed sprints, and event time-boxed tasks within sprints, bring a sense of urgency to the development

project making project teams commit to certain deliverables at the beginning of each sprint and thus being under pressure to deliver them within the agreed timetable (Cooper, 2016).

The fact that agile method calls for daily meetings provide teams with powerful face-to-face communications which is far more efficient than what can be provided with written documents. Also fast and continuous feedback given by the customers in terms of a product features helps to the creation of a more efficient project and subsequently of a better product. The whole procedure leads to cross-functional and more effective teams that have good internal cooperation and communication- both elements frequently cited as the key not only to increased speed to market but also to higher success rates in NPD (Cooper, 2016).

FUTURE RESEARCH DIRECTIONS

Although it has arisen some case studies there is still a large gap in exploratory studies, it is essential that this gap should be bridged in order to better establish and develop the hybrid model. Future research is essential to be conducted so that starting points and practical examples of development and implementation of agile systems can be clearly stated in terms of the management of service oriented organisations (Mircea & Andreescu, 2010).

Researchers do not know for sure what the critical factors or characteristic of the team, the project environment and the organization that will favor the use of all practices, its tools and techniques are. It is highly likely that they may include team characteristics, people competencies, organizational culture, structure and available resources or probably technology uncertainty and market characteristics. For these potential factors additional investigation is strongly recommended. So, taking multiple cases into consideration what should be identified is firstly, the importance of these factors and secondly which of these might affect the adoption of hybrid frameworks under different organizational and project conditions (Conforto & Amaral, 2016).

As the importance of the service sector both in developed and developing economies has been on the increase, attention has focused on the problems of managing service organizations. At the same time, increasing customers expectations, competition and speed of technological development force service organisations to constantly look for new approaches to service design and to delivery. Opportunities to develop new, improved services are offered by new methods and technologies. This is why New Service Development (NSD) is regarded as an essential part of a procedure so as to profitability or viability of existing services via increased sales and cost reduction, to attract new customers and to create loyalty amongst existing ones (Raman et al., 2017; Smith et al., 2007).

However, there are many new services which fail to achieve their either financial or any other objectives resulting in customer dissatisfaction with potential long-term consequences. Research has shown that service organizations do not adopt formal process while the NSD process itself offers a considerable scope for organizational conflict, inefficiencies and poor decision making (Kitsios & Kamariotou, 2016a; b; Smith et al., 2007; Witell et al., 2014). Applying the Stage-Gate model in NSD an emphasis on the analysis of the products fit with organizational objectives and resources is provided. Also the emphasis of this model on decision points (gates) can be extremely helpful as without having appreciated the impact of design decisions the costs of progressing service design would be significant (Smith et al., 2007).

Not only NPD, but also servicing companies have to be re-organised if they wish to overcome the challenges of the 21st century. Nowadays the needs of customers are highly specific but at the same time are rapidly changing. Although they ask for high quality products that keep them not just fully

satisfied but also delighted they wish these products so be of a low cost. As long as a company wants to be competitive in the market so as to survive it should respond to these new, rapid, continuous but yet predictable changes. In this competitive environment a flexible, adaptive and responsive paradigm should be developed by future researchers who can combine agile software and the Stage-Gate model in order to evaluate its effectiveness in services. Case studies could be used to apply the hybrid model in different services (e.g. hospitality, financial, e-government) and provide recommendations to managers about the improvement of the NSD process (BüyüKözkan et al., 2004; Gunasekaran & Yusuf, 2002; Juhola et al., 2014).

CONCLUSION

The purpose of this chapter was to provide a systematic approach regarding the implementation of the Stage-Gate model and agile software in NPD process. Authors derived recommendations for practitioners who want to study Stage-Gate and agile methods in NPD and a research agenda for academics that highlights the need for further research in this area. In addition, the resulting systematic overview is useful as a reference work for researchers in the field of NPD and helps them identify both related work and new research opportunities in this field.

In general, independencies bring the software product development closer to the AM. In addition, many of the product design principles in AM (e.g. modularity, customization) can be directly applied to the software production. On top of that, enterprise level concepts such as collaboration, core competence management and workforce factors are basically technological independent (Kettunen, 2009). Although it has arisen some case studies there is still a large gap in exploratory studies, it is essential that this gap should be bridged in order to better establish and develop this philosophy. A lack of exploratory scientific research leads to conflicting and even contradictory perspectives of several authors (Conforto & Amaral, 2016; Leite & Braz, 2016).

Despite the great differences between structured and flexible approaches and the fact that literature concerning NPD framework is evolving, yet studies are limited when it comes to understanding the benefits and the limitations that derive from the combination of different practices through approaches that meet current state of technology and product development in today's changing and competitive business environments. So, allegedly there is a lack of empirical studies that could show whether the combination of Stage-Gate and AM can contribute to agility and consequently to better project and product development or not (Conforto & Amaral, 2016). One example that illustrates that is that researchers do not know for sure what the critical factors or characteristic of the team, the project environment and the organization that will favor the use of all practices, its tools and techniques are. It is highly likely that they may include team characteristics, people competencies, organizational culture, structure and available resources or probably technology uncertainty and market characteristics.

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KEY TERMS AND DEFINITIONS

Agile Manufacturing: An organization which has developed tools, processes, and skills to develop products that meet customer needs and quickly respond market changes.

Agile Software Development: An approach which is used by organizations that combine requirements and solutions of software development to develop products enabling cross-functional teams and customers or end users.

New Product development (NPD): A holistic process which includes the stages of launching a new product to the market.

Software Design: A specification of a software artifact is developed in order to achieve specific objectives, intended to accomplish goals, using a set of primary components and subject to restrictions.

Software Development: A planned and structured process of designing, programming, writing, and testing the source code in order to create and support applications, frameworks, or other software components.

Software Development Process: The division of a software development project into distinct phases in order to meliorate project management, product development and product design.

Software Prototyping: The development of prototypes of software applications (e.g., incomplete versions of a software program which has not been developed yet).

Section 4

Business Information Systems

Research Trends in Information Systems From the Management Discipline Based on Co-Occurrence Analysis

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INTRODUCTION

There is a generalised consensus on the notable role that information systems and technologies (IS/IT) play in organisational performance (Mithas and Rust, 2016; Chen et al., 2014; Sabherwal & Jeyaraj, 2015; Wamba et al., 2017). The literature has traditionally associated the impact of IS/IT with technical and operational factors related to cost reduction and improved efficiency and productivity (e.g. Markus et al., 2000; Gattiker and Goodhue, 2005; Kale et al., 2010; Rouhani and Mehri, 2018). Recently, however, its impact seems to have been demonstrated in other management factors, such as those related to the satisfaction and motivation of human resources, their communication and internal coordination, their performance in decision making and in improving quality and services to clients (Shang and Seddon, 2000; Al-Mashari et al., 2003; Kale et al., 2010; Rouhani and Mehri, 2018) as well as strategic factors, linked to internationalisation (Morikawa, 2004), management of cooperation agreements (Sarker et al., 2012), organisational learning (Shang and Seddon, 2000) and innovation (Simao and Franco, 2018; Singaraju et al., 2016).

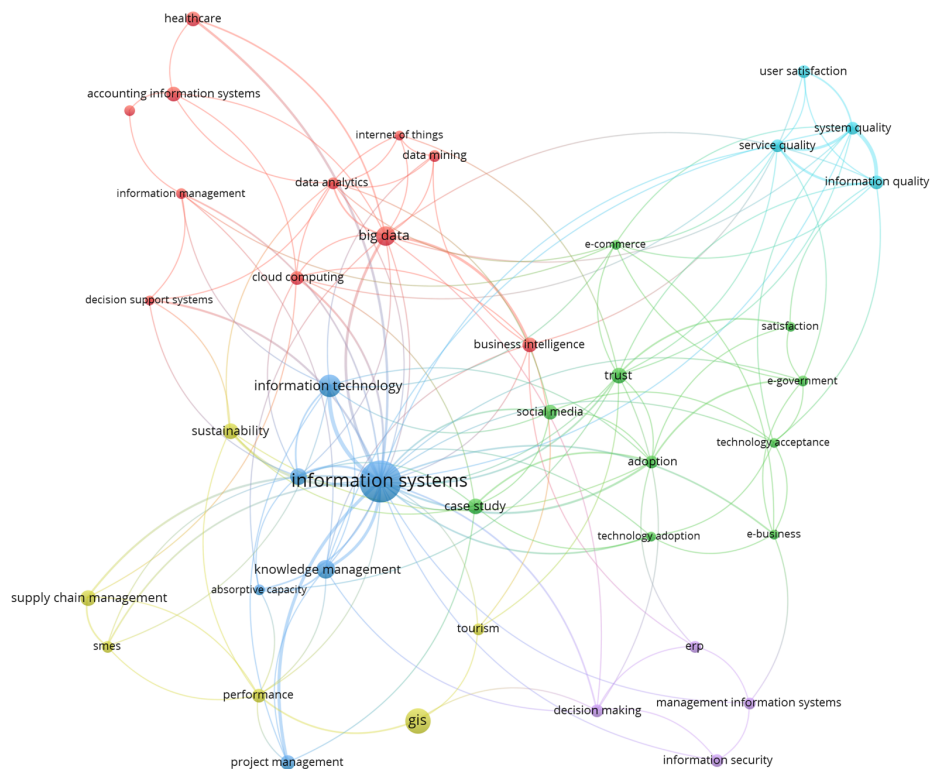
IS/IT support has thus led to the development and implementation of new organisational and inter-organisational business models (Loebbecke and Picot, 2015), which favour the creation of virtual clusters (Hernández and Peiró, 2013), improve the supply chain (Vendrell-Herrero et al., 2017), and even enable more sustainable strategies linked to the circular economy (Jabbour et al., 2017).

This evidence has been widely explored and recognised by both business practice and academia (Chen et al., 2014); as a result, the literature on information systems has acquired considerable relevance in the field of business administration due to its major role in the strategic process (Whittington, 2014). A growing number of journals now specialise in information systems and have a major impact in the field of management knowledge; some examples are MIS Quarterly, Journal of Information Technology, Journal of Strategic Information Systems, Information & Management, Information & Management, Journal of Management Information Systems, and Information Systems Research.

In order to observe the impact of information systems research on the scientific community, we carried out a bibliometric study based on an analysis of the concurrences (Lou and Qiu, 2014) of the key words used in publications on the subject. This type of quantitative analysis can reveal the structure that supports a certain topic in a discipline and its evolution, as well as the most relevant related concepts.

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Figure 1. Network of key concepts with the greatest concurrence linked to information systems (period 2016-2019)

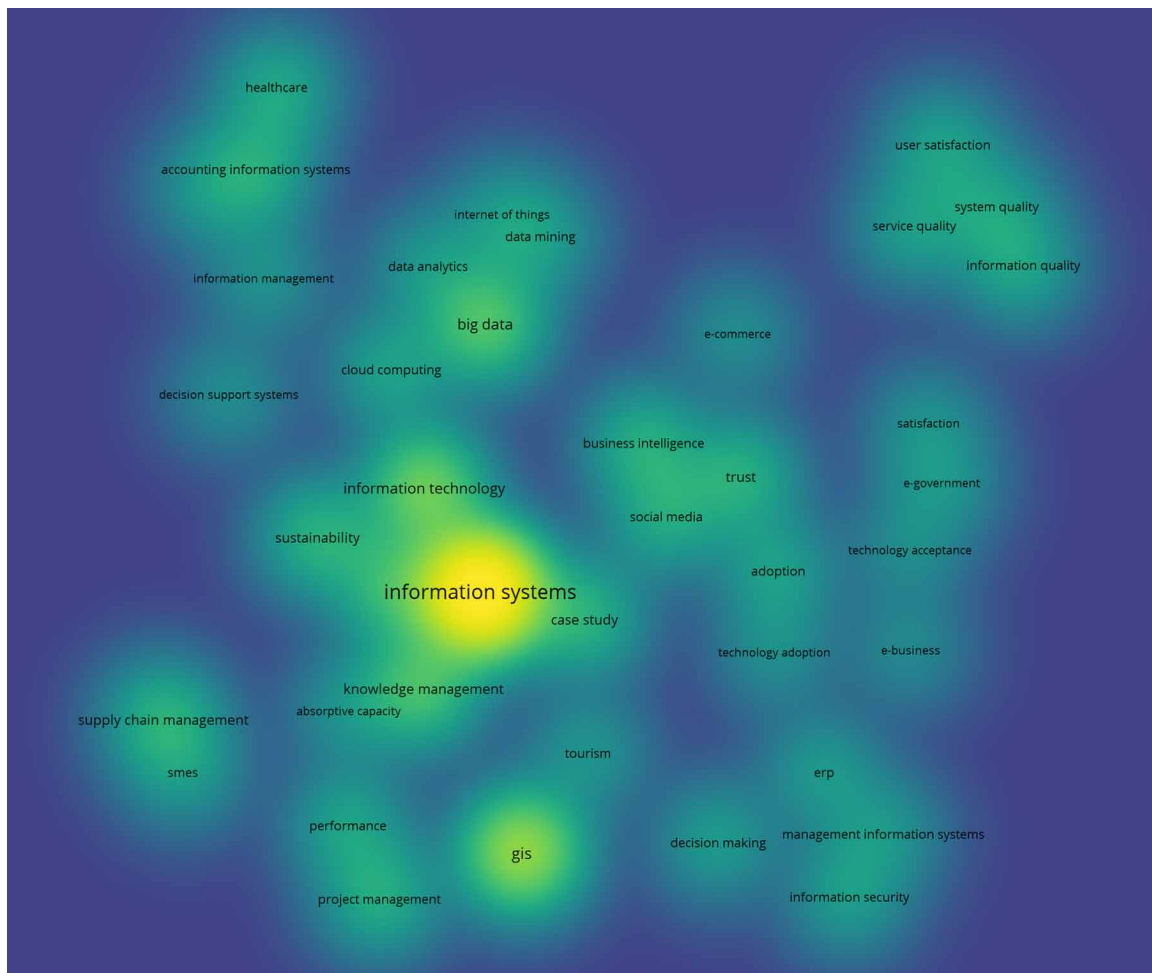


Our search strategy in the Scopus database was to first select all articles in the business, management and accounting category for the period 2016-2019 (up to 6 February 2019) whose keywords include information systems. This search yielded an input of 1,778 scientific articles. We then analysed these articles using the VOSviewer program to identify the most frequent keywords, which are highlighted in the figure and tables below.

Specifically, Figure 1 displays the nets, while Figure 2 displays the densities of the nets. Both figures were created by taking the 7737 keywords (introduced by the authors), filtered to obtaining a minimum of eight occurrences; this process resulted in 42 keywords related to the information systems in the articles of the area of business, management and accounting.

Based on this information, the next step in this bibliometric study is to conduct a cluster analysis of these 41 concepts (Wang et al., 2006). Specifically, the program displays six clear groups of theoretical analysis, as shown in Tables 1-6. In what follows, these six clusters are described together with their main focuses of analysis and publications in the literature.

Figure 2. Density of concepts linked to information systems



BACKGROUND

The first cluster obtained, labelled **Data Analytics**, includes a series of tools and methods that allow the capture and, above all, the strategic processing and exploitation of data to support decision making (Shollo and Galliers, 2016). These tools provide valuable support to improve the exploitation of environmental opportunities and face threats.

This cluster brings together the literature on *big data*, *business intelligence*, *cloud computing*, *data mining* and *the Internet of Things*, which also includes specific applications for *accounting information systems* and *healthcare*.

In fact, according to authors such as Trieu (2017) many of the above terms – business intelligence (BI), business analytics, big data and data mining are used indistinctly in the literature. Gartner (2013) defines BI as a set of applications, tools, infrastructure and practices that allow the access and analysis of information to optimise performance and decision making. In other words, BI transforms information into knowledge for strategic decision making.

This cluster also integrates one of the most relevant concepts in the literature, after information systems, namely big data, which provides the necessary data structure and methodologies for strategic analysis (Kowalczyk and Buxmann, 2014).

Big data is closely interrelated with the analytical components of business intelligence (Chen et al., 2012), considered one of the most influential technologies in organisations for its decisive role in strategic management (Horkoff et al., 2014), in its dynamic capacities (Wamba et al., 2017) and adaptation to the market (Enrevelles et al., 2016).

According to authors such as Chen et al. (2012), data analysis systems have evolved in different stages, from techniques such as accounting information systems, increasingly oriented towards the incorporation of both economic and social and environmental objectives (Schaltegger and Burritt, 2017; Dillard et al., 2016), to data mining for statistical analysis (e.g. classifying data, clustering them, analysing their associations, time series and other outliers) of large data aggregates, such as those derived from the most highly evolved systems, based on sensors and mobile applications; one example is the Internet of Things.

These authors highlight the widespread application of the advances in this type of computing to intelligent health and well-being, which demonstrates the importance of developments of information systems in the literature on health sciences, not only for the collection of data on patients, but for their analysis, research, diagnosis and treatment (Raghupathi, 2016; Wang, King and Byrd, 2018). These advances have an important impact for end customers and for public health policies.

Also linked to data analysis systems, cloud computing is conceived as a form of information technology outsourcing (Schneider and Sunyaev, 2016). It is a powerful technology that removes the need to maintain expensive computer hardware, dedicated space and software. This type of technology radically changes the way companies manage their IS components – applications, telecommunications, equipment and databases – in a customised environment with quality assurance (Wang et al., 2008). Such is the rise of these systems that a massive growth has been observed in the scale of data or big data generated through cloud computing (Abaker et al., 2015).

The systems evolving in the Internet of Things, together with other information technologies related to robotics, artificial intelligence, networking and knowledge management, such as blockchain, form the basis of this new Industry 4.0 paradigm. The main goals of Industry 4.0 are to achieve higher levels of operational efficiency and productivity, as well as greater automation and customisation of production (Li, 2017). Therefore, although the bibliometric analysis does not report the concept of Industry 4.0 as a key word in the business, management and accounting fields, it should be recognised as a relevant subject to include due to the disruptive effects it is having on supply chains, business models, and business processes (Shafiq et al., 2016).

The second cluster, labelled **Intra and Inter-organisational Electronic Interchanges**, covers the literature on *social networks*, *e-commerce*, *e-government* and *e-business*. Other concepts integrated in this group, which largely determine the success of electronic media in the management of intra- and inter-organisational relationships, are the degree of *adoption and acceptance of technologies*.

E-business is any exchange of goods, services or information between several companies (business-to-business), or relations between company and consumer (business-to-customer, intra-company such as business-to-employee), with the administration (business-to-administration) or between two consumers (consumer-to-consumer). The OECD Handbook (2005) defines the term e-business “as actions that significantly introduce different organisational structures, in order to implement advanced management techniques, or establish new or substantial changes in strategic direction”.

The growing development of the Internet has favoured the diffusion of social networks as a means of collaboration, creation and sharing of knowledge, between organisations and individuals through web

Table 1. Cluster 1 relative to Data Analysis instruments

CLUSTER 1: DATA ANALYTICS	
<i>Concept</i>	<i>occurrences</i>
Big Data	32
Business Intelligence	19
Accounting Information Systems	17
Healthcare	17
Cloud Computing	15
Data Mining	12
Data Analytics	11
Business Process	10
Information Management	10
Decision Support System	9
Internet of Things	9

Source: the authors, based on Scopus data

and mobile applications. Specifically, the analysis of e-commerce through mobile devices has led to the incipient analysis of m-commerce (Shin et al., 2018). This impact is transferred to the organisational level in the creation of new processes and capacities, above all, linked to the management and satisfaction of consumer needs (Lee and Kim, 2017).

E-commerce has been highlighted as a key lever for the development and growth of small and medium-sized enterprises in both developed and developing countries (Kurnia et al., 2015).

A growing number of studies highlight the importance of social networks in improving the transfer and flow of knowledge among the employees of a company (Razmerita et al., 2016), and, therefore, the processes of knowledge management and organisational learning (Zhang et al., 2015).

According to Al-Hujran et al. (2015: 189) “Electronic government refers to the use of information and communication technology (ICT) tools and applications to enhance government transparency and accountability in public administration by improving public services delivery, access to information and services and public governance”.

The main objective of e-government is not to implement new IT systems to automate traditional public service processes, or to add a new online service delivery channels per se, but rather to improve transparency, accountability and public sector governance (Chatfield and Alanazi, 2015).

The adoption and acceptance of social networks and IT by users for both commercial and public service access purposes depends largely on their level of trust. Previous e-government research has therefore highlighted the importance of trust as a determinant of citizen adoption of these services (Al-Hujran et al., 2015; Venkatesh et al., 2016). Trust can be classified as trust in the entity providing the service, and trust in the technology through which the service is provided.

The influence of social networks has also spread to achievements in open innovation and co-creation (Singaraju et al., 2016) and creation of value for society, through actions of crowdfunding (Agrawal et al., 2015), which connects financing parties with the developers of a project, and crowdsourcing (Xu et al., 2016), which promote the development of technologies applied to the acquisition, integration and analysis of large data derived from different sources in urban spaces (e.g. sensors, vehicles, buildings and people) in order to protect people’s safety and prevent disasters.

Table 2. Cluster 2 linked to Intra and Inter-organisational Electronic Exchange

CLUSTER 2: ELECTRONIC INTRA AND INTER-ORGANISATIONAL EXCHANGES	
Concept	occurrences
Case Study	21
Trust	20
Social Media	17
Adoption	14
Technology Adoption	14
E-government	10
E-commerce	9
Satisfaction	9
E-business	8
Technology Acceptance	8

Source: the authors, based on Scopus data

Social networks have promoted consumer interaction and have driven the creation of rating forums, forcing companies to improve their practices and invest in innovation (Kim and Chen, 2015).

Finally, keywords such as case study and trust are also included in this group. Trust is again postulated as a key precedent for the success of both the organisation's use of technology (Söllner et al., 2016) and the social networks and e-commerce it establishes with end consumers and society in general. In this line, the marketing literature has extensively studied user confidence in electronic relations with companies, as well as user behaviour patterns in social networks (Chang, Yu, and Lu, 2015).

Dynamic Capabilities is the concept used to refer the third theoretical group covering the main constructs with the greatest concurrence in the literature, *information systems* and *information technology*, which denotes the centrality and impact of the topic, as well as the main constructs linked to the literature on dynamic capabilities such as *knowledge management*, *innovation* and *absorptive capacity*.

The literature on dynamic capabilities is grounded in the seminal works of Teece et al. (1997) and Eisenhardt and Martin (2000), and emphasises the processes and capacities of organisations to introduce new endowments of resources and capacities and/or to reconfigure and transform existing ones.

Knowledge management is now a very prolific line of research in information systems, encompassing both internal creation within the company and the acquisition of knowledge from sources external to it (Forés and Camisón, 2016). The use of IT/IS play an important role in the external creation and sharing of knowledge, facilitating the creation of the virtual communities necessary for open innovation (Cui et al., 2015).

Other processes covered by this knowledge management, in which IS/IT are necessary, refer to the sharing of knowledge within and outside the organisation (Loebbecke et al., 2016) and to the management and application of this knowledge for its subsequent exploitation to create value (Cegarra-Navarro et al., 2015), in terms of organisational (Simao and Franco, 2018) and technological innovation (Zhang et al., 2018; Subramaniam and Youndt, 2005). Specifically, the study by Parida et al. (2016) reveals that IT capabilities influence adaptive dynamic capabilities, networking and innovation.

Absorption capacity is defined by Cohen and Levinthal (1990) as the ability of the enterprise to value, assimilate and apply, for commercial purposes, knowledge from external sources. Zahra and George (2002) reconceptualised the construct significantly, defining it as the set of organisational routines and

Table 3. Cluster 3 related to Dynamic Capabilities

CLUSTER 3: DYNAMIC CAPABILITIES	
Information Systems	143
Information Technology	40
Knowledge Management	29
Innovation	23
Project Management	19
Absorptive Capacity	10

Source: the authors, based on Scopus data

strategic processes by which companies acquire, assimilate, transform and exploit external knowledge with the intention of creating a dynamic capacity. Unlike Cohen and Levinthal (1990), who emphasise the phases of assimilation and exploitation of externally generated knowledge, Zahra and George (2002) focus on the study of the distribution and integration of internal knowledge, for which information systems are a key antecedent (Jansen et al., 2005; Camisón and Forés, 2010; De Mattos and Laurindo, 2017).

Specifically, studies such as those by Francalanci and Morabito (2008), Liu et al. (2013) and Zhang et al. (2018) highlight the important role of absorption capacities in the relationship between the company's information systems and technologies and its innovative performance.

However, the relationship between information systems and absorption capacity is reported to be recursive, and studies such as Trieu (2017) stress that absorption capacity contributes to success in adopting systems such as business intelligence, while Park et al. (2007) show that there is a direct and positive relationship between an individual's ability to assimilate new knowledge about ERP systems and his or her ability to apply it.

This cluster also includes the concept of *project management*, considered a specialised management technique to plan and control the development of projects related to knowledge management (Park and Lee, 2014; Brahami and Mata, 2018) and organisational innovation (Hornstein, 2015). This is an abundant line of research in the management literature, which explains its inclusion in this cluster of analysis.

The fourth cluster, labelled **Geographical Agglomerations, Sustainability and Tourism**, includes the powerful construct of *geographic information systems* (GIS), linked to *tourism* studies, and other concepts that emphasise the importance of networks between agents, especially *SMEs*, such as the *supply chain*, to obtain potential returns in terms of *performance* (economic or innovative) or *sustainability*, both of which are also integrated in this cluster of analysis.

A geographic information system (GIS) is a computer system for capturing, storing, consulting, analysing and displaying geospatial data. Geospatial data describes both the location and attributes of spatial features. This is an indispensable tool for today's tourism, due to its impact on resource planning and management, public health and agricultural management (Chang, 2017). This type of tool offers location services, maps and other geographic information.

This cluster also includes the growing analysis of the application of IS/IT to the design of intelligent city planning (smart cities) (Neirotti et al., 2014) linked to sustainability (Ahmad and Mehmood, 2015), as well as the provision of infrastructure and other resources to improve the attractiveness of a certain community or region (Jabbour et al., 2017), tourist destination (Wang et al., 2016), or even a developing country (Senyo et al., 2016).

The application of the most advanced IT/IS has also triggered debate on the digitisation of the supply chain (Vendrell-Herrero et al., 2017), and its institutionalisation through security protocols and standards

Table 4. Cluster 4 linked to Territorial Agglomerations, Sustainability and Tourism

CLUSTER 4: GEOGRAPHICAL AGGLOMERATIONS, TOURISM, AND SUSTAINABILITY	
GIS	54
Sustainability	21
Supply Chain Management	20
Performance	15
SMES	11
Tourism	11

Source: the authors, based on Scopus data

provided by blockchain technologies (Korpela et al., 2017). IT has also enabled the implementation of systems to manage relationships between the agents of this sustainable value chain, establishing more social and ecological practices in production processes, services and final products (Camargo et al., 2017; Srivastava, 2007). The study of sustainable supply chains has also had a considerable impact in the field of tourism (Xu and Gursoy, 2015) due to the growing concern of consumers, communities and governments for the development of sustainable business practices.

IT is therefore acknowledged as an important tool for pursuing sustainability, increasing the company's knowledge of its impacts both at the supply chain level (Gold and Schleper, 2017; Formentini et al., 2016; Ivanov et al., 2018) and territorial agglomerations linked to the circular economy (Jabbour et al., 2017), and at the corporate level, analysing their impact on the adoption of more sustainable business models (Majid, 2018; Rauter et al., 2017). In this line, Camargo et al. (2017) highlights the information capacities derived from an information system, in terms of improved communication and knowledge transfer between and through functions, which enables effective compliance with environmental requirements.

Sustainability represents a fundamental paradigm capable of addressing economic, social and environmental issues under the same construct (WCED, 1987). The first notions of this concept emerged in the 1960s (Clark et al., 2004) when the sustainability of current prosperity trends was questioned, given the increasing rate of exploitation of natural resources.

The fifth cluster, labelled under the main concept of **Enterprise Resource Planning** (ERP), integrates several generic notions, such as *decision making*, *information security* and *management information*. All of these concepts are linked to the adoption of ERP systems, which have been widely recognised and documented by both academics and professionals.

ERP is a program that integrates information from all departments and functions of the organisation, providing access to all employees who need information from anywhere in the company. The program consists of modules that collect information from each company function, which is then stored in a central database for subsequent access and processing by any person or function that requires it. The use of this program helps to prevent redundant and duplicated information, and enhances integration of the company's departments. It is not only about information itself; rather, it is about processes and information flow.

ERPs are made up of a series of core components that deal with the classic elements of most ERP systems, focused on internal operations such as accounting and finance, production and materials management, human resources or marketing and sales. ERPs can also include additional extensions (or extended ERP components) that meet the needs not covered by the main components and that focus mainly on external operations. These extensions include business intelligence, customer relationship management, supply chain management and e-business.

Table 5. Cluster 5 defined around ERPs

CLUSTER 5: ERP	
Decision Making	13
Information Security	13
ERP	12
Management Information	11

Source: the authors, based on Scopus data

On the basis of interdepartmental integration and cohesion, and with the main agents in the external environment, several studies point to the impact of ERPs on knowledge management (Acar et al., 2017; Migdadi & Abu Zaid, 2016). Security is another of the concepts integrated in this cluster, one of the critical factors in the success of its implementation and use (Gupta and Misra, 2016).

Data and information security are of paramount importance to the cloud user. Server message blocks (SMBs) that adopt cloud ERP services for their business needs are unaware of the ways in which a cloud provider stores the user's confidential information. According to Gupta and Misra (2016: 3) there are four problems in information security, namely data confidentiality, encryption, accountability and maintenance.

Finally, the sixth cluster, labelled **Quality**, groups all the literature on information systems and quality – such as *information quality*, *service quality* and *system quality* – and *user satisfaction*.

User satisfaction with the use of any IS or IT, either as an agent maintaining business relationships with a company through electronic means (e.g. Lin et al., 2016; Ghasemaghaei and Hassanein, 2015), or as a company employee (Laumer et al., 2017), is strongly determined by quality. Following authors such as Laumer et al. (2017) and DeLone and McLean (2003) this can be analysed through several prisms: a) the quality of the system, which comprises the desirable characteristics of the technology itself, such as ease of use, efficiency, navigation and reliability; b) the quality of the service, which represents the quality of support or assistance that users receive from the IS department and IT support staff; and c) the quality of the information, defined as the degree to which the information meets the user's expectations (in terms of accuracy, integrity, coherence, or relevance) and with the requirements of the particular activity in which the user is involved (Ghasemaghaei and Hassanein, 2015).

Table 6. Cluster 6 related to Quality

CLUSTER 6: QUALITY	
Information Quality	15
User Satisfaction	14
Service Quality	13
System Quality	13

Source: the authors, based on Scopus data

FUTURE RESEARCH DIRECTIONS

This co-occurrence analysis, based on hierarchical clustering and supplemented by two visualisation techniques, has yielded results that can be easily interpreted by practitioners and managers, showing

how the field of information systems is evolving in the management literature, and detecting new trends and relationships among key topics. We are hopeful that this study will provide valuable support for future work in this field.

Future studies could usefully explore the latest trends in the research on information technologies from other fields such as engineering, computer science, biology and even psychology to complete this bibliometric study.

CONCLUSION

The study aimed to provide and discuss the most outstanding trends and topics in recent years with implications for the short-term future linked to information systems in the field of management and business. The research developed a bibliometric analysis based on a literature review and co-occurrence analysis, considering articles published since 2016 in Scopus. Keyword co-occurrence can uncover the structure of science, its evolution and potential relevance to the discipline (Lou and Qiu, 2014). The keywords analysis yielded network and density graphs from which six theoretical clusters were observed and defined: 1) data analytics, 2) electronic intra and inter-organisational exchanges, 3) dynamic capabilities, 4) geographical agglomerations, sustainability and tourism, 5) ERP, and 6) quality.

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KEY TERMS AND DEFINITIONS

Big Data: Refers to large data sets. The definition of the term may also include the specific tools for their processing and structured or unstructured analysis that facilitate business decision making by revealing new patterns, associations, and trends.

Blockchain: Is a system in which a record of different types of interactions (commercial or not) made in a chain and cryptographically signed are managed through a peer-to-peer network. It allows information to be transferred under highly secure standards, and with validation at each step.

Business Intelligence: Includes the tools, practices, and infrastructures necessary for the organisation, management and analysis of information, in a visual and customised way, to improve business decision making.

Cloud Computing: Is the practice of accessing and using remote servers hosted on the Internet to organise, manage, analyse, and deliver data. It removes the need to maintain expensive computing hardware, dedicated space, and software.

Data Mining: Is the technology that allows relationships and trends to be discovered through the analysis of amounts of data stored in databases.

Geographical Information System (GIS): Is an ensemble of hardware, software and geographic data that facilitates the capture, storage, analysis, and presentation of any type of information related to geography or spatial data.

Internet of Things: Comprises the array of all the devices and objects whose status can be queried or modified via the Internet, with or without the active participation of people. It therefore includes the Internet, cloud computing, mass data analysis and sensors, whose convergence will lead to automatic learning, remote control and optimisation of machines and autonomous systems.

Smart City: Is the designation given to a city that integrates procedures, actions and IT to enhance its sustainability in terms of providing better quality in its landscape, governance, urban services for citizens, environmental responsibility, education, etc., and reduces consumption and costs.

Organizations Operating in Real Time (Real-Time Enterprise) and the Role of IT as a Tool Supporting Their Management Systems

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INTRODUCTION

An RTE is an enterprise processing information in real time – an organization focused on quick response to the needs of the market and client, fast decision making, transparency and immediate information sharing among internal groups (Borg 2011, Šibalija, 2018).

Competition within this time-frame has become crucial for many businesses and quick response is the key element of success in face of critical events minimizing costs and maintaining perfect quality of activities (Cundius & Alt, 2017). Specifically, there is the necessity to apply tools enabling access to critical information in proper time and place (Karnouskos & Colombo, 2011), which allows for quicker decision making (Olofson & Morris, 2013).

The functioning of RTE without support from IT technologies seems impossible. Yet, a number of organisational changes need to be conducted within the enterprise which will be ‘solidified’ by IT. The aim is, among others, to focus on the activities which produce a bigger value (Hongren et al., 2015) and allow for optimisation of business processes (based, among others, on Lean), defining goals and preparing analysis of the time courses (Kyte 2004; Brand, 2012), as well as modification of some specialists’ qualifications (Vasarhelyi, 2010).

On the basic level IT solutions for RTE should enable:

1. Monitoring of the enterprises and its surroundings in real time,
2. Access to information in real time,
3. Acceleration of business processes.

The main objective of this chapter is to shed some light in the determinants of IT systems for RTE. First, the basic RTE areas will be analyzed. Second, the IT requirements for these areas will be presented, including sets of proposed determinants. Finally, conclusions and future research will be proposed.

BACKGROUND

The constant changes in the market and the increase in competition make it necessary to dynamically adapt the way of running a business (Wirtz et al., 2007). Enterprises must develop business flexibility by adapting new business models (Sikri, 2015) and implementing effective innovations (Grauer et al., 2010; Zhou et al., 2018). Technological progress changes the way enterprises conduct business (Vasarhelyi & Alles, 2008), requiring the use of tools that provide access to critical information at the right time and the right place, supporting rapid decision-making (Azvine et al., 2005). The reduction of time delays becomes the goal and way to implement the real-time system (Kejariwal & Orsini, 2018).

Therefore, the competitive advantage of real time enterprises (RTE) results from responding faster than the others the changing business conditions and opportunities.

Real time economy already exists (Vasarhelyi, 2010) and regards numerous industries, from fashion (Luskham, 2011), through finance (Kekwaletswe & Lesole, 2016), to software production (Martínez-Fernández, 2018). Processing information in real time – i.e. RTE – is also the core of Smart Factory in the Industry 4.0 concept (Herrmann, 2018).

The aim of these activities is to identify new business possibilities, avoid failures and minimize delays of the main business processes (Polites, 2006), improve flexibility, speed and quality of decisions, client relationships, increase the return on investments, as well as to increase productivity of the staff at each level of the organization (Smith, 2009). For the functioning of RTE is related to the use of proper techniques of human resources management (Yuan, 2016).

Specifically, there is the necessity to apply tools enabling access to critical information in proper time and place (Karnouskos & Colombo, 2011), which allows for quicker decision making (Thorpe & Kerr, 2011).

RTE acts quickly due to the integration of internal and external data, information analysis and communication among business partners (Kuglin & Thielmann, 2005). This may be compared to a gigantic spreadsheet where new information is sent via computer systems used by the enterprise and its suppliers. (Ramaswamy, 2015). In the ideal RTE model (Snabe et al., 2009):

- information circulates within the enterprise and beyond, with no barriers;
- business processes are continuously being monitored and improved;
- gathered and processed information on business processes provides an incentive for quick response to changes in the enterprise and beyond;
- key business processes are flexibly automated, usually in compliance with in-built principles.

ORGANIZATIONS OPERATING IN REAL TIME AND EXPECTATIONS FOR IT

As already mentioned the functioning of RTE without support from IT technologies seems impossible. When considering the use of IT tools in the implementation of RTE, its basic areas should be analyzed: monitoring of the enterprises and its surroundings in real time, access to information in real time and acceleration of business processes.

Real Time Monitoring

Efficient management is only possible when we have information about the organization and its surroundings and the quality of the information is good (Albers, 2014).

Currently, many everyday business transactions are not being efficiently monitored and supervised (Yousef et al., 2018), although many values which used to be seen as static are now gaining increasing variability.

Monitoring of an organisation and its surroundings in real time regards, among others the organisation's ability for detection of critical events, reporting, making decisions and responding, as well as its perfect business insight (Cannata et al., 2009; Kyte, 2004, McNurlin et al. 2009).

Measurements of an organisation which may be conducted in real time and compared to target values allow to continuously measure the activities (Subramanya 2011, Tank, 2015) and secure immediate access to key business indicators (Kang et al., 2011).

It is expected that the real time information processing technology allows not only to continuously monitor almost each link in the supplies chain, from product design, through purchasing raw materials, production, transportation, storing, distribution and after-sale service (Atzori et al., 2010), but also to provide customers with real time remote monitoring of the services provision (Lai et al., 2018) or information about the condition of machines and equipment. (Nel & Jooste, 2018).

For example, manufacturing companies need to be informed in real time on orders status, location of transported products, etc.

Precise monitoring is related to generation of vast amounts of data (Song et al., 2017), which create the, so called, stream of events possible to be processed in real time (Zhang et al, 2018). So IT should detect situations vital or critical for a particular monitored area in real time, based on the, so called, events patterns (Garro et al., 2016; Macià et al. 2016).

Real-Time Access to Information

To make decisions, business users need quick and reliable information delivered in real time (Yuhanna, et al., 2006, Fong & Hang, 2011). The need to access data in real time regards numerous areas of business, such as customer service and sale (Anand, 2012), logistics (Yin & Khoo, 2007) or production (Chen and Tu, 2009).

The freshness of data in IT systems should only depend on business needs (Watson et al., 2006, Ioana, 2008, McKenna, 2011). Therefore, in case of an enterprise implementing RTE strategies information is delivered when it is needed, easily, in the proper graphic form and based on defined business rules (Rabin, 2003; Mathes, 2016).

Information may be sourced from IT systems of the enterprise, i.e. ERP, CRM, SCM, MES (Hwang at al. 2018) or various Business Intelligence solutions working in traditional ways and in real time. Especially real time analytics becomes more and more necessary (Andriole, 2012) when data should be analysed immediately when it gets to the organisation (Sandu, 2008), providing decision-makers with the most recent information on the operational and tactical levels (Tank, 2015), enabling immediate reaction (Davcheva & Benlian, 2018) or improved efficiency, being capable of servicing terabytes of data (Pareek, 2010), using effective visualization solution (Davcheva & Benlian, 2018).

For example, production companies must have real-time access to reports on their own and subcontractors production capabilities, stock status, planned orders, etc.

Acceleration of Business Processes

The enterprises implementing the RTE concept must be capable of conducting their business processes in real time (Ouarhim & Baïna, 2019), relying on the best information available from all sources and delivered immediately to the decision making spot (Olofson & Morris, 2013), in an automatic way comprising various systems, media and organization limits (Khosla & Pal, 2002).

The term “real-time process” is used when there is no or little delay between the process’s input and output (HBR-Report, 2014). On-line processes are discussed consisting in computerised and automatised workflows (Kaymaz, 2015).

Four basic types of delays in complex business processes implementation may be identified which may be serviced by applying IT technologies (Vasarhelyi et. al., 2010):

- Delays within processes – the time needed for execution of the process. They are minimized by automation of subsequent steps in the process,
- Delays between systems: the time of transferring data between processes,
- Delays in decision making: the time needed to make decisions,
- Delays in implementation of already made decisions.

It is often believed that effects of IT functioning are best visible on the level of business processes (Ray et al., 2005). IT should reduce the execution time of business processes and shorten the time of making decisions (Ward & Honggeng, 2006) and, properly implemented, it give a competitive advantage (Powell & Dent-Micallef 1997). Automation of business processes reduces delays in their performance because the human-executed processes take minutes or hours and their automation allows for reduction of the execution times to some fractions of a second (Chan et al. 2009, Teeter & Vasarhelyi, 2010).

For example, in the automotive industry, a customer who wants to buy a new car after its configuration can receive the exact date of pickup of the car within a dozen or so minutes. Such a fast speed of information delivery results from the integration of SCM, ERP, etc. systems of producers and their suppliers.

SOLUTIONS AND RECOMENDATIONS

IT in RTE Implementation

The RTE concept implementation may involve enterprises in various industries, even very narrow ones. Therefore, to meet the RTE objectives it is necessary implement and modernize integration of various information systems. The nit may be concluded that the IT system servicing RTE will be a system of systems (as mentioned in the literature, for example by Hofman & Bastiaansen, 2014).

An initial conclusion from the analysis of local and international companies is that in many industries there exist real-time or near-real-time business processes (Table 1). They are serviced by a number of IT systems integrated in various ways and the ERP was the most common system.

Business information may come from a variety of business IT systems, i.e. ERP, CRM, SCM, MES, SCADA, etc.). Real-time information may also be sourced from RFID tags and the IoT objects, which sometimes requires a very detailed definition of events.

Thanks to IT solutions acquisition of measurement-related data and its transformation into useful information becomes a simpler and more automated process. According to the recent trends, transac-

Table 1. Examples of real-time (or near-real-time) processes in various industries and IT solutions applied for their servicing, source: own research

No	Industry	Example of real-time or near-real-time business process RTE	Short description of procedures/ main process steps	Examples of applied IT systems
1	Finance	Credit card payment	Purchasing a product or service from an acceptant Authorisation Transaction provision Payment to acceptant	Card servicing systems, fraud detection, BI,...
2	Telecommunication	New client (technical servicing)	Selection of service, entering the agreement, SIM card activation, Propagation of card recognition	Call Center, CRM, Billing Systems, RMCA and rating, OSS (network layer), BI
3	Retail	Selling the product in the internet	Selection of product from the internet shop, choice of delivery and payment options, delivery	Internet Sales app, ERP, BI, logistics systems
4	Utilities, energy sector	Malfunctions reporting	Information about the network malfunction, reporting affected individuals, sending a repairs team	SCADA, call center, billing/ customer service system, Workforce Management Systems, ERP, BI
5	Manufacturing	Sale of a vehicle	Initial vehicle configuration, Final vehicle configuration, pricing, entering the agreement, date of receipt confirmation	CRM, sale support systems, ERP, SCM, BI.

tions processing and analysis in a real time enterprise (RTE) may be serviced by solutions relying on in-memory data bases.

As business processes support involving a number of functional areas of the enterprise require a big number of the organisation's IT systems the IT system integration enables coordination of activities in the scope of product design, supplies as well as supervision of production or dispatching activities.

Use of the quickly growing domain – Artificial Intelligence may be crucial for implementation of the RTE concept. On an advanced level the AI may be viewed in terms of support for the fulfilment of important business needs: business processes automation, obtaining an insight through data analysis, as well as actively involving the customers and employees, decision making support and monitoring, reporting, business analyses and R&D, forecasts.

Preparing an all-encompassing IT system for enterprise processing information in real time (a real-time enterprise) is a complicated matter. It may be concluded that to benefit from implementation of enterprise processing information in real time (RTE), i.e. primarily to secure monitoring of the enterprise and its surroundings, as well as real-time access to data and an acceleration of business processes, it is required from the information technology to:

1. Implementation of new or development of existing IT systems in the core areas of the business, i.e. finance, production, sale and distribution, and supplies.
2. Integration of the IT systems in the scope of business processes, information and human resources.
3. Secure IT tools for the change management and continues improvement of the enterprise's processes.

Based on the analysis of the literature on the subject for each of the fields listed above a set of determinants may be offered supporting creation of an IT system for RTE. The determinants are expectations/requirements towards IT.

Implementation of New or Development of Existing IT Systems in the Core Areas of the Business

To conduct business activities enterprises use a number of IT systems in particular areas, f.e. ERP for the main back office activities, CRM for managing customer relations, SCM for transportation, BI for reporting etc. From the point of view of RTE these systems:

- Support execution of the whole or a part of business processes
- Function as a source of data for other IT systems within the enterprise.

So it seems to be very important to analyse if the required for RTE functionalities may be fulfilled by existing enterprise systems, their integration or new IT systems implementation is needed. The proposed list of exemplary determinants for this field is as follow:

1. CRM systems: improving customer relations, better understanding of the customer behavior and needs, improving customer retention, obtaining guidelines regarding product development;
2. ERP systems: bookkeeping and managerial accounting, production management, materials management, sale management, maintenance and repairs management;
3. MES: production process management, status of production level activities, detailed operation schedule;
4. SCM: securing visibility and product movement tracing options, management of physical, logical and financial flows within and outside of enterprise, sharing information with business partners and customers.

Integration of IT Systems in the Scope of Business Processes, Information and People

Business processes usually flow through various IT applications and they often require human interaction and exchange of information. Combining them, therefore, necessarily involves integration of human resources and information. IT technologies make it possible to share information and combine resources beyond the limits of the enterprise. From the point of view of RTE, integration of IT systems is needed for the reduction of delays in execution of business processes, access of information and efficient human labour.

Striving at integration and control of the enterprise at the same time requires ordering of organizational procedures and embedding methods of their execution in the applied information system.

IT integration, therefore, regards seamless interlinking of people, processes and information which may cross organization limits despite the existence of numerous potentially heterogeneous platforms and protocols, as well as numerous access devices.

The proposed list of exemplary determinants for this field is presented below:

1. Multi-channel service: securing the customers access to services and products via numerous communication channels, combining communication channels in an enterprise with the view of providing proper employees with up-to-date and coherent information, using information coming from one channel to make better decisions in other channels;
2. Portal: collective single window access to data and information, integrated access to applications, portal based automated work and documents flow, using collective tools for obtaining, coding, publication, search and sharing knowledge;
3. Co-operation: options for parallel work of people in various locations and time zones, supporting information sharing and informal communication, providing information about the status of co-workers' activities and increasing awareness of their activities, support for various types of work, i.e. meetings, presentations, sharing information with communities, screens sharing, collective notion of work space;
4. Business Intelligence: integration of a multitude of data coming from various sources, data provision to the user in the form and time favored by him/her, tracing processes and applications statuses, monitoring of key process indicators (KPI), quick access to original data coming from various systems, enabling work with integrated data, use of Real Time Business Intelligence (RTBI) – reduction of the decision-making time, applying BI for analysis of weak signals of approaching change, predicting future events (Predictive Analytics), use of Data Stream Management Systems for efficient processing of continues, infinite, varying in time data flows, including data mining.
5. Knowledge Management: securing the organisation's ability to obtain, manage and provide customer, product or service information in real time with the aim of improving the customer's responsiveness and guaranteeing faster decision making based on reliable data, support for the organisation's continues learning process and application of knowledge at hand, reduction of delays and challenges related to the bottleneck effect in terms of new products development, support for knowledge-based business processes, cooperation with other organisations due to improved quality and easier sharing of knowledge, providing a single, integrated access point to all documents of the organization and its surroundings
6. Master Data Management: option for joint defining key data used in the enterprise IT systems, creating a standard model for the enterprise key information objects integration and management, securing high quality of data
7. Integration Brokering: option for data translation from one format to another, securing easy access of applications to data exchange mechanisms, remote function call, creation and combination of webservices, secure two-way data flow between various workflow systems, download of data from RFID, IoT, etc.
8. Business Process Management: options for modelling, configuration, execution, monitoring and adjustment/correction of business processes with IT applications, managing business processes exceeding the organization boundaries and beyond its applications, business events management (e.g. Complex Event Processing), performing analyses and studying relationships between numerous events and triggers, defining Key Process Indicators.

Securing IT Tools for Change Management and Continuous Improvements of the Enterprise Processes

Creating an IT environment implementing the RTE concept requires organizational change management and altering the existent IT solutions. This also involves subsequent changes – already within the functioning RTE.

Organisations are social systems. The way they tackle changes is crucial for the success and survival of the enterprise. Change is intermingled with risk and, therefore, needs to be efficiently managed.

Managing change may be defined as “a process of continuously reviewing the direction, structure and possibilities of the organization with the aim of catering to the continuously changing needs of internal and external customers” (Moran & Brightman, 2001). Efficient change in the organization involves such domains as: the employee, leadership, training and development, awards and recognition, culture, politics and IT systems.

From the IT perspective – in order to secure flexibility of business processes and quick response to the changing requirements it is essential to implement these changes to the current IT environment as quickly as possible. Changes, especially to big organizations involve substantive costs of maintenance, modernization and integration of IT systems.

In bigger organizations with a more complex IT architecture there is an absolute need for central management of the imposed changes – their planning and execution (e.g. relying on ITIL).

It is essential to guarantee interoperability of systems and safety resulting from proper execution of all changes. In the scope of each implemented IT projects there exists a change approval workflow regarding accountability of particular staff, documentation, division among developer, test and manufacturing jobs, authorizations, granting approval etc.

The proposed exemplary determinants for this field is presented below:

1. Ability for change management and business processes continues improvement: managing the processes of obtaining permits and documentation regarding changes in the organization, simple changes to business processes in IT, application of V-model linking tests to the prepared change documentation, optimal functioning of IT components, the need for possession, maintenance and securing proper quality of documentation of applied IT systems, securing ergonomics and comfort of work, proper users training, proper users attitude towards duties.

FUTURE RESEARCH DIRECTIONS

Preliminary research enterprises allowed to identify areas where real-time information processing is the most important. It is related to, among others with customer, law and technology requirements. Interesting cases were observed, among others in financial services, telecommunications, manufacturing and retail.

As part of the basic research, the proposed lists of determinants regarding IT support for RTE implementation are currently being checked among a specified group of enterprises.

For many companies, striving for RTE is not the main goal of the activity. It takes place on the occasion of the modernization of individual business areas based on IT and appropriate changes in the organization (change management and further improvement).

Also for each of the areas, the proposed lists of determinants can be extended and more detailed. This will allow for even more accurate understanding of the implementation of real-time processes in enterprises.

The proposed directions for further research should also include deepening research in the field of RTE implementation through the analysis of:

- a) new, currently developed functionalities of IT business systems;
- b) future development of information technology in the field of integration of business processes, people and information,
- c) detailed models for the provision of IT security and continuity, ability to manage change and continuous improvement.

The proposed set of determinants may be converted into the method of preparing the areas of the enterprise for real time information processing.

CONCLUSION

The ability to conduct real time operations is becoming more and more important in a number of industries. Therefore, the idea of RTE, an enterprise that processes data in real time, is becoming more and more important.

RTE requires, among others, monitoring of the enterprises and its surroundings in real time, access to information in real time and acceleration of business processes.

The basis for efficient work for each of these areas is IT. Therefore, it seems important to identify determinants for the IT environment that will ensure its proper preparation.

Identified determinants can be divided into three groups:

1. Implementation of new or development of existing IT systems in the core areas of the business,
2. Integration of the IT systems in the scope of business processes, information and human resources,
3. Secure IT tools for the change management and continues improvement

It results from the conducted research that the strongest impact of RTE supporting systems is observed in terms of immediate access of information, which translates into the ability for quicker decision making, as well as into a more dynamic conduct of business processes. The human and his or her competences emerge as the prime limits to the development. The specified earlier determinants may constitute the basis for analysis and creation of IT in Real Time Enterprise supporting its operations in competitive markets.

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KEY TERMS AND DEFINITIONS

BI: Business Intelligence, IT system which use data to generate information and knowledge supporting the process of decision making.

CRM: Customer Relationship Management, IT system which manages customer relations, used at sale, marketing, customer service and contacts center.

Determinant: Factor that resolutely controls or affects what happens in a particular situation.

ERP: Enterprise Resource System, encompasses the whole of internal processes in the enterprise, for example, finance accounting, controlling, purchases, production, distribution.

Industry 4.0: Trend towards automation and data exchange in manufacturing technologies and processes. It encompasses the internet of things (IoT), cyber-physical systems (CPS), artificial intelligence

(AI), cloud computing and cognitive computing. A concept related to RTE, in the field of data processing in real time and the fastest possible business processes

MES: Manufacturing Execution System, IT system which provides information needed for optimization of production activities.

Real Time: Receiving and processing of source data by the system immediately at the time of their creation

RTE: Real Time Enterprise, enterprise which processes information in real time.

SCADA: System Control And Data Acquisition, IT system which serves for visualization, supervision and control of complicated technological lines, industrial processes, machines and equipment.

SCM: Supply Chain Management, IT system which encompasses all activities related to flow of goods and services.

Smart Factory: Manufacturing based on computer-integrated manufacturing, interoperable systems, digital information technology, high levels of adaptability and rapid design changes (f.e. on demand), optimization of the supply chain.

Interfacing Communication and ICTs in a Divisionalised Structure: Effects on Good Governance

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INTRODUCTION

Every organization exists to achieve some set goals. To facilitate quick and cost effective attainment of these goals, they are broken down into different tasks for different people to undertake. Jobs are grouped into departments such as marketing, sales, advertising and manufacturing depending on the size of the organisation. In such a corporate setting, there must be constant communication and information sharing to properly harmonise the activities of each department. Information and communication technology plays critical roles in fast-tracking organizational decision making process. The more progress the companies make, the more they can contribute to national development. Against the backdrop, this study, anchored on technological determinism and governance theories, evaluates the interface of communication and ICTs in a divisionalized organisational structure and the implications on corporate governance and sustainable development in Nigeria. The chapter also attempts to provide good understanding of the concept of divisionalised structure, pinpointing its features, purposes, prospects and challenges. The study also seeks to identify the role of communication and ICT in the organizational decision making process.

BACKGROUND

The quests for sound organizational management and efficient corporate governance have received more impetus in today's business environment. This is because it has been observed especially among large scale enterprises and multinational companies of incidences of wastage of human and material resources, inefficiency and sluggishness in the corporate decision making process at huge cost to the company on one hand and to shareholders on the other. In contemporary corporate setting, large scale organisations tend to have more specialisation, departmentalisation, centralisation and regulation than small scale enterprises. Particularly, companies with wide variety of products often give preference to divisionalisation purposely to ensure efficiency and effectiveness in the corporate decision making process. However, despite the adoption of divisionalised structure supported with effective communication and information technology, there are yet apprehensions that such practices oftentimes do not translate to good corporate governance characterised by growth, probity, accountability and return on investment. To build sound business management founded on good corporate governance that will guarantee sustainable development in Nigeria, there are tasks that must be accomplished.

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According to Gbadamosi and Adebakin, (2006), organisations exist in a society and combine materials (technology) and human (personnel) resources for the attainment of corporate survival. The earlier conception of organizations described them as highly structured, hierarchical, restrictive and undemocratic ((Eisenberg and Goodall, 1993). Miller (1995) cited by Soola and Ayoade (2000, p.10) has characterized organizations using three different features. First, an organization includes two or more people who are seen as social collectivities that require some level of understanding, coordination and communication to act in concert. Second, an organization is structured in the pursuit of a goal or set of goals which direct the activities of the organization members and are equated with the purpose and goals of its members. Third, an organization involves coordination of activities which is a process by which organizational goals are achieved. Although organisations have been defined in various ways by different theorists, virtually all the definitions contained certain common features which Adolor (1985, p.63) summarised as follow:

- an interdependence, or interlocking activities;
- role specifications for members who occupy positions;
- a division of labour and varying degrees of job specification;
- status hierarchy which exists as a coordinating and controlling mechanism;
- a dynamic system which is in a constant state of change;
- a system of processing various 'inputs' to produce various 'output';
- a communication network, or more accurately, a network of networks, and;
- a combination of individuals and groups- a group of people.

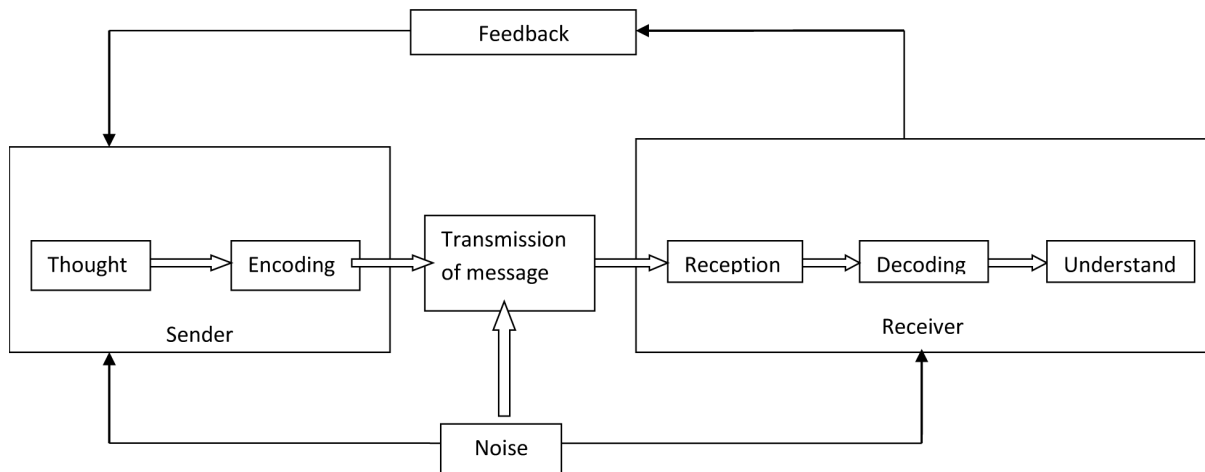
Modern society depends largely on the efficiency and optimal performances of its organisations for its social and economic sustenance. Business organisations such as manufacturing, aviation, banks, insurance, petroleum and gas, construction and media among others, thrive in an environment of sound management. As a process, management can be defined as network of activities, which entail responsibility for the effective and economic planning and regulations of a business enterprise. Going by the above definition, management process involves goal setting, planning and implementation, measurement of outcome and general supervision.

It is important to note that as business manager in any corporate setting, responsibility demands that one must be accountable. Accountability is a function of responsibility. According to Glautier et al (2011), specific responsibility arises by reason of the nature of a relationship either patented or contractual responsibility. The pre-condition to good accounting system is the presence of responsibility towards others which imposes an obligation to account for one's actions. Responsibility accounting is a basic component of management functions and control systems particularly in large organizations with product or service diversification (Arora (2012). Accounting involves the process of identifying, measuring, recording, reporting and communicating economic information that permit judgment and sound decision making by the end users. It also includes keeping accounting records, data, information and reports, monitoring cash position and settling of bills as at when due.

As the subject matter of accounting is very important in the day to day organizational management so also is the issue of communication, which is a major prerequisite towards managerial accountability as well as achieving the overall organizational goals and objectives. In addition, for every person working in a particular establishment, there is the necessity of interacting and functioning together to accomplish corporate goals. In order to facilitate interrelationship in organizational setting, communication is a key factor (Gbadamosi and Adebakin, 2006).

For communication to achieve its purpose, both the sender and receiver must have shared code otherwise, there would be no intelligibility and information could get lost. In today's corporate environment, managers desire information about their organization and its operational environment at a faster rate than before. This, according to Koontz and Weihrich (2004), is because a slight hitch in the production line can result in huge losses to the organization. Therefore, to accelerate free flow of needed information for efficient business management, information and communication technology ICT provides a variety of proven tools and techniques that can fast-track every facet of organizational communication and management process.

Figure 1. Diagram showing communication as a process



Each organization decides to choose the appropriate structure that fits its policy. The structure of an organization refers to the different hierarchies and levels that can drive the company to accomplish set goals. Organizational structures range from simple to complex but basically, there are three types: functional, divisional and matrix structure. The adoption of a particular structure depends on so many factors such as the nature of business, sector, product mix, size of the organization, personnel, management style, geographical location and spread, corporate vision and mission, strategic business direction among others (Kozenkow, 2015).

Top management of growing and large business organisations are daily confronted with the challenges of effectively managing business tasks, activities and responsibilities to achieve their corporate objectives. This explains why modern organizational practice is dynamic and gives preference to constant structuring and restructuring so as to guarantee efficient management system that conforms to international best practices.

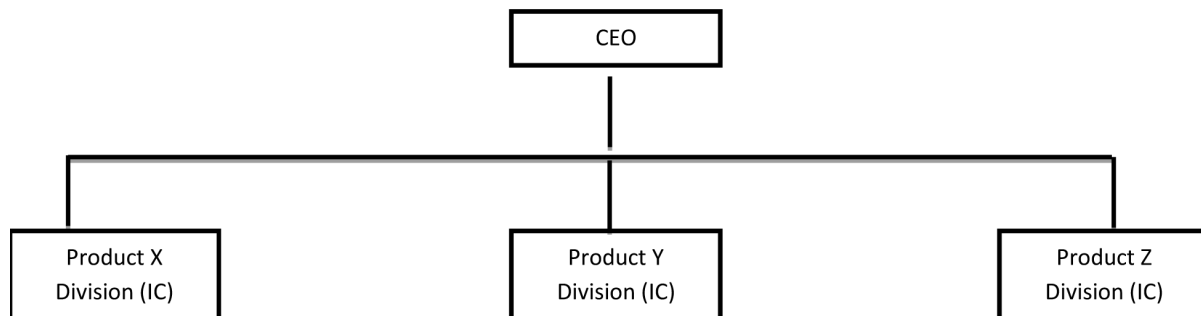
Some scholars have proffered different conceptual definitions of organizational structure, which they viewed as the ways in which responsibility and power are allocated and work procedures are carried out by organizational members (Dewar & Werbel, 1979; Germain, 1996). There are body of evidences showing that the size of an organisation affects its structure. For instance, large scale organisation tends to have specialised, departmentalised, centralised and regulated structure. This usually facilitates formal allocation of job schedule and administrative mechanism to control and integrate work activities in order to guarantee efficiency.

Understanding the Concept of Divisionalisation

The basic philosophy of divisionalised structure is that it might be difficult and problematic to centrally managed large diversified organisations as a single entity hence the rationale or necessity of decentralising into divisions along functions, product and territorial lines (Oliveira & Takahashi, 2012). Other reasons may be due to target customers and raw materials. Moreover, divergent laws, customs or culture or regulatory framework of different geographical region may demand that an organisation adopts the policy of divisionalisation to fully realize its corporate objectives. Ogundele (2012, p.24) identified seven structure which include (i) entrepreneurial structure (ii) mechanistic structure (iii) professional structure (iv) diversified structure (v) innovative structure and (vi) political structure.

While contributing to the discourse on organisational segmentation, Dury & El Shishini (2005) describes the division as profit centre or investment centre, subsidiary or business unit or branch of a corporate body. “A division is a part of the organisation where the manager is accountable for generating revenues, controlling costs and making satisfactory return on capital invested in the division.” Whatever name it is called whether a subsidiary, department or division, the important thing is that divisionalised structure involves the establishment of separate or semi-autonomous units on the basis of individual products, product groupings, functions or geographical operations. Contrary to departments, divisions are more independent, with each having its top executive and management to handle their own hiring, budgeting, accounting and finance. In effect, it gives room for decentralised decision making process of an organisation. In most cases, divisionalised model is commonly adopted by all large, thriving multinational companies like General Motors, General Electric, IBM, Microsoft, Nestle, Unilever, Cadbury and many other such conglomerates around the world.

Figure 2. Diagram showing divisional organisational structure



Organisation may also be departmentalised according to functionality. Functional structure simply means having all activities of a similar kind within an organisation like production, engineering, personnel, purchases, sales or marketing and finance under a departmental head. Alternatively, big organisations may operate a divisionalised structure based on their products where the divisional head is responsible for all operations, revenue generation and cost management.

Responsibilities of Central Management and Divisional Managers

In a divisionalised structure, the top management team are duty-bound to carry out certain roles. These comprise: determining the strategic direction of the organisation in terms of vision, mission, core values

and culture, formulating the corporate goals for the organisation, evaluating and approving division's business plan, periodic performance assessment and monitoring of division's activities, appointment, dismissal and promotion of divisional managers, providing support services like financial, human resource, corporate and legal services.

The divisional managers on the other hand are expected to manage and implement divisional business plan and regularly provide divisional reports for the central management.

Benefits of Divisionalisation

When an organisation creates organisational structure into divisions, there are inherent benefits. According to Ogundele (2012, p.14), it facilitates quick and easy decision making process, assists the top management in evaluating both personnel and product performances, allows divisional management to operate freely and independently, enables the management and the divisional managers to collaborate and achieve managerial goals and provides opportunity for career development leading to easy realisation of management succession plan. Other benefits include enabling effective delegation of responsibility and determination of product performance and contribution to organisation's profit margin.

Limitation of Divisionalised Structure

Studies have shown that despite the attractiveness of divisionalised structure, there are inherent risks in this management practice. Although it is a better alternative for large scale enterprises and bureaucratic organisational structure yet, it is a very complex and complicated practice that would require good understanding and knowledge to implement. Most importantly, there is the likely problem of improper and inadequate coordination and control system which may result in conflict of interest between the central management and divisional managers. Oftentimes, if this situation is not properly managed, it can degenerate into crisis that can undermine the entire system. Among others, divisionalised structure may lead to escalated cost of management, frustration of central management if divisional managers keep vital information from them, divisional managers may misuse delegated authority for self-enrichment and management might lose control of the divisions, if effective monitoring mechanism is lacking (Hall & Tolbert, 2009, p.213).

Theoretical Foundation For better grounding of this paper, it is premised on two theories; technological determinism theory and corporate governance theory.

Technological Determinism Theory

This theory propounded by Everett Rogers in (1986) is one of the intellectual constructs that interprets and provides the direction for this paper. The term 'technological determinism' was coined by Thorstein Veblen and it revolves around the proposition that technology in any given society defines its nature. Technology is perceived as the driving force of culture and history in a society. It explains who or what could exercise control over human affairs. The theory questions the degree to which human thought or action is influenced by technological factors.

According to technological determinists, particular technical developments, communications technologies or media are the sole or prime causes of changes in the society. Technology is seen as the fundamental condition underlying the pattern of social organization (Chandler, 2014). The first major elaboration of a technological determinist view of socioeconomic development came from Karl Marx. His

perception of the theory is that changes in technology and specifically productive technology, constitute the primary influence on human social relations and organizational structure, and that social relations and cultural practices ultimately revolve around the technological and economic base of a given society. Marx's position has come to be accepted in modern society, where different kinds of technological innovations have altered man's life and its environment. This can be seen in the accelerated pace at which roles are performed and how technological advancement in-turn influenced the cultural, political and economic aspects of the society.

Technological determinism theorists such as McLuhan believe that the advancement in technology especially in the area of information and communication ICT has constricted the world into a global village through reduction in distance, time and space. In other words, information technology has transformed the world into a globalised village where ideas and culture are frequently exchanged. In addition, the theory believes that new technologies have strong potential of influencing human five senses and his entire existence.

Corporate Governance Theories

Although there are so many corporate governance theories, however, for this paper, we are going to dwell on 'agency' and 'stakeholders.'

Corporate Governance Theories

Although there are so many corporate governance theories, notwithstanding for this paper, we are going to dwell on agency and stakeholders.

Agency Theory: According to this theory, corporate governance believes there must be separation between the ownership of an organisation and employees which results in principal-agent relationships otherwise referred to as employer-employees relationships in modern corporations. The agency theorists regarded corporate governance as a mechanism where a board of directors is a crucial monitoring device to minimize the problems brought about by the principal-agent relationship.

Two key factors according to the theorists were observed to be responsible for agency theory. According to Daily, Dalton and Cannella, (2003), the first factor is the reduction of corporation into two major participants, shareholders and managers whose positions and interests are clear and distinct. The second assumption is that humans are self-interested and reluctant to sacrifice their personal interests for the interests of the others. An organisation, public or privately owned as a legal entity is seen as a connection of different interests all of which have come to equilibrium within the framework of contractual relationship among the stakeholders. These contractual relationships, according to Jensen and Meckling (1976), are not only with employees, but with suppliers, customers and creditors. The motive of this contractual relationship is that each party to the contract has the responsibility to maximize the value of the organization, reducing the agency costs so as to sustain the organisation. The agency theory is of the notion that the principals have the obligatory role of monitoring the corporate activities. In this regard, they or their agents who oftentimes constitute the members of the Board of Directors performs governance function in serving the shareholders by ratifying the decisions made by the managers and monitoring the implementation of those decisions in order to shore up the share value of the company. In cases where the principal fails to monitor the activities of the agents (managers), the agency theorists believe there is the tendency that the managers may sometimes fail to maximise the shareholders wealth in order to satisfy self. This is where the role of accounting becomes relevant in reducing the agency

cost in an organization. This can be achieved effectively through written contracts tied to the accounting systems as a crucial component of corporate governance structures. The understanding is that if a manager is rewarded for their performance through the accounting profits, they will attempt to increase profits which will lead to an increase in bonus or remuneration resulting from profit increase.

The agency model assumes that individuals have access to complete information and investors possess significant knowledge of whether or not governance activities conform to their preferences and the board has knowledge of investors' preferences (Smallman, 2004). Therefore according to the view of the agency theorists, an efficient market is considered a solution to mitigate the agency problem, which includes an efficient market for corporate control, management labour and corporate information (Clarke, 2004).

Stakeholders' theory: This theory centres on the issues concerning the stakeholders in an institution. It postulates that a corporate entity always seeks to maintain a balance between the interests of its diverse stakeholders in order to ensure that each interest of constituency receives some degree of satisfaction (Abrams, 1951).

Stakeholder theory identifies the parties involved apart from investors, employers, suppliers and customers include governmental bodies, political groups, trade associations, trade unions, communities, associated corporations, prospective employees and the general public. In some scenarios competitors and prospective clients can be regarded as stakeholders to help improve business efficiency in the market place. Besides, stakeholder theory has also recognized that the activities of a corporate entity affect the external. This means, the organisation is also accountable to some external publics as well as to stakeholders. It has however been argued that the performance of a firm is not and should not be measured only by gains to its stakeholders. Other key issues such as flow of information from the management to lower ranks, interpersonal relations, working environment among others are all critical issues that should be considered (Jensen, 2001). The three identified theories above have been found to possess the customized principles and experience that explain the role of communication and ICT in ensuring managerial accountability and optimal business profitability in a divisionalised structure, and by extension how it serves to impact on general corporate governance and sustainable development.

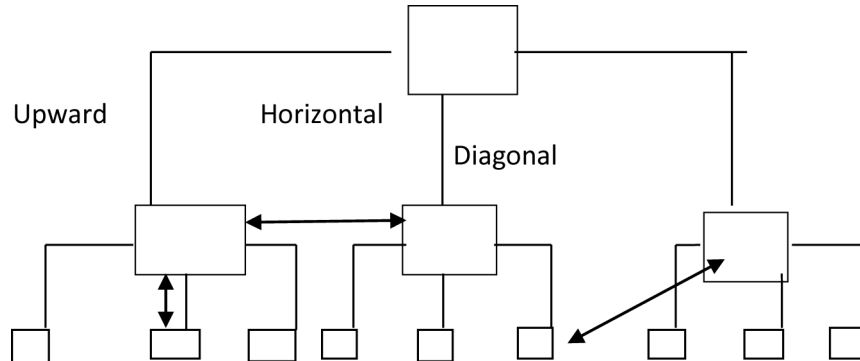
Communication, ICTs and Divisionalised Structure: A Trinitarian Interaction

In order to ensure managerial effectiveness, managers in every organisational division need pertinent information that can assist them to take informed decision. According to Okwechime (2015), communication is the transmission of information from one party to another through the use of symbols within the frame of reference of both parties (Soola, 2008). Communication cannot be regarded as effective unless the message transmitted is clearly and unambiguously understood by the receiver who must respond to the content. In organisational communication, (Gbadamosi and Adebakin, 2006, p131-2) identified seven forms that communication can take. These include

- giving instruction;
- sending and/or receiving information;
- exchanging idea;
- announcing plans or strategies;
- comparison of actual result against a plan;
- laying down rules or procedures;
- job description and organisational chart

Giving the different stakeholders involved in organisational setting therefore, information is usually communicated in various directions: vertically, horizontally and diagonally.

Figure 3. Diagram showing communication flow



Vertical Communication

This type of communication flows from people at higher level of organisational organogram to those at the lower rung, in other words, superior to subordinate. It is also referred to as downward communication. This kind of communication could be oral such as face-to-face instructions, speeches, meetings, telephone, instant text messages, grapevine and public address system PAS. It could also be written such as memos, organisational handbook, employee manuals, faxes, telegrams, proposal, contract, postcard, advertisement, brochure, news releases, magazine, letters, pamphlet, policy statement, internet websites, and electronic news displays (Koontz and Weihrich, 2004, 327).

Upward Communication

This also flows from subordinate to the superior. However, this type of information flow often encounters gate-keeping at different points by the superiors along the communication chains who may find the entire message or a part of it unpleasant. Thus, the entire message or a part of it may be filtered out deliberately. Notwithstanding, it needs be emphasised that the managers constantly require objective transmission of information for decision making process. The management needs information on daily production performance, marketing facts, and financial data among others. Koontz and Weihrich, (2004, p.327) also identified the media used for horizontal or upward communication to include: suggestion systems, appeal and grievance procedures, complaint systems, counselling sessions, joint setting of objectives, the grapevine, group meetings, practice of open door policy, morale questionnaires, exit interviews and the ombudsperson.

Horizontal Communication

This type of communication occurs when information flows between the people on the same rank in the same section or department or in different section or department.

Lateral Communication

This occurs among persons at different levels of different departments who have no direct reporting relationships with one another. This is also referred to as diagonal or sideways communication.

External Communication

This is otherwise regarded as corporate communication. Organisations do communicate regularly with their external stakeholders so as to establish and guarantee mutual understanding, acceptance and cooperation. The responsibility for information sharing to both internal and external publics falls within the ambit of corporate communication function. To effectively reach the heterogeneous audiences (publics) spread across the nation as large as Nigeria and beyond, there must be active partnership between the organisation and the mass media. The public relations department needs the traditional media (prints and electronics), new media (social media) and the indigenous media to transmit information to its numerous publics.

Role of ICTs in Organisational Decision making process

In this era of information and communication explosion vividly illustrated by rapid evolution of new technologies in the areas of computer and internet, ICTs have impacted greatly not only on information gathering, processing and dissemination within and outside the organisation but on the decision making process. Organisational managers are daily inundated with the art of making decision. The choices and how well the decisions are made determine the future sustainability of the company. Making decision is one of the most significant activities in a business environment on which, the advent of ICT has had profound influence. According to Ramey (2015), ICT simplifies and accelerates the decision making process by providing an organisation with a decision support system (DSS) and artificial intelligence (AI) system. The combination of these ICT systems helps a business to generate information through online analytical process (OLAP) and to facilitate decision making tasks that might require significant effort and analysis.

Decision making process as an important area of business management has also been researched to investigate the influence of ICT in different industries, with particular emphasis on strategic decision making (Dika, 2004). There are different types of decisions. First, straightforward decisions, which are known as programmed decisions, or decisions that occur frequently enough that we develop an automated response to them. Decision could also be non-programmed. In other words, this is a unique and important decision that requires conscious thinking, information gathering, and careful consideration of alternatives. A crisis situation constitutes a non-programmed decision for organizations (Qureshi, et al (2014). A classical example was when DE United Food Industries Ltd, the maker of indomie noodles, the most popular fast food among Nigerian school pupils was alleged to have produced and sold contaminated product to the market. Headlines such as “How Indomie Was Contaminated”; “Nigeria: NAFDAC Recalls killer Indomie for Destruction” and “Management of “Killer” Indomie Scare and Impact on Consumer” among others were seen on the pages of Newspapers.

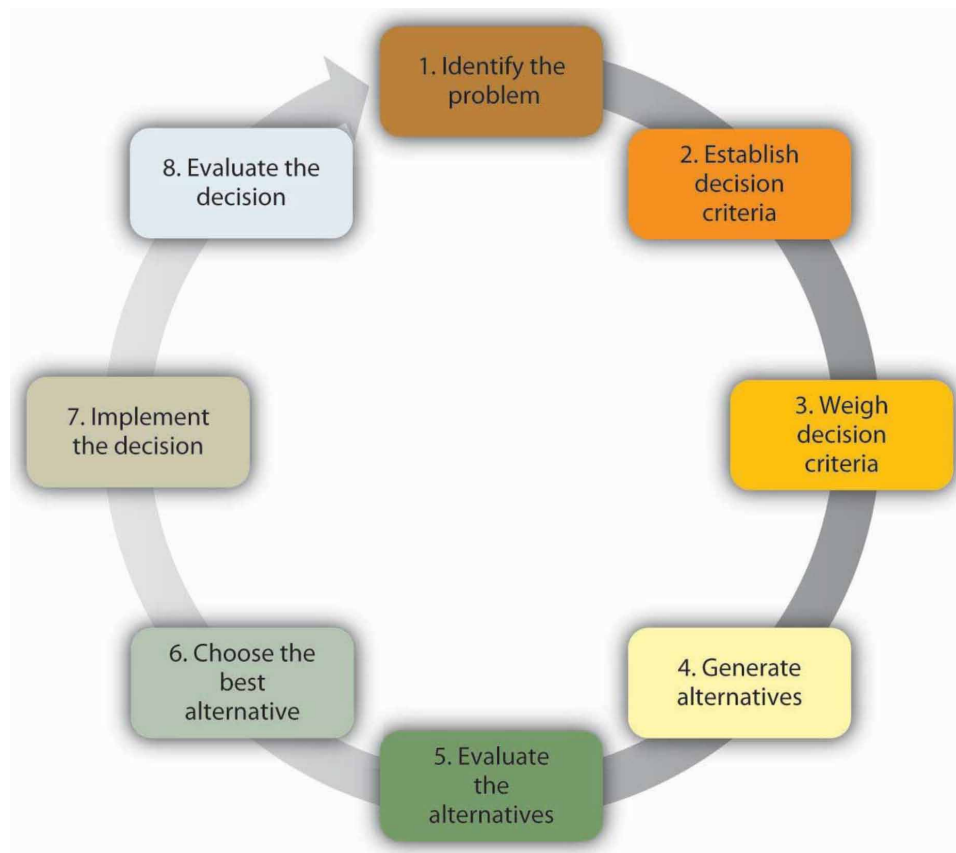
The popular product’s image received another bashing when rumours made the rounds that some unidentified persons had died after taking meals of Indomie. Within few hours when the news broke, unknown persons had begun sending text messages spreading the unsavoury message about Indomie

to Nigerians living in different parts of the country. The story which appeared in the front pages of all the national newspapers gave the management of the company sleepless nights for about two weeks.

Apart from programmed and non-programmed, decision making can also be classified into three categories based on the level at which they occur. 'Strategic decisions' set the course of an organization; 'tactical decisions' are decisions about how things will get done while operational decisions refer to decisions that employees make each day to make the organization run

Decision making involves various processes which are influenced by technology. As can be seen in the diagram below, there are eight interconnected steps in organisational decision making process.

Figure 4. Steps in Decision-Making Model



When trying to make crucial decision, there is dedicated software that can enhance the process. These, according to Ramsey, (2014, p.14), include:

- Decision support systems (DSS) – This is a highly flexible and interactive IT system that is designed to support decision making when the problem is not structured.
- Group decision support system (GDSS) – This is a type of decision support system that facilitates the formulation of and solution to problems by a team.
- Geographical information systems (GIS) – This is a decision support system designed specifically to work with spatial information.

- Artificial intelligence (AI) – the science of making machines imitates human thinking and behaviour.
- Expert systems – This is an artificial intelligence system that applies reasoning capabilities to reach a conclusion.
- Neural network – This is an intelligence system which is capable of learning to differentiate patterns.
- Genetic algorithm – This an artificial intelligence system that mimics the evolutionary, survival-of-the-fittest process to generate increasingly better solutions to a problem.

Transaction Processing System(TPS) ‘processes thousands of routine transactions that occur every day in most organizations, including sales, payments made and received, inventory shipped and received, and employees payroll (Bioney, 2000:35)

Management Information Systems (MIS) Computer systems used by Tactical management (middle managers) provide information in the form of reports and displays to managers and many professionals. For example, sales managers may use their networked computers and web browsers to obtain the daily sales volume of their products and access the company’s intranet for their daily sales analysis reports in order to evaluate the performances of each sales representative The MIS is also believed to have the potential of solving many other problems such as poor program scheduling, poor estimate of staff requirements, and lack of accurate information on personnel and facilities, piling-up of administrative matters, lack of feasible budget estimates among others (Fabunmi, 2003).

Executive Information systems (EIS) These systems provide critical information from a wide variety of internal and external sources in easy-to-use displays to executives and managers. The top management and divisional managers need constant supply of information so as to take rational decisions that can uplift the fortune of their organisation. This, they can easily glean through the internet technology.

While emphasising the importance of ICT in organization and manpower development, Reffell and Whitworth (2002) cited in Owolabi (2018) note that skills in book keeping, secretarial service, clerical and administrative work, spreadsheets, word processing and databases, stock taking, reprographics, information gathering and storage, photography and graphic design among others constitute a set of computerized services that necessitate ICT skills.

E-mail has become one of the predominant forms of communication employed internally and externally. Internally it has replaced print materials such as newsletter, memos and face to face communication and externally, it has replaced news releases, and media alerts among others. The cell phone has added a new dimension to how information and messages are communicated. Within the cell phone, communication platforms such as facebook, twitter, instagram, whatsapp among others are used to send instant and short messages to targeted public. Web logs or blogs and web site are online platforms where organisations can share information with their stakeholders. Many organisations have also created intranets (internal internets) and extranets (external internets) used to share large volume of information with their employees, journalists, investors and consumers. Podcasting, live telecast through television and live streaming through the instrumentality of ICTs have added new angle to information dissemination, news sharing and special events.

Recognising the cross cutting nature of Information, Communication and Technology and their roles in the social and economic development, OECD (2002) and Michalsons (2018) assert that ICTs are primarily intended for the recording and/or processing, monitoring and transmission of voice, data, image, text or any combination used in the following activities: accounting, calculating, data processing, data transmission, duplicating, text processing, document reproduction, document transmission, record

keeping and record retrieval, broadcasting or transmission for entertainment or information purposes of voice and/or text or any combination thereof and/or; the provision of services relating to the above.

ICT has not only brought about fundamental changes to communication process, organisations can now respond faster to global changes. ICT has started changing the way businesses are done and create new value. Business transactions are now made possible electronically as people can produce and buy goods and services online (Shafer, 2000). Apart from heightening the production and distribution of goods and services, ICT also improves competition and innovation among the divisional groups as well as in the global market (Koontz & Weihrich, 2004).

The organisation structures for the global economic and business environment vary in many ways. There is no best way to structure; the most important thing is for each organisation to choose the most suitable pattern based on prevailing factors. Divisionalised structure which is the focus of this paper has its advantages and disadvantages. Notwithstanding, a company may internationalise its operation by simply establishing its headquarters and the company may in the course of time expands its operations, foreign subsidiaries and international divisions in various countries and regional block such as Africa, Asia, Europe among others. In addition, African division may be divided into Southern, Western, Northern and Eastern countries with each reporting to a manager in charge of global operation at the headquarters. Whatever the structure, one thing is constant. No division is completely independent of others. They are connected and each division is supervised through information and communication technology.

Communicating Corporate Governance for Sustainable Development

The economic growth and the socio-economic development of a nation are predicated upon the policies and programme put in place by the political class. Whatever the economic policies initiated, it is the responsibility of the business organisations to translate them into tangible products and services that determine the Gross Domestic Product (GDP) of the nation (Oboh, 2004).

Globally, the international community particularly, the World Bank and UNESCO have continued to show concern about the unenviable economic condition of the developing world as vividly illustrated by socio-economic instability, heightened inflationary trend and corrupt practices such as stealing, money laundering, round-tripping among others. In most cases, poverty, diseases, unemployment and underdevelopment are widespread where these indices are paramount. The reason was that, the funds that should have strengthened the economy oftentimes found their ways into private offshore accounts domiciled in another country while leaving the home country's economy gasping for breath. For example in Nigeria, many large organisations that were once thriving well in Nigeria have wound up operation or are presently struggling to survive due to factors that borders on lack of sound financial management and bad corporate governance.

The success or otherwise of any organisation is predicated upon the quality of governance put in place. This means, governance is a determining factor of the quality of decision made to solve organisational problems. According to Carrington, DeBuse, and Lee (2008), within the context of international organizations, "governance describes the processes and institutions that guide and restrain the collective activities taken by an organization and its stakeholders".

Against the backdrop, corporate governance therefore, is a process by which business associations are directed and controlled. While contributing to the corporate governance discourse, Esty, (2007, p.36) observes that the concept as it applies to business organizations has three characteristics: first, a shared understanding of objectives and standards of conduct pertinent to the organization's specific subject or goal of governance; second, agreed-upon rules that seek to give structure and substance to the organization's

objectives; and third, a regulatory structure to monitor and enforce compliance with the organization's rules, amend and resolve disputes arising from their interpretation. Against the observed characteristics, three pertinent things are evident in a good governance system whether private or public. These include: an agreed condition that must be fulfilled by stakeholders in the organisation; every stakeholder is bound by standing rules that serve as code of conduct while seeking to accomplish corporate goals and a governing body that ensures interactivities of every department of the organisation. To guarantee workable agreement to work together under a common authority for the purpose of achieving a stated goal there must be mutual understanding. This is where communication becomes germane. The personality of the people who constitute the governing body determines the extent to which information is shared among the stakeholders. According to Jeremy (1966, p.16), "Information is power. Without it, there can be no accountability. The more people who possess it, the more power are distributed". At this point, the mass media become very relevant to serve as efficient watchdog over the management and conduct of both public and corporate affairs. According to the normative theories of the press, the media enjoy certain freedom in the society which is expected to make them socially responsible to the society. "The mass media serve the economic system by connecting manufacturers/service providers with sellers, performing surveillance role; and by giving priority in coverage to economic content and development needs of the society" (McQuail 2010). The media's responsibility as the nation's watchdog is to clearly ferret out every underhand deals among the political and business groups as well as bringing to light and analyse harmful behaviours among the citizens which are capable of compromising the ideal corporate principles and constitute potential threat to development.

The issue of underdevelopment has since the beginning of this millennium gained serious attention from the international community. The outcome of the year 2000 United Nations summit was the eight interdependent development goals otherwise referred to as Millennium Development Goals, (MDGs) (Frank, 2008). This was again reviewed in year 2015 summit to 17 goals now known as Sustainable Development Goals (SDGs) (UNDP, 2015, p.4). In modern society, professionals have all agreed that communicating useful and applicable information in a corporate setting through vibrant (ICTs) is foundational to sustainable development.

Oladipo (1996, p.1) cited by Owolabi (2014, p.101) defines sustainable development as:

"development that not only generates economic growth but distributes its benefits equitably; empowers people rather than marginalising them; it gives priority to the poor, enlarging their choices and opportunities and provides for their participation in taking decisions affecting them. It is a development that is pro-poor, pro-nature, pro-jobs, pro-women and pro-children."

Owolabi, (2018) emphasizes that Nigerian corporate body has not actively participated and benefitted maximally in the globalized market due to lack of vibrant information sharing channels. This explains Olubamise's (2010) assertion that significant progress in virtually all areas of human endeavours including global communications, trade, business, culture, education, services, entertainment, tourism and research can only be guaranteed in an environment where ICTs are given a pride of place. According to Koontz and Weihrich (2004, p.372), effective communication supported by ICT among others, "increases outputs in the production and distribution of goods and services; intensifies productivity which in-turn results in higher living standards; improves global impacts, enhances competition and innovation which are made possible by processing large amount of data in research and development."

CONCLUSION

The performance of divisionalised companies can be measured by return on investment or residual income. This can also be assessed by evaluating the organisational contribution to the globalisation process. However, it is observed that globalisation has placed some nations, including Nigeria at economically disadvantage because they lack the basic requirements that can guarantee their active participation with other globalising nations. According to Ihonvbere (2002, p.67), these requirements include “growing economy, effective communication and functional ICTs, highly trained technical manpower and supportive institutional capacity and good governance exemplified by transparency, openness and accountability”. The government of Nigeria in particular needs to invest more in ICT (hardware and software) and manpower development as well as diversifying the economy for better participation in the globalization process.

Divisionalised structure according to territory, product or service has been observed to be a very good model of organisational departmentation among growing firms. However, it has been perceived that there is the need for efficient communication among the stakeholders who are affected by the organisation and whose activities can affect the organisation. The quantity and quality of information shared among this various categories of stakeholders will define their relationship with the company and its ultimate success or otherwise.

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KEY TERMS AND DEFINITIONS

Corporate Governance: This is the distribution of resources, rights and responsibilities among different participants in the corporation and description of the rules and procedures governing decision making on corporate affairs.

Decision Making: It is an organisational concept referring to making choices among alternative courses of action.

Divisionalised Structure: Is defined as a segment within the organisation where the divisional Chief executive officer is responsible for most of the production and marketing activities of the segment and is accountable for profitability measure.

Information and Communications Technology (ICT): Is an umbrella term that includes any communication device or application, encompassing: radio, television, cellular phones, computer and network hardware and software, satellite systems among others, as well as the various services and applications associated with them, such as video conferencing and distance learning.

Organisation: Is a group of people who are seen as social collectivities that require some level of understanding, coordination and communication to act in concert.

Organisational Communication: For management purposes, communication is perceived as the process by which people working in organisations transmit information to one another and share meanings.

Responsibility Accounting: Is defined as a method of accumulating and reporting both budgeted and actual costs as well as raising the level of revenues by divisional managers saddled with the responsibility.

Information Technology in Mining Services Applications

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1. INTRODUCTION

Information technology (IT) can play a significant role in mining industries by driving continual improvements in efficiency and safety, reducing the cost of extraction of coal and minerals and maximizing profits. Mining, being hazardous in nature, is one of the oldest and most important industries (Agricola & Hoover, 1950). Coal and minerals extracted from mining industries always take part in driving growth and steering progress across various aspects of the economy of the nation. Energy is collectively acknowledged as one of the most significant contributions for economic growth and human development (Dialogues at the Economic and Social Council, 2008). The growth of the nation, taking into account the all segments of the economy and all sections of society, is dependent on meeting its energy requirement adequately. Coal is the most important component of energy matrix for a long time and still contributing a reasonable amount of energy supply to the nations (Yuan et al., 2018; Melikoglu, 2017; Tiewsoh, Sivek, & Jirásek, 2017; Garg, 2012). On the other hand, minerals are important contributors for the production of metals/alloys, fertilizers, ceramics, electronic items and an extensive range of other products (Rankin, 2011). It is worth mentioning that business existence in the present scenario is dependent upon the ability of the management to update with real-time information, make decisions and execute timely. Now the question arises, how to do it? The answer is the adoption of information practices and automated technology. Further, in order to stand parallel in the market with other industries, the mining including oil and gas industries is also taking up the state-of-the-art technology in its operations. Mine safety is in general based on the use of geotechnical and environmental information to make suitable and timely decisions in order to prevent hazards. The continuous involvement of IT applications in mining industry can i) improve the mechanism of information dissemination, ii) enhance safety, iii) provide remote operations and excel towards mechanization, iv) improve fleet management, v) analyze environmental impact of mining operations, vi) map the exploration data and estimate the ore reserves, vii) improve the approach from material extraction and marketing to sales and transportation and viii) overall increase efficiency to improve productivity, reduce cost of production and maximize profits. On the other hand, in the oil and gas sectors, information technology helps to optimize the processes and simultaneously enhances the efficiency of upstream and downstream operations (Anthony and Abdulkareem, 2013; Petersen, Doyle, Carlsen, van der Linden, Myhre, Sansom, Skavhaug, Mikkelsen and Sjong, 2008)

2. BACKGROUND

Earlier researchers have developed and even proposed a number of IT based systems for improving the overall efficiency of mining operations. Golosinski (2001) recapitulated the IT-related developments and their impacts on the mining industry. Further, Chaulya, Bandyopadhyay, & Mishra (2008) proposed

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futuristic development of IT-based systems by highlighting the existing problems and their respective solutions by proposing a web-based information and decision support system for coal mining industry. Gupta, Mukerjee, & Singh (2013) presented various scopes of application of IT for the Indian mining industry. A comparison between traditional and modern design techniques of mining methods using computer and IT has been illustrated by Miladinović, Čebašek, & Gojković, (2011). A number of applications of Radio Frequency Identification (RFID) as well as wireless sensor network (WSN) for information dissemination including tracking and tracing of miners, equipment and explosives have been discussed for mining sector (Bandyopadhyay, Chaulya, & Mishra 2010; Mishra, Bolic, Yagoub, & Stewart, 2012; Mishra, Mandal, Kumar, & Sinha, 2013; Mishra, Stewart, Bolic, & Yagoub, 2014; Singh & Mishra, 2016, Mishra, Pratik, & Kumar, 2017; Minhas et al., 2017; Kumar, Chand, & Kumar, 2018). Virtual reality i.e simulation of real-world and imaginary environments and situations with a high degree of realism is a fast growing technology based on information and communication technology. Virtual reality-based training tools can provide simulated exposure to real-world working conditions without the associated risks. However, the training outside the direct working environment provides only limited real-life opportunities. Van Wyk and de Villiers (2009) discussed regarding the virtual reality applications including its appropriate requirements and limitations. Further, Singh & Mishra (2016) presented the need for radar-based systems and virtual reality system in mining industry. A wireless real-time sensing platform using vibrating wire-based sensor has been developed to communicate the geotechnical information wirelessly by means of Zigbee based sensor network to a remote and safer place or even at the surface (Mishra, Pratik, Kumar, Kumar & Mandal, 2018). The developed sensing platform has been integrated with the Internet of Things (IoT) to make the data available to anyone and everyone authorized for the same (Mishra, Kumar, Pratik, Kumar, and Kumar, 2019). They developed a Zigbee based wireless sensor network (WSN) and further extended to IoT with IP enabled gateway. An android based application has been designed for retrieving the data using the corresponding IP address. Further, the display of data on web browser has also been incorporated. Ike, Anthony and Abdulkareem (2013) presented the core application of information and communication technology (ICT) in oil and gas industries for upstream and downstream operations. They presented a case study for the application of ICT in oil and gas sectors. A reliable Internet of Things based architecture for oil and gas industry was presented by Khan, Aalsalem, Khan, Hossain and Atiquzzaman (2017). They proposed a novel IoT based architecture for Oil and gas industries and suggested the methodology for applying the same to upstream, midstream and downstream operations.

Keeping in view of the above, the attempts have been made in the present chapter to discuss the potential applications of IT in the mining industry in the present strategic business scenario. The section 3 of the present chapter deals with the various mining activities and methods as well as key issues to be faced by IT-based systems during implementation. Section 4 discusses the various application sectors of IT in mining industry and section 5 illustrates the application of IT in oil and gas industries followed by future prospects and conclusions in section 6.

3. THE WORLD OF INFORMATION TECHNOLOGY IN MINING

Information is a core component of globalization. However, information is not communication. Communication involves the provision of information in a format and manner that can be used by the beneficiary. Information technology can become an integral part of information dissemination, safety, remote operations, mine mechanization, fleet management, environmental impact due to mining operation,

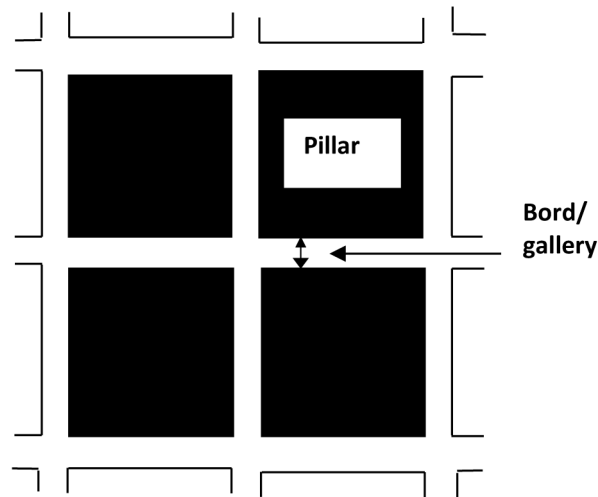
exploration of coal, minerals, oil and gas, process improvement and efficiency enhancement. It will play even major role in meeting the issues of the sustainable development facing the mining industry in the 21st century with new measures and innovative ideas (Rankin, 2011). However, before going into details of the application of IT in the mining industry, the outline of the mining activities and the key challenges posed during the implementation of IT are equally important to discuss.

3.1 Overview of Mining Activities and Methods

The sequence of activities in modern mining takes place usually in the five stages in the overall life of a mine namely prospecting, exploration, development, exploitation, and reclamation (Hartman & Mutmansky, 2002). The primary stage in the utilization of a mineral deposit is prospecting, the search for ores or other valuable minerals such as coal or nonmetallic. The exploration determines the size and value of a mineral deposit as accurately as possible. The work of opening a mineral deposit for exploitation is performed in the third stage of mining i.e. development. It initiates the actual mining of the deposits. Access to the deposit can be done in two ways either by stripping the overburden (soil and/or rock) to expose the near-surface ore or valuable minerals for mining or by excavating openings from the surface to access deposits buried inside in turn to develop underground mining. Exploitation, the fourth stage of mining, is associated with the actual recovery of minerals from the earth. The method of mining is decided by the characteristics of the mineral deposits keeping in view the restrictions imposed by safety regulators, environmental concerns, the viability of the technology, and economics (Brady & Brown, 2007). Further, the geological conditions, for example, the dip (inclination of a geologic structure from the horizontal), competency of the surrounding rock, and shape and strength of the ore/minerals, also play a key role in selecting the mining method. Conventionally, two mining methods i.e. surface and underground mining methods are taken into consideration. Surface mining is the predominant exploitation procedure worldwide. Open pit or open cast mining method comes under this category. open pit mining method is preferred to exploit a near-surface deposit or one that has a low stripping ratio which can be defined as the ratio of the volume of overburden required to be handled in order to extract some tonnage of ore or other valuable minerals (Okubo & Yamatomi, 2009; Sjöberg, 1996). A thick deposit is normally mined in benches or steps, whereas thin deposits may require only a single bench or face. Underground mining method is usually classified into three categories: unsupported, supported, and caving (Brady & Brown, 2013; Hamrin, Hustrulid, & Bullock, 2001). The unsupported method does not require major artificial support to tolerate superincumbent loads. In this method, the superincumbent loads are managed by the natural competence of the walls of the openings and pillars. However, reasonable amounts of roof bolting and localized support measures such as light structural sets of timber or steel are often employed. This method of mining is used to extract roughly tabular, flat or steeply dipping mineral deposits associated with surrounding rock. Room-and-pillar is the most common unsupported mining method. This method is used for flat-lying seams or bedded deposits like coal, limestone, and salt. In room-and-pillar mining, rooms are excavated and the support of the roof is provided by natural pillars of the minerals that are left standing in a systematic pattern (Wagner, 1980; Hustrulid, 1982; Peng, 2008). Fig. 1 shows the room-and-pillar mining method. Mines, which are having weak rock structures, are usually preferred for supported mining methods. It requires a substantial amount of artificial support to maintain stability during excavation and provide systematic ground control throughout the mine. In general, this method of mining is employed when unsupported and caving methods are not pertinent. Caving method of mining is associated with induced, controlled, massive caving of the overlying rock/ore body or both (Laubscher, 1994). Longwall mining is a caving method (Fig. 2). This method is well

adapted to horizontal seams, usually coal, at some depth. Longwall mining provides complete extraction of the coal contained in a large rectangular block or panel (300m wide and 2 to 3 km long), and subsequently, the roof in the mined-out area is allowed to cave or collapse (Mishra & Kumar, 2017; Peng 2019). Longwall mining consists of self-advancing hydraulic roof supports, a sophisticated coal-shearing machine, and an armored conveyor parallel to the coal face. Operating under the movable roof supports, the shearing machine travels over the conveyor while cutting and spilling the coal onto the conveyor for transportation to the surface. As the shearer cuts the full length of the coal face, it starts moving in the reverse direction without taking turn along the face taking the next cut. The movable support continuously shifts closer to the newly cut face. The steel canopies of the roof support take care of the safety of miners and equipment, while the roof is allowed to collapse. Extraction continues in the same fashion till the entire panel of coal is removed. The final stage, reclamation is the process of closure of the mine in which restoration of land and water takes place. Further, reclamation mitigates and reduces the environmental effects of mining.

Figure 1. Plan view of developed Bord and Pillar mining method for underground coal mines (Not to scale)



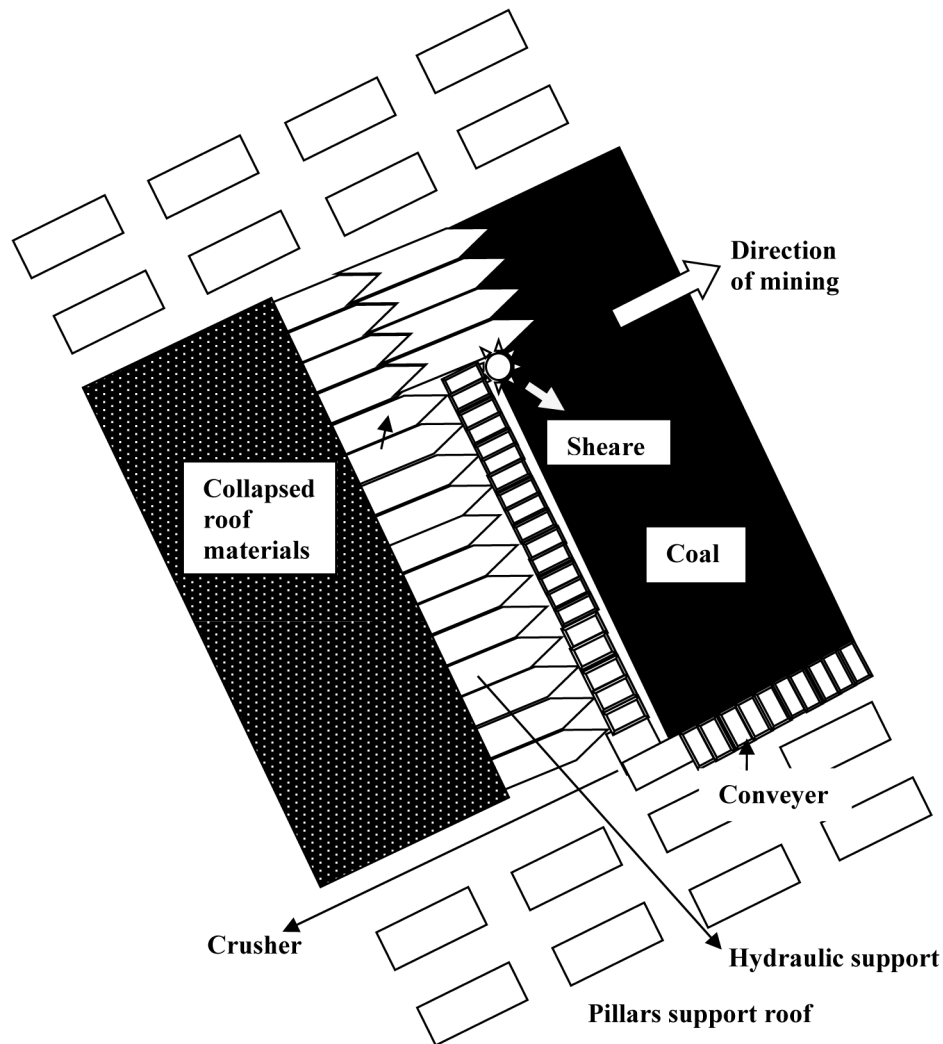
3.2 Key Challenges

IT has to face a number of challenges during its implementation in mining industry. To name few (Mishra, Bolic, & Yagoub, 2009; Mishra et al., 2014): i) harsh environment with extremes of temperature, humidity, inflammable gases and dusts, ii) shielding of electromagnetic signals by vehicles, rock, minerals, ore body and metal infrastructure, iii) exposures of explosives, detonators, and high voltages with electromagnetic signals during transmission, iv) lack of adequate infrastructures, v) explosion protection requirement for the electrical and electronic installation in hazardous areas etc.

4. SECTORS OF APPLICATION OF INFORMATION TECHNOLOGY IN MINING

Mining industry is facing many challenges due to its hazardous in nature as well as the globalization of the other industries to compete with them. Demand for coal, minerals and allied product is gradually

Figure 2. Plan View of Longwall Mining for underground coal mine (Not to scale)



increasing due to the industrial and population growth. Therefore, to balance the demand and supply ratio, it is important for mining industry to make the transition from traditional method to technology enabled processes like information technology and automation to improve the safety requirement as well production and productivity. Some of the fundamental roles of Information technology in modern era for economic growth and development are: i) it reduces transaction costs from more expensive means of communicating and transacting the messages from physical travel of personnel/letter/paper from one place to other, ii) it offers immediate connectivity for data, voice and even audio-visual means resulting to improve efficiency, accuracy and transparency, iii) it expands the scope of potential market of the coal, minerals and allied products, iv) it also widen the scope of engaging the suitable skilled personnel as per the requirement of the activity to be performed. Some of the following sectors can be targeted for application of information technology in mining industry:

4.1 Information Dissemination

It goes without saying that information is an important resource in decision making process for any industry. It becomes more vital when the situation is always changing hourly, shift-wise or day-wise such as in mining industry. Since mining is a dynamic process, therefore, the geotechnical and environmental parameters are always varying in case of both underground and open pit mines. Mining activities take place at multiple locations/districts within a mine and a large number of miners and mine personnel are engaged in various activities. Sharing the real time information across the workforce can help in enhancing the output per man shift as well as in fast and suitable decision making. In addition, machine for some particular activity can also be used at other location within the mine resulting to reduce the machine idle time if the previous activity has been completed. Information sharing with miners regarding their rights and obligations under legislation in force can make them aware to their responsibilities (Gibson, 2001). IT can help by displaying their rights and duties periodically at the work place or sending messages/emails etc. to recall. Further, mine management can also engage the suitable skilled personnel overcoming geographic isolation as per the requirement of the activity to be performed. Information technology can help the mine management to create a repository of all the information shared for future best practices by learning from the past experiences. This will also help in eliminating multiple information silos and associated perplexity.

4.2 Safety

The high risk associated with mining operations due to its perilous in nature puts safety on the priority list against the backdrop of various accidents took place in recent years (Mishra, Prasad, & Roy, 2015; Mishra and Kumar, 2017; Kumar, Mishra, & Kumar, 2017; Mishra and Kumar, 2017; DGMS annual report, 2017; DGMS annual report, 2018; MSHA, 2018). Improvement in safety measures can not only help in saving the lives and assets of the industry but also to save costs from insurance claims, accident damages, litigation and production delay. IT will provide internet sites such as local area network (LAN)/wide area network (WAN) for safety measures to be taken during various mining activities. Further, mining industry requires online and real-time geotechnical and environmental monitoring using IT enabled active systems to increase the safety in mining operations to the next level (Song, Rinne, & Van Wageningen, 2013).

Slope stability in open pit mining operation is one of the major concerns for safety which impedes the production of the mine to a large extent. Stability of any slope mainly depends upon the interaction of driving and resisting forces. The driving force causes down slope movement of materials and the resisting force opposes the same and prevents such movements. When the driving force exceeds the resisting force, the downward movements take place, and the slope becomes unstable (Tatiya, 2005). The continuous monitoring of slopes prior to slope failure can be very helpful in protecting life of miners, mining equipment and infrastructure developed for open pit mining operations. Slope failures are in general a result of small scale slope movements sometimes limited to a few centimeters of total displacement. Evaluation of rock slope instability requires the following three parameters (Bieniawski 1989): i) detailed information on the geometry of the exposed rock, ii) analysis of discontinuity properties such as joints, fractures and bedding planes, and iii) definition of the rock mass because these factors determine the mechanical behavior of the rock mass to a large extent. IT enabled 3-D laser scanners can be a suitable mode of accurate and minute monitoring for providing detailed information on exposed rock faces

(Slob, Hack, & Turner, 2002) and provide prior warning before failure. The advent of 3D laser scanners leads to a new method of measuring volumes and examining physical features of the Earth. Turner, Kemeny, Slob, & Hack (2006) evaluated the unstable rock slopes with 3-D laser scanner and developed an algorithm for determining rock discontinuity information and defining block size distribution. Singh (2017) has also highlighted the importance and features of 3-D laser scanner for monitoring the slope stability of open pit mines.

It goes without saying that blasting operation is still prevailing in most of the mines for extraction of coal and minerals, where adequate safety is required as an extensive amount of explosives and detonators are to be dealt with. Identification of the misfired holes is a challenging task if it takes place during blasting. RFID modules installed within or applied upon the explosives materials/articles can be used for real time tracking, tracing and monitoring the explosive materials (Morhard, Gelormino, & Zuckovich, 2007). Further, Mishra et al. (2012) discussed in details the feasibility for locating of misfired holes using RFID including the safety measures to be taken into account.

Strata control problems, which continues to be a major safety concern for underground mines, are very common. The problems include roof fall and side fall, air-blast, pillar crushing, or fall of cantilever behind the longwall face support in case of coal mines. IT can help to prevent such hazards in the following ways: i) continuous monitoring of strata condition and data acquisition, ii) online evaluation of strata behavior and real time and online transmission of the same to management level, iii) online decision making by the mine management, if problem persists with a feasible solution, and iv) giving warning at a very fast rate to the workers of the affected area for evacuation at a safer place. With outstanding advantages and ease of configuration, flexibility to shrink or expand the monitoring range, strong fault-tolerance and mobility, wireless sensor network (WSN) can play an important role in monitoring and analyzing dynamic, hostile and unfamiliar environments.

Toxic and combustible gases, typically found in underground coal mines due to various mining operations, are regarded as a problem of special significance for example, the mixture of various underground gases forms different type of dampers such as black and white dampers which causes suffocation as well reduces intake of oxygen into the blood, respectively affecting the health of miners. Further, hydrogen sulphide (H_2S) is an extremely toxic and irritates the lungs and respiratory tract and can even cause death with high level of exposure (>500 ppm) (Mishra & Kumar, 2017). In addition, the presence of inflammable/combustible gases lead to mine fire if persists beyond threshold limit. Therefore, innovative approaches are needed to improve the health of the miners working in underground. For this purpose, autonomous remote monitoring system or intelligent support system with the provision of audio-visual alarm could be an option. Here, WSN can be an opportunity as it has manifold interfaces to connect multiple environmental sensors for monitored the underground environment easily. Osunmakinde (2013) developed an autonomous remote monitoring framework for monitoring the underground environmental parameters using WSN coupled with intelligent decision making for miners. A number of researchers have developed/proposed the underground environmental monitoring system using WSN. A fuzzy logic approach has been presented using WSN for fire monitoring in underground coal mines by Muduli, Jana, & Mishra (2018). Moridi et al. (2015) proposed an automated underground mine monitoring and communication system based on the integration of WSN and Geographic Information System (GIS). They developed ZigBee nodes for sensing the underground environmental parameters including switching ON and OFF ventilation fans, and texting emergency messages. The system can turn the auxiliary fans remotely or automatically and send evacuation messages to underground miners during unsafe condition. Ray, Majumder, Maity, Roy, & Karmakar (2015) developed a robotic system to remotely

monitor the environment of a hazardous mine tunnel from the surface. The system is equipped with a set of operational sensors such as CO, CO₂, CH₄, temperature and humidity for monitoring underground environment and navigational sensors such as infra red sensors, compass, laser range finder and camera. The robot can be controlled either manually or autonomously and data can be transferred to the over ground monitoring station.

Sudden inrush of water during mining operation is a real threat associated with mining industry especially for those which are operating mines (Mishra & Kumar 2017). In general, additional pumps are engaged to lower the water level and permit miners to escape. If the flooded area is very large then a rescue shaft is developed by drilling. IT can play a significant role by integrating the additional water level sensors including other gas and geotechnical sensors at the strategic places with the WSN.

4.3 Mine Mechanization and Remote Operation

Mining industry is realizing the benefits of mechanization and remote operation in terms of production, productivity, improved efficiency and safety (Bandyopadhyay et al. 2010). In fact, this transforms the mining operations into greater reliance on technology. With the help of modern technology, the equipment involved in various mining operations can be controlled and even management of these operations can also be done remotely. On the other hand, due to minimal human intervention, the chance of manual mistakes will be minimized. Further, if the system will have capability for monitoring the critical parameters of machine health including geotechnical and environmental parameters, the automatic alerts as well as remedial measures will also be provided to initiate corrective actions. However, for effective implementation of mechanization and remote operation for various mining activities, it is vital to ensure that all the systems function in a synchronous manner to enable seamless data exchange. Mining being dynamic in nature and in general located in far flung areas, it offers another challenge namely, connectivity. It goes without saying that laying cables especially in underground mines is difficult and costly affair due to their uneven terrain and cable gets damaged in case of any disaster/hazard and the transmission of information will be stopped. Further, the cable has to be extended periodically as the mining operation progresses. So, the cable will have a number of joints and somehow reduces the performance of transmission. Therefore, wireless remote operation can help in this regard to a large extent (Mishra et al., 2018).

Automated system allows miners and mine personnel to communicate with and control machinery remotely without exposure to dangerous mining environments. It reduces health and safety risks. Automated equipment operates in a controlled fashion and precise manner which reduces machine idle time and in turn improves efficiency. It has been observed in many instances that efficiency improvements translate into reduction in requirements of energy and consumables and offer less wastage of the same (Fisher & Schnittger, 2012).

Further, remote automation relies highly on the use of sensor nodes that are proficient in offering the information needed to manage mining and processing operations. Advances in information processing allow these sensor nodes to evaluate signals and incorporate data from a number of geotechnical and environmental sensors. Artificial intelligence with Global Positioning Systems (GPS) and wireless connectivity with sensor nodes enable driverless trucks to either drive on their own or be driven by a remote operator. Computer systems that supply data on the velocity and position of the vehicle can stop accidents and improve the lifetime of these machines. Productivity loss can be reduced as breakdown regularity diminishes resulting in enhanced productivity and profitability.

4.4 Fleet Management

The productivity of mining operations essentially depends upon the efficient management and effective utilization of fleet. Managing equipment, tracking data, and transporting materials are top priorities especially for open pit mining operators, making fleet management a crucial part of their daily job. Mining industry manages large fleets of vehicles. Therefore, efficient management of these fleets of vehicles is a requirement for the mining industries which can play an important role in the safe transportation of both mine workers and mining materials. In the earlier literatures, many authors indicated that material transportation alone costs 50 to 60% of the total operating expenditure in an open pit mine (Alarie & Gamache, 2002). Reducing these expenditures by even a few percent using information technology will contribute in overall benefit to the mine. The use of information technology can be effective in a number of ways (Chaulya et al., 2008): i) reducing of idle time of machinery, ii) optimizing utilization of heavy earth moving machinery (HEMM), iii) health monitoring of HEMM, iv) quality control, v) crusher throughput management, vi) improving mine safety, vii) extensive online real time reporting of machines, and viii) feeling of mine activity through electronic eye. Whereas, in conventional mining operation/manual dispatch system includes i) manual attendance listing of available equipment, ii) manual allocation of equipment, iii) manual information of equipment, iv) trip counted by trip men, v) manual maintenance schedule and vi) manual report preparation.

Presently, truck dispatch systems are being used in most of the open-pit mines for efficient operation in the following fashion: i) minimizing shovel waiting time by assigning empty truck to the shovel waiting for a truck from long time, ii) minimizing shovel saturation by allocating the trucks to the shovel at equal time intervals to keep a shovel in operation without waiting for trucks, iii) minimizing truck waiting time by allotting an empty truck to the shovel where the truck loading operation will be initiated first, and iv) minimizing truck cycle time. For these purposes, a number of technologies have been integrated with manual dispatching system to minimize the time of operation and make the operation cost effective. Dispatching procedures range from simple relative priority rules (Crosson, Tonking, & Moffat, 1977) to solving linear programming-network flow formulations (Hagenbuch, 1986). Soumis et al. (1986) described a three-part procedure involving consideration of long-term objectives, non linear programming and the classic assignment problem. All of these systems have specific methods of deciding on best truck assignments. Lizotte, Bonates, Leclerc (1987) and Batchelor (1987) have reviewed and described the benefits of previous dispatching systems. They also designed and implemented the dispatching system using computer simulations. A tracking and monitoring system for opencast mines has been investigated by Bandyopadhyay, Chaulya, & Mishra (2014). The system has the capability of continuously tracking and monitoring the HEMMs and moveable equipment in opencast mines using ZigBee-enabled active RFID devices forming a dynamic wireless network among them and other static and mobile ZigBee devices placed at strategic locations. Use of system would help in i) maintaining computerized record and analyzing the performance of costly shovels and dumpers deployed in opencast mines, ii) optimizing the placement of dumpers with each shovel depending on the change in working and dumping places, iii) maintaining computerize attendance of dumper operators and other personnel working in an opencast mine, iv) providing warning to the signal man and dumper operator, while dumper approaching close proximity to the signal man, v) establishing two-way message communication among the personnel engaged in an open-pit mine and vi) improving production, productivity and safety in open-pit mine.

Keeping in view the developing pace of technology, the days are not far when that fleet management system of mining industry would explore smart information system by fusing IT with operation technology (OT). A proof of concept for cloud technology based fleet management system has also been suggested by Sodeyama, Takada, Hane, Furuno, & Watanabe, (2015). The said system consists of the following sub-modules: i) a server that runs the fleet management system software, ii) units installed in each vehicle to connect to the server via a wireless local-area network, and iii) the client applications that the dispatchers use for their work. The dispatchers use their client applications to monitor vehicle status and issue commands to the vehicle operators. The server stores production data collected during extraction process, production totals and details of vehicle operation. The server is commonly put in a room at the mine location, where its operation is administered by on-site system technicians. There are following five advantages of the system as claimed by the authors: i) remote dispatching, ii) ease of installation, iii) reliability and stability, iv) on-demand use, and v) access from mobile devices.

4.5 Exploration of Coal and Minerals

It goes without saying that exploration of coal and mineral is the first phase of mining cycle. However, most explorations do not turned into mine. Geographic information system (GIS) helps in managing data related to geographic locations in terms of compilation, processing, analyzing, displaying, and storing extensive amount of data. GIS It plays a crucial role in exploration of coal and minerals (Bonham-Carter, 1994). GIS replaced traditional map-analysis processes, drawing tools, and drafting and database technologies. GIS has helped in a number of mining operations from exploration to stope development, and production to mine rehabilitation. In case of exploration, GIS is an ideal tool for integrating various datasets such as geophysical images, geologic maps, radiometric surveys, geochemistry, boreholes, and mineral deposits. The main approaches in generating mineral potential maps using GIS are (Porwal & Carranza, 2015): i) establishing the exploration conceptual model, ii) building a spatial database, iii) analyzing the spatial data such as extraction of evidence maps, and iv) combination of evidence maps to predict mineral potential. It is obvious from the above discussion that mining organizations can use GIS to target mineral exploration, evaluate mining conditions, model mine construction and display geochemical or hydrological data. Therefore, information technology and computer methods have become the integral part of mineral exploration and mineral processing and management.

4.6 Environmental Impact of Mining Operations

Mining operations basically impact on the following environmental parameters: i) water resources, ii) air quality, iii) soil quality, and iv) carbon budget.

From water monitoring to air quality, information technology can save users operational time and resources by getting data to mining personnel without requiring them to spend hours in the field. Automatic information gathering and analysis help mine management to save on operating and maintenance costs and extend asset life, while at the same time complying with stringent regulatory and safety requirements. Innovative wireless systems allow field data to be captured and automatically downloaded when the unit is installed, eliminating human error during data transfer (Osunmakinde, 2013).

4.7 Process Improvement

Mining organizations need to ensure process improvement to remain cost effective and competitive from mining to material extraction and marketing to sales and transportation. Information technology can help to analyze and optimize organizational processes for improving efficiency. IT can help to make available the up-to-date operational information to the mine management to improve the mining operation and machine health, if required. Accurate and relevant information can be made available regarding production and sale online with only authorized access which in turn helps in marketing.

5. INFORMATION TECHNOLOGY IN OIL AND GAS INDUSTRIES

IT can help in upstream and downstream operations of oil and gas sectors. Upstream operations include exploration and production of crude oil and facing the challenge of increasing oil production and improving the rate of oil recovery. IT can assist in collecting huge amounts of data concerning to oil fields. Those data can be extrapolated by means of computational models for decision making with respect to optimal oil recovery methods. Horizontal drilling of oil wells requires accuracy in data management. By using well logging devices during drilling, the data from the oil wells can be transmitted to the management to ensure best practices. Downstream oil operations involve transportation and refining of crude-oil and processing and purifying the raw natural gases including marketing and distribution. IT can optimize the overall supply chain of oil and gas sectors.

6. FUTURE RESEARCH DIRECTIONS

Seeing the pace of development in information technology, it goes without saying that the future scenario of mining and allied industries will be a digital landscape. Technologies such as robots, robotic trucks, 3D printing, and automated exploration drones, autonomous stockpile management, autonomous robots for recovery of recycling material, pit drones, smart sensors, and industrial internet of things (IIoT) offer opportunities for mining and metal companies to revolutionize their operations and create remarkable value. It is worth mentioning that involving information and communication technologies with coal and mineral excavation including oil and gas exploration will lead towards an intelligent and unmanned operation in the near future.

7. CONCLUSIONS

Information and communications technology can be employed to the entire value chain and lifecycle of mining and mineral extraction. Further, upstream and downstream operations of oil and gas industries can also reap the benefits of the application of information and communication technology apart from the marketing and transportation. Exploitation of information technology for storing data, analysis and prediction of results helps in better control and optimization of mining operations. Data storage helps to quickly respond to information and remain successful in competitive market. By use of information technology, complaints can be reduced which in turn improve efficiency. Application of information technology can help in a number of key areas as said in the preceding sections, for example informa-

tion dissemination, safety, remote operations, mine mechanization, fleet management, environmental impact, exploration of coal and minerals, process improvement and efficiency. In addition, intelligent mining has the potential to avoid mistakes that result in loss of lives and expensive write-off of assets.

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KEY TERMS AND DEFINITIONS

Coal: Coal is basically a fossil fuel. It is the altered form of prehistoric vegetation that originally accumulated in swamps and peat bogs. High temperatures and pressures caused physical and chemical changes in the vegetation, transforming it into coal.

Information Technology: Information technology is the science and activity of moving data digitally.

Mine: An excavation made in the earth to extract coal and minerals.

Minerals: A naturally occurring inorganic element or compound with an orderly internal structure and a characteristic chemical composition, crystal form and physical properties and has been formed as a result of geological processes.

Mining: The activity, occupation, and industry pertaining to extraction of coal and minerals.

An Approach for Estimating the Opportunity Cost Using Temporal Association Rule Mining and Clustering

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INTRODUCTION

Inventory control is a process employed to maximize a company's use of inventory. The main objective of inventory control is to keep the total cost associated with the system to a minimum. This requires familiarity with supply sources, price negotiations including bulk quantity discounts, modes of transportation, budgeting, physical handling, record keeping, and monitoring the incoming quality of items. In real life situations, there are very large numbers of items in an inventory. It may not be possible to review (which includes computing inventory-on-hand, placing orders, receiving stock etc.) such a large number of items with equal intensity. Review activities take time and cost money. Hence items are usually classified into important and less important groups. The important ones get more attention than the others. The goal is to keep stocks at low level while giving good service.

Traditionally, ABC analysis has been based on the criterion of dollar volume and on the principle that there are a relatively small number of items. However, over the last 30 years, there has been an accumulation of research questioning this focus on a single criterion—the dollar volume. Several researchers suggested that multiple criteria should be used in the classification of inventories (Flores & Whybark 1987; Lenard & Roy 1995). However, the problem is that the profit of one item not only comes from its own sales, but also from its influence on the sales of other items or reverse, i.e., the cross-selling effect (Anand et al., 1997). In such a situation, it should be explained clearly whether the cross-selling effects would influence the ranking of items or not, and how to group the items if such effects existed, not concerning what and how many criteria could be used. For effective inventory management, lost sales should also be considered. Lost sales means the customer is impatient and may buy the products from other suppliers because of the shortage, the unmet demand is lost and opportunity cost (OC) of lost sales therefore occurs. Most researchers agree on selecting a constant value as the unit opportunity cost (UOC) of lost sales. Sharma & Sadiwala (1997) considered UOC as a constant value. However, such constant value should not be arbitrarily assigned. Sung & Seok Ock (1992) and Hsu & Lowe (2001) proposed that the penalty cost of lost sales can be estimated by customer goodwill loss. However, they do not provide a quantitative method to estimate the value of the goodwill loss. Many researchers (Wang (2002); Pentico & Drake (2009)) have considered opportunity cost by considering goodwill loss. Though, there are many models for calculating opportunity cost by considering goodwill loss, but there are very few models that have proposed a specific method to estimate the opportunity cost and the goodwill loss.

Further, Brijis *et al.* (2000) proposed a PROFSET model to select only the most valuable items for customized marketing. It determines the most profitable categories based on their profit lift into frequent item-sets of interest, by solving an all-binary optimization problem. The resulting categories imply a high

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monetary value and the ability to initiate cross-selling in the respective customer segment. However, the PROFSET model does not consider the strength of relationship between items. Also, it does not provide relative ranking of selected items, which is important in classification of inventories. Therefore, the PROFSET model cannot be used to classify inventory items. Kaku & Xiao (2008), further extended inventory classification considering cross-selling effect and ABC classification. The main drawback of this model is that they have not considered that whether and how the quality of association with related items impacts such ranking methodology. Xiao et al. (2011) classified inventory items which are correlated each other using the concept of cross-selling effect together with ABC classification and loss profit. The main advantage of this model was that they ranked inventory items in such a way that it helps inventory manager in really perceiving most profitable items. They classified items based on loss rule (Wong et al. 2005). The loss profit of item/item set is characterized as the basis for assessing the significance of item, in view of which inventory items are classified. They disclosed that to pass judgment on the significance of a item (set), it is not only by looking at the profit it brings in when it is on the shelf, yet additionally the loss profit it might remove when it is missing or stock out. Further, Many reaeachers (Mittal et al. (2015a, 2015b); Agarwal et al. (2016); Agarwal(2017a, 2017b)) have determined ordering policy using data mining algorithms. The opportunity cost of lost sales should be equal to the sum of lost sales of the unmet demand and the ADU brought by the associated products (Kaku *et al.*, 2011). However, they have not calculated opportunity cost for various clusters and particular time-periods.

Proposed Approach

In this chapter, how to estimate the opportunity cost, which are correlated each other is discussed by using the concept of ‘cross-selling effect’. We have discussed two cases for calculating the opportunity cost with cross-selling effect.

Case 1: A mathematical model to estimate the opportunity cost based on association rules considering cross-selling effect in different clusters.

An association rule is an implication expression of the form $X \rightarrow Y$, where X and Y are disjoint item-sets, i.e $X \cap Y = \emptyset$. The strength of an association rule can be measured in terms of its support and confidence. Support determines how often a rule is applicable to a given data set, while confidence determines how frequently items in Y appear in transactions that contain X .

Let $I = \{i_1, i_2, i_3, i_4, \dots, i_m\}$ be a set of items. Now, support of item i_1 is defined as the frequency of its occurrences in total transactions and confidence is defined as conditional probability of purchasing i_2 when i_1 is purchased and is given by formula:

$$Support(i_1) = \frac{Frequencyof i_1}{TotalnumberofTransactions} \quad (1)$$

$$Confidence(i_1 \rightarrow i_2) = \frac{Supportof i_1 \cup i_2}{Supportof i_1} \quad (2)$$

The clustering algorithm aims to minimize the cost due to large items and small items (Wang *et al.*, 1999). The overview of the clustering algorithm is described in Figure 1.

Figure 1. Overview of clustering algorithm

```

/* Allocation phase */

(1) while not end of the file do
(2) read the next transaction <t,- >;
(3) allocate t to an existing or a new cluster Ci ;
(4) write <t, Ci >;
/* Refinement phase */

(5) repeat
(6) not_moved = true;
(7) while not end of the file do
(8) read the next transaction <t, Ci >;
(9) move t to an existing cluster Cj to minimize Cost C;
(10) if Ci ≠ Cj then
(11) write <t, Cj >;
(12) not_moved=false;
(13) eliminate any empty cluster;
(14) until not moved;

```

Further, if the sale of item I_i is lost, all the purchasing patterns that contain I_i will not happen with the corresponding probability, until I_i is replenished. Hence, with regard to item I_i , it is reasonable that the total opportunity cost (TOC) in all transactions should be the DU of all possible item groups associated with item I_i (Kaku *et al.*, 2011).

Let $\text{sup}(\{I_i\})$ be the support of one-item set $\{I_i\}$, $\text{sup}(\{I_i, I_j\})$ be the support of two item set $(\{I_i, I_j\})$ and r_i is the unit DU of item I_i . The TOC of item I can be given by equation:

$$C_i = r_i \cdot \text{sup}(\{I_i\}) \cdot \{T\} + \sum_{I_j \in I - I_i} r_j \cdot \text{sup}(I_i, I_j) \cdot \{T\} \quad (3)$$

Let $\text{conf}(\{I_i \otimes I_j\})$ be the support of the association rule of $I_i \otimes I_j$. From equation (1), we can easily get the UOC of item i , which is represented by UOC_i as equation (2). As well as, the ROC, i.e., Ratio of TOC to DU (ROC in short) of item I is denoted as ROC_i , which is formulated in equation (3).

$$\text{UOC}_i = r_i + \sum_{I_j \in I - I_i} r_j \cdot \text{conf}(\{I_i \rightarrow I_j\}) \quad (4)$$

$$\text{ROC}_i = 1 + \sum_{I_j \in I - I_i} \frac{r_j}{r_i} \cdot \text{conf}(I_i \rightarrow I_j) \quad (5)$$

Thus, the opportunity cost (OC) is defined from the point view of association rules in each cluster.

Case 2: A mathematical model to estimate the opportunity cost based on association rules considering cross-selling effect in various time-spans.

Association rules are used to determine strength between relationships. The general temporal association rule is of the form $(P \Rightarrow Q)^{MCEP(PQ)}$ where $MCEP(PQ)$ is the maximum common exhibition period of items. Let $I = \{i_1, i_2, i_3, \dots, i_m\}$ be a set of m distinct items. The item-set could represent different items in a supermarket. A transaction T is a set of items I . A transaction could represent customer purchases of some items from a supermarket. A database Db is a set of transactions. Furthermore, the rule $(P \Rightarrow Q)^{MCEP(PQ)}$ is frequent if and only if $support((P \Rightarrow Q)^{MCEP(PQ)}) \geq min_supp$ and $confidence((X \Rightarrow Y)^{MCEP(PQ)}) \geq min_conf$ (Lee *et al.*, 2003). The working of temporal association rule mining algorithm is shown below:

Step 1: Firstly, the database is partitioned according to the exhibition period. An association rule $(A \Rightarrow B)^{MCEP(AB)}$ is called a general temporal association rule where $MCEP(AB)$ is the maximum common exhibition period of items.

Step 2: After 1st scan of database, candidate 2-temporal-item-set can be found.

Step 3: Candidate 2-temporal-item-set can be used to produce candidate temporal item-set and sub item-sets.

Step 4: After 2nd scan of database, find all frequent temporal item-set and sub item-sets.

Step 5: Generate all rules that satisfies minimum confidence values i.e. the rule $(A \Rightarrow B)^{MCEP(AB)}$ is frequent if and only if $support(A \Rightarrow B)^{MCEP(AB)} \geq minimum\ support\ and\ confidence$ $(A \Rightarrow B)^{MCEP(AB)} \geq minimum\ confidence$.

Further, if the sale of item I_i is lost, all the purchasing patterns that contain I_i will not happen with the corresponding probability, until I_i is replenished. Hence, with regard to item I_i , it is reasonable that the total opportunity cost (TOC) in all transactions should be the DU of all possible item groups associated with item I_i (equation 3,4 and 5).

Thus, the opportunity cost (OC) is defined from the point view of association rules in each time-period.

Numerical Example

Case 1: An example is shown to illustrate the approach of calculating opportunity cost of frequent items in each cluster. Let the set of items be $I = \{A, B, C, D, E, F, G, I\}$ and the corresponding unit DU is $r_A = 30.00, r_B = 20.50, r_C = 45.52, r_D = 50.00, r_E = 45.52, r_F = 40.00, r_G = 32.00, r_I = 23.00$

The parameters required are given below:

Table 1. An inventory transaction database

TID ITEMS
TID1 a b c
TID2 a b c d
TID3 a b c e
TID4 a b f
TID5 d g h
TID6 d g i

Minimum support, $\min_sup = 60\%$

Minimum confidence, $\min_conf = 75\%$

Each row in Table 1 can be taken as an inventory transaction. The association rule can be identified from these inventory transactions using the apriori algorithm..

Consider the transaction database of Table 1. It is assumed that the user-specified minimum support is 60%. A large item must be contained in at least 4 transactions (i.e., $6 * 60\%$). By applying clustering algorithm, the transaction database of Table 1 is clustered into two clusters consisting of $C_1 = \{tid1,$

Table 2. Opportunity cost of items in Cluster C1

Cluster C1				
Support	Confidence	TOC	UOC	ROC
Item A				
$sup(A)=1$		$r_A.sup(A). \{T\} +$	$r_A +$	$1 +$
$sup(A, B)=1$	$Conf(A, B)=1$	$r_B.sup(A, B). \{T\} +$	$r_B.conf(A, B) +$	$r_B/r_A.conf(A, B) +$
$sup(A, C)=3/4$	$Conf(A, C)=3/4$	$r_C.sup(A, C). \{T\} +$	$r_C.conf(A, C) +$	$r_C/r_A.conf(A, C) +$
$sup(A, D)=1/4$	$Conf(A, D)=1/4$	$r_D.sup(A, D). \{T\} +$	$r_D.conf(A, D) +$	$r_D/r_A.conf(A, D) +$
$sup(A, E)=1/4$	$Conf(A, E)=1/4$	$r_E.sup(A, E). \{T\} +$	$r_E.conf(A, E) +$	$r_E/r_A.conf(A, E) +$
$sup(A, F)=1/4$	$Conf(A, F)=1/4$	$r_F.sup(A, F). \{T\} =$	$r_F.conf(A, F) =$	$r_F/r_A.conf(A, F) =$
		$30 * 1 * 4 + 20.50 * 1 * 4 +$ $45.52 * 3/4 * 4 + 50 * 1/4 * 4 +$ $45.52 * 1/4 * 4 + 40 * 1/4 * 4$ $= 474.08$	$30 + 20.50 * 1 + 45.52$ $* 3/4 + 50 * 1/4 +$ $45.52 * 3/4 + 40 * 1/4 =$ 118.52	$1 + 20.50/30 * 1 +$ $45.52/30 * 3/4 + 50/30 * 1/4$ $+ 45.52/30 * 1/4 +$ $40/30 * 1/4 = 3.9505$
Item B				
$sup(B)=1$		$r_B.sup(S). \{T\} +$	$r_B +$	$1 +$
$sup(B, A)=3/4$	$conf(B, A)=1$	$r_A.sup(B, A). \{T\} +$	$r_A.conf(B, A) +$	$r_A/r_B.conf(B, A) +$
$sup(B, C)=3/4$	$conf(B, C)=3/4$	$r_C.sup(B, C). \{T\} +$	$r_C.conf(B, C) +$	$r_C/r_B.conf(B, C) +$
$sup(B, D)=1/4$	$conf(B, D)=1/4$	$r_D.sup(B, D). \{T\} +$	$r_D.conf(B, D) +$	$r_D/r_B.conf(B, D) +$
$sup(B, E)=1/4$	$conf(B, E)=1/4$	$r_E.sup(B, E). \{T\} +$	$r_E.conf(B, E) +$	$r_E/r_B.conf(B, E) +$
$sup(B, F)=1/4$	$conf(B, F)=1/4$	$r_F.sup(B, F). \{T\} =$	$r_F.conf(B, F) =$	$r_F/r_B.conf(B, F) =$
		$20.50 * 1 * 4 + 30 * 1 * 4$ $+ 45.52 * 3/4 * 4 +$ $50.00 * 1/4 * 4 + 45.52 * 1/4 * 4$ $+ 40 * 1/4 * 4 = 474.08$	$20.50 + 30 * 1 +$ $45.52 * 3/4 + 50 * 1/4 +$ $45.52 * 1/4 + 40 * 1/4 =$ 118.52	$1 + 30/20.50 * 1 +$ $45.52/20.50 * 3/4$ $+ 50/20.50 * 1/4 +$ $45.52/20.50 * 1/4 +$ $40/20.50 * 1/4 = 5.7806$
Item C				
$sup(C)=1$		$r_C.sup(C). \{T\} +$	$r_C +$	$1 +$
$sup(C, A)=3/4$	$conf(C, A)=1$	$r_A.sup(C, A). \{T\} +$	$r_A.conf(C, A) +$	$r_A/r_C.conf(C, A) +$
$sup(C, B)=3/4$	$conf(C, B)=1$	$r_B.sup(C, B). \{T\} +$	$r_B.conf(C, B) +$	$r_B/r_C.conf(C, B) +$
$sup(C, D)=1/4$	$conf(C, D)=1/3$	$r_D.sup(C, D). \{T\} +$	$r_D.conf(C, D) +$	$r_D/r_C.conf(C, D) +$
$sup(C, E)=1/4$	$conf(C, E)=1/3$	$r_E.sup(C, E). \{T\} =$	$r_E.conf(C, E) =$	$r_E/r_C.conf(C, E) +$
		$45.52 * 1 * 4 + 30 * 3/4 * 4 +$ $20.50 * 3/4 * 4 + 50 * 1/4 * 4 +$ $45.52 * 1/4 * 4 = 429.1$	$45.52 + 30 * 1 +$ $20.50 * 1 + 50 * 1/3 +$ $45.52 * 1/3 = 127.85$	$1 + 30/45.52 * 1$ $+ 20.50/45.52 +$ $50/45.52 * 1/3 +$ $45.52/45.52 * 1/3 = 2.8087$

Table 3. Opportunity cost of the items in the numerical example

Clusters	Frequent Items	TOC	UOC	ROC
Cluster C1	A	474.08	118.52	3.9505
	B	474.08	118.51	5.7806
	C	429.1	127.85	2.8087
Cluster C2	D	223	146.5	2.23
	G	223	111.5	3.278

tid2, tid3, tid4} and $C_2 = \{\text{tid5, tid6}\}$. After applying apriori algorithm on both clusters, we find item-set {a, b, c} is the most frequent item-set in cluster C_1 and item-set {d, g} is the most frequent item-set in cluster C_2 .

After calculating the support and the confidences of all frequent items in each cluster, the OC of lost sales in cluster C1 can be calculated as in Table 2 by using equations (3)-(5). Similarly, the opportunity cost of lost sales in cluster C2 can be calculated as shown in Table 3.

Observations

1. Consider cluster C1, the unit DU of item 'B' is the smallest in all items. However, the ROC of its lost sales is the largest. That implies, the item whose OC is the biggest may not be the most costly one which holds the biggest DU. Due to cross-selling effect, the OC of lost sales relies upon the way that what number of related items the item has. Consequently, the inventory model ought to recognize the interdependencies between items.
2. Consider cluster C1, item 'A' and item 'B' has same number of occurrences in the database. The item 'B' has a very small unit of dollar usage and occurrences of only four times in cluster, yet it holds the biggest ROC, because there are many items associated with item 'T'.
3. Consider cluster C2. Obviously, the unit DU of item 'G' is the smallest in all items. However, the ROC of its lost sales is the largest due to the fact that many items are associated with item 'G'.

Therefore, in inventory management, we should consider not only the profit of an item itself, but also the profit of its associated item.

Case 2: An example is shown to illustrate the approach of calculating opportunity cost of frequent items in each time-period. Let the set of items be $I = \{P, Q, R, S, T, U\}$ and the corresponding unit DU is $r_P = 5.00, r_Q = 4.00, r_R = 3.00, r_S = 2.00, r_T = 2.00$, and $r_U = 1.00$. Consider minimum support, $\text{min_sup} = 30\%$ and minimum confidence, $\text{min_conf} = 50\%$.

Consider the inventory item-set be $I = \{P, Q, R, S, T, U\}$ and inventory transaction set (TID) be: $\text{TID} = \{\text{TID1, TID2, TID3, TID4, TID5, TID6, TID7, TID8, TID9, TID10, TID11, TID12}\}$ shown in Table 4. Each row in Table 4 can be taken as an inventory transaction. S1, S2 and S3 are three partitions of the database db, in accordance with the month. As a result, a partial database $\text{db}^{2,3} \subseteq \text{Db}$ consists of partitions S2 and S3. Similarly, $\text{db}^{1,3} \subseteq \text{Db}$ consists of partition S1, S2 and S3 and $\text{db}^{3,3} \subseteq \text{Db}$ consists of partition S3. Using support-confidence framework, the temporal association rules can be identified from the database.

Table 4. An inventory transaction data base

TID	TID1	TID2	TID3	TID4	TID5	TID6	TID7	TID8	TID9	TID10	TID11	TID12
Items	Q,S	Q,R,S	Q,R	P,S	Q,R,T	S,T	P,Q,R	Q,R,S,T	R,T,U	Q,T,U	P,S	Q,S,U

Table 5. Scanning database for first time

S1 C2 Start Count QS 1 2 QR 1 2 RS 1 1 PS 1 1	S1+S2 C2 Start Count QS 1 3 QR 1 5 QT 2 2 RT 2 2 ST 2 2 PQ 2 1 PR 2 1 RS 2 1	S1+S2+S3 C2 Start Count QS 1 4 QR 1 5 RT 2 3 ST 2 2 QT 2 3 QU 3 2 RU 3 1 TU 3 2 PS 3 1 QS 3 1 SU 3 1
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Further, 1st scan of database is done. The database $db^{1,3}$ is considered which has three sub-partitions S1, S2 and S3. After scanning the first partition S1, we got four transactions {QS, QR, RS, PS}. Table 5, shows the scanning of database S1, S1+S2, S1+S2+S3.

After 1st scan database db, the candidate item-sets are as follows:

Candidate temporal item-set: $\{QR^{1,3}\}$, $\{QS^{1,3}\}$, $\{RT^{2,3}\}$, $\{QT^{2,3}\}$, $\{QU^{3,3}\}$, $\{TU^{3,3}\}$.

Table 6. Scanning database for second time

Candidate		Count	S ^r
C1	$\{Q^{1,3}\}$	8	4
	$\{S^{1,3}\}$	7	4
	$\{R^{1,3}\}$	6	4
	$\{Q^{2,3}\}$	5	3
	$\{T^{2,3}\}$	5	3
	$\{R^{2,3}\}$	4	3
	$\{Q^{3,3}\}$	2	2
	$\{T^{3,3}\}$	2	2
	$\{U^{3,3}\}$	3	2
C2	$\{QR^{1,3}\}$	5	4
	$\{QS^{1,3}\}$	4	4
	$\{QT^{2,3}\}$	3	3
	$\{RT^{2,3}\}$	3	3
	$\{QU^{3,3}\}$	2	2
	$\{TU^{3,3}\}$	2	2

Table 7. Pruning stage

Candidate Count
C1 {Q ^{1,3} } 8
{S ^{1,3} } 7
{R ^{1,3} } 6
{Q ^{2,3} } 5
{T ^{2,3} } 5
{R ^{2,3} } 4
{Q ^{3,3} } 2
{T ^{3,3} } 2
{U ^{3,3} } 3
C2 {QR ^{1,3} } 5
{QS ^{1,3} } 4
{QT ^{2,3} } 3
{RT ^{2,3} } 3
{QU ^{3,3} } 2
{TU ^{3,3} } 2

Further, Table 6 depicts the 2nd scan of the database and Table 7 shows the pruning stage in which if candidate item-set does not satisfy minimum support requirement is pruned.

After 2nd scan of database db, the frequent item-sets are as follows:

{Q^{1,3}}, {S^{1,3}}, {R^{1,3}}, {Q^{2,3}}, {T^{2,3}}, {R^{2,3}}, {Q^{3,3}}, {T^{3,3}}, {U^{3,3}}, {QR^{1,3}}, {QS^{1,3}}, {QT^{2,3}}, {RT^{2,3}}, {QU^{3,3}}, {TU^{3,3}}.

The final temporal association rules after 2nd scan of database are shown in Table 8.

Table 8. Temporal association rules after 2nd scan

Rules	Support	Confidence
(Q=>S) ^{1,3}	33.33%	50.00%
(S=>Q) ^{1,3}	33.33%	57.00%
(Q=>R) ^{1,3}	41.67%	62.50%
(R=>Q) ^{1,3}	41.67%	83.33%
(Q=>T) ^{2,3}	37.50%	60.00%
(T=>Q) ^{2,3}	37.50%	60.00%
(R=>T) ^{2,3}	37.50%	75.00%
(T=>R) ^{2,3}	37.50%	60.00%
(Q=>U) ^{3,3}	50.00%	100.00%
(U=>Q) ^{3,3}	50.00%	66.66%
(T=>U) ^{3,3}	50.00%	100.00%

Hence, items Q, S, R are frequent in time-period from January to March, items Q, T, R are frequent in time-period from February to March and items Q, U, T are frequent in time-period of March only. After calculating the support and the confidences of all frequent items in each time-period, the OC of lost sales in time-period of January to March can be calculated as in Table 9 by using equations (3)-(5).

Similarly, the opportunity cost of lost sales in time-period from February to March and March only can be calculated as shown in Table 10.

Table 9. Opportunity cost of items in time-period from January to March

Support	Confidence	TOC	UOC	ROC
Item Q				
sup(Q)=2/3		$r_Q \cdot \text{sup}(Q) \cdot \{T\} +$	$r_Q +$	$1 +$
sup(Q, P)=1/2	conf(Q, P)=1/8	$r_P \cdot \text{sup}(Q, P) \cdot \{T\} +$	$r_P \cdot \text{conf}(Q, P) +$	$r_P / r_Q \cdot \text{conf}(Q, P) +$
sup(Q, R)=5/12	Conf(Q, R)=5/8	$r_R \cdot \text{sup}(Q, R) \cdot \{T\} +$	$r_R \cdot \text{conf}(Q, R) +$	$r_R / r_Q \cdot \text{conf}(Q, R) +$
sup(Q, S)=3/12	Conf(Q, S)=3/8	$r_S \cdot \text{sup}(Q, S) \cdot \{T\} +$	$r_S \cdot \text{conf}(Q, S) +$	$r_S / r_Q \cdot \text{conf}(Q, S) +$
sup(Q, T)=3/12	Conf(Q, T)=3/8	$r_T \cdot \text{sup}(Q, T) \cdot \{T\} +$	$r_T \cdot \text{conf}(Q, T) +$	$r_T / r_Q \cdot \text{conf}(Q, T) +$
sup(Q, U)=1/12	Conf(Q, U)=1/8	$r_U \cdot \text{sup}(Q, U) \cdot \{T\} =$	$r_U \cdot \text{conf}(Q, U) =$	$r_U / r_Q \cdot \text{conf}(Q, U) =$
		$4.2/3.12 + 5.1/12.12 +$ $3.5/12.12 + 2.3/12.12 +$ $2.3/12.12 + 1.1/12.12 = 65$	$4 + 5.1/8 + 3.5/8 +$ $2.3/8 + 2.3/8 +$ $1.1/8 = 8.125$	$1 + 5/4.1/8 + 3/4.5/8 +$ $2/4.3/8 + 2/4.3/8 +$ $1/4.1/8 = 2.0313$
Item S				
sup(S)=7/12		$r_S \cdot \text{sup}(S) \cdot \{T\} +$	$r_S +$	$1 +$
sup(S, P)=2/12	conf(S, P)=2/7	$r_P \cdot \text{sup}(S, P) \cdot \{T\} +$	$r_P \cdot \text{conf}(S, P) +$	$r_P / r_S \cdot \text{conf}(S, P) +$
sup(S, Q)=4/12	conf(S, Q)=4/7	$r_Q \cdot \text{sup}(S, Q) \cdot \{T\} +$	$r_Q \cdot \text{conf}(S, Q) +$	$r_Q / r_S \cdot \text{conf}(S, Q) +$
sup(S, R)=2/12	conf(S, R)=2/7	$r_R \cdot \text{sup}(S, R) \cdot \{T\} +$	$r_R \cdot \text{conf}(S, R) +$	$r_R / r_S \cdot \text{conf}(S, R) +$
sup(S, T)=2/12	conf(S, T)=2/7	$r_T \cdot \text{sup}(S, T) \cdot \{T\} +$	$r_T \cdot \text{conf}(S, T) +$	$r_T / r_S \cdot \text{conf}(S, T) +$
sup(S, U)=0	conf(S, U)=0	$r_U \cdot \text{sup}(S, U) \cdot \{T\} =$	$r_U \cdot \text{conf}(S, U) =$	$r_U / r_S \cdot \text{conf}(S, U) =$
		$2.7/12.12 + 5.2/12.12 +$ $4.4/12.12 + 3.2/12.12 +$ $2.2/12.12 + 1.0/12.12 = 50$	$2 + 3.2/7 + 4.4/7 +$ $3.2/7 + 2.2/7 +$ $1.0 = 6.5713$	$1 + 3/2.2/7 + 4/2.4/7 +$ $3/2.2/7 + 2/2.2/7 +$ $1/2.0 = 3.286$
Item R				
sup(R)=6/12		$r_R \cdot \text{sup}(R) \cdot \{T\} +$	$r_R +$	$1 +$
sup(R, P)=1/12	conf(R, P)=1/6	$r_P \cdot \text{sup}(R, P) \cdot \{T\} +$	$r_P \cdot \text{conf}(R, P) +$	$r_P / r_R \cdot \text{conf}(R, P) +$
sup(R, Q)=5/12	conf(R, Q)=5/6	$r_Q \cdot \text{sup}(R, Q) \cdot \{T\} +$	$r_Q \cdot \text{conf}(R, Q) +$	$r_Q / r_R \cdot \text{conf}(R, Q) +$
sup(R, S)=2/12	conf(R, S)=2/6	$r_S \cdot \text{sup}(R, S) \cdot \{T\} +$	$r_S \cdot \text{conf}(R, S) +$	$r_S / r_R \cdot \text{conf}(R, S) +$
sup(R, T)=3/12	conf(R, T)=3/6	$r_T \cdot \text{sup}(R, T) \cdot \{T\} +$	$r_T \cdot \text{conf}(R, T) +$	$r_T / r_R \cdot \text{conf}(R, T) +$
sup(R, U)=1/12	conf(R, U)=1/6	$r_U \cdot \text{sup}(R, U) \cdot \{T\} =$	$r_U \cdot \text{conf}(R, U) =$	$r_U / r_R \cdot \text{conf}(R, U) =$
		$3.6/12.12 + 5.1/12.12 +$ $4.5/12.12 + 2.2/12.12 +$ $2.3/12.12 + 1.1/12.12 =$ 54	$3 + 5.1/6 + 4.5/6 +$ $2.2/6 + 2.3/6 + 1.1/6$ $= 8.999$	$1 + 5/3.1/6 + 4/3.5/6 +$ $2/3.2/6 + 2/3.3/6 +$ $1/3.1/6 = 2.9998$

Observations

1. Consider the time-period from January to March, the unit DU of item 'S' is the smallest in all items. However, the ROC of its lost sales is the largest. Because of cross-selling, the OC of lost sales depends on the fact that how many associated items the item has.
2. Consider the time-period from February to March, item 'Q' and item 'T' has same number of occurrences in the database. The item 'T' has a very small unit of dollar usage and occurrences of only five times given time-period, yet it holds the biggest ROC, because there are many items associated with item 'T'.

Table 10. Opportunity cost of the items in the numerical example

Time-Span	Frequent Items	TOC	UOC	ROC
January to March	Q	65	8.125	2.031
	S	50	6.571	3.286
	R	54	8.999	2.999
February to March	Q	45	9	2.25
	T	37	7.25	3.625
	R	38	10	3.334
March only	Q	13	6.5	1.625
	U	13	6.5	6.5
	T	13	6.5	3.25

3. Consider the time-period of March only. Obviously, the unit DU of item ‘U’ is the smallest in all items. However, the ROC of its lost sales is the largest due to the fact that many items are associated with item ‘U’.

Therefore, in inventory management, we should consider not only the profit of an item itself, but also the profit of its associated items.

With the help of results obtained, retail stores like wal-mart, reliance fresh and big bazaar, can analyze their inventory data in a more realistic way. Their data can be mined using temporal association rule mining to predict patterns in particular time-periods. These patterns can be further used to estimate opportunity cost of lost sales of frequent items in particular time-periods, which will help the retail stores to predict loss profit more accurately. This approach results in higher profit to the stores.

CONCLUSION

Introducing correlations of inventory items into inventory policies is very natural because such situations often occur in the real world. In this chapter, we have discussed to calculate opportunity costs which are correlated each other by using the concept of ‘cross-selling effect’. We have discussed two cases for estimating opportunity cost with cross-selling effect. In Case 1, temporal association rule mining has been applied to find relation between item-sets. This relationship is used to determine the customer’s purchasing behaviors considering cross-selling effect and various time-spans. However, this case does not classify inventory items considering similarity between transactions. In case 2, association rule mining has been applied to find relation between item-sets. This relationship is used to determine the customer’s purchasing behaviors considering cross-selling effect and various clusters. The lost sales of one item can influence the other item’s sales, which can be characterized by association rules. Based on this idea, we have considered different clusters to estimate the OC of frequent items. The opportunity cost is the sum of the profit of the item itself and the ADU that made by the related items. Results suggest that, the cheaper items may have larger OC in consideration of cross-selling effect, which depends on how many associated items they affect.

Future Research Directions

A future study would be extended to propose the model by using combination of various data mining techniques in order to integrate the associated demand and the lost sales into the multi-item inventory model. Also, an inventory model will be proposed considering time series in scenario, where variables are correlated.

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KEY TERMS AND DEFINITIONS

Association Rule Mining: It is used for searching interesting relationships among items in a given data set.

Clustering: It is defined as a group of similar elements.

Cross-Selling Effect: It describes the dependency of purchase of one item onto the purchase of another item.

Opportunity Cost: It is the profit lost when one alternative is selected over another.

Temporal Association Rule Mining: It discovers valuable relationship among the items in particular time periods.

Systems, Services, Solutions of the Public Cloud

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INTRODUCTION

Cloud computing impacts the way people interact with technology, at least for consumers. Users no longer store personal data on a single device, but instead access it from a range of devices. When people purchase a new phone, they need only to link it to the appropriate provider to access their contacts, calendar and other data, whether it be documents, photographs or financial statements, and they can exchange one device for another seamlessly and still be able to do what they wish to do. If an individual device fails, it may be inconvenient, but ultimately it does not involve loss of data or prevent access to the data from another device. As providers hold an up to date copy of the data, a user may for instance begin working on a presentation on a PC, continue working on it on a tablet, and decide to do some light editing on a smart phone.

What is not quite as clear is how these underlying technologies both function and coalesce, and moreover how organizations are to leverage the cloud to bring value to a range of stakeholders and interested parties. This article begins by outlining the fundamentals of cloud computing, concepts like service models and how cloud computing may or may not interact with traditional on-premise infrastructure. Then it considers the at times vexed, contentious questions of risk, security, governance and compliance. Once these questions are addressed and the suitable technologies properly implemented, the cloud is capable of delivering to organizations accelerated innovation and quality. This potential is reflected in the growth of the public cloud. European, Middle Eastern and Asian (EMEA) organizations sourced 35% of their total IT infrastructure from the cloud in 2017 and by 2022 this is forecast to grow to 63% (Scott, 2018).

BACKGROUND

A common view of the cloud is that it is nothing new, that people have been using centralized computing in the form of mainframes for instance. While this sheds light on some of the similarities between mainframes and the cloud, it does not reflect the differences between them, differences that are significant. One useful analogy is to compare the cloud and earlier technologies, with the smart phone and the traditional telephone. While the telephone as such is not new and the smart phone can do the same kinds of things as the traditional phone, it is much more flexible and powerful, and this is down to, in large part, how mobile devices take advantage of the cloud, making them more functional and helping extend battery life (Liu, Chen, Ma, & Xie, 2016). As a term “cloud computing” is problematic because it does not mean one thing, but is “an umbrella term” (Missbach, Stelzel, Gardiner, Anderson & Tempes 2013) that refers not just to a set of technologies but a new model of delivering a wide range of computing resources, services and solutions.

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Fortunately, the National Institute of Standards and Technology (NIST) has made a deliberate effort to define cloud computing and done this well, so much so that its three-page description of this term is now considered the standard for the industry. NIST defines cloud computing as “a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction” (Mell & Grance, 2011). This definition is comparable to the four key characteristics of cloud computing as “pay-per-use”, “elastic capacity and the illusion of infinite resources”, a “self-service interface” and “resources that are abstracted or virtualised” (Voorsluys, Broberg, & Buyya, 2011). The cloud is “ubiquitous”, “convenient”, and “on-demand” in the sense that users can access applications and data from anywhere and at any time, and because organizations (or “customers” as the literature often calls them) can, without having to talk to anyone, provision computing resources and services from a “shared pool of configurable computing resources,” a business model that involves renting multi-tenanted infrastructure.

SERVICE MODELS

Cloud providers, through the use of virtualization, essentially abstract the software, whether it be a server, a database or a network from the underlying physical infrastructure and offer customers logical software-defined computing resources and services that they can customize, secure, provision and manage in a way that meets their needs and requirements (Buyya, Vecchiola, & Thamarai Selvi, 2013). The service models in cloud computing all reflect this principle of abstraction and represent different sets of responsibility depending how much or how little customers wish to outsource. Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS) therefore represent progressively lower levels of engagement on the part of customers, as they cede more of their responsibilities to the cloud provider.

With IaaS, customers no longer need to purchase physical equipment and associated infrastructure, and manage it, whether it is a server in the case of a small business or a large datacenter in the case of a large business. They can instead utilize the provider’s resources presented to them in the form of *virtual* infrastructure such as virtual machines (VMs), networks, storage, firewalls, and load balancers, all on a granular pay-as-you-go basis, so that the customer pays for example for each hour of use of a small VM, which will be cheaper than a more powerful VM. While the benefits outweigh the constraints, customers need to know not just what the provider can but also what it cannot do and work within the limitations of a particular cloud. For instance, in Microsoft Azure once a virtual network has been created it is not possible to add a virtual machine to it. There are workarounds, for instance keeping the disk with the data and connecting them to newly created VMs in the existing virtual network.

In the case of PaaS, customers have no access to or control over not just to the underlying physical but also virtual infrastructure, such as servers, networks, storage and operating systems. PaaS involves the provision of resources and services, such as a development environment, database, and integration and development tools that can be used in a matter of minutes, all provided so as to reduce the effort and cost for SaaS vendors (Brown & Nyarko, 2013). Customers can instead focus on the functionality and logic of applications. It is the responsibility of the provider to ensure that a database for instance can cope with the increasing demands made on it and that the underlying operating system is properly patched and secure. Well-known examples of PaaS are AWS Elastic Beanstalk and Force.com (part of Salesforce.com). In terms of IaaS and PaaS, Amazon Web Services (AWS) is currently the largest public

cloud provider and Microsoft the second largest public cloud provider, with 57% and 20% of enterprises making use of them respectively (RightScale, 2016). This is in line with the Gartner magic quadrant (Leong, Toombs, & Gill, 2015).

SaaS is a fully-built software solution that customers can use immediately. It is an application that is owned by the provider, who takes responsibility for all aspects of its development, deployment and operation (Carstensen, Morgenthal, Golden, 2012) as well as for security, performance and availability. The application is accessed through a network connection by the customer, who usually pays a subscription of some kind instead of the traditional upfront license fee, which costs a great deal more because it gives the customer a permanent right to use the software whereas the subscription does not. The application or set of applications is hosted on a remote system and the customer data is stored by the provider but the customer can access the application or set of applications and the data from various devices and systems. Well-known examples of SaaS are Microsoft Office 365 and Salesforce.

DEPLOYMENT MODELS

NIST identifies four cloud deployment models: private cloud, public cloud, hybrid cloud and community cloud (Mell & Grance, 2011). The private cloud is owned and operated by a single organization that may have various customers, such as departments or business units. The organization is completely responsible for managing all aspects of the private cloud: procurement, configuration, maintenance, support and delivery of services. As a result, there are usually few significant cost savings or economies of scale or pooling of resources typical of the public cloud. Some commentators argue that few organizations will implement an on-premise cloud environment that satisfies the NIST definition because that is not only expensive but is also technically a highly complex undertaking (Golden, 2015). When most people refer to the “cloud,” they are thinking of the public cloud, a cloud entirely owned and managed by an external third-party provider. In most cases the public cloud involves shared third-party infrastructure, though exceptions can be made for those customers willing to pay a premium for hardware dedicated for their exclusive use.

The hybrid cloud acknowledges that most organizations would wish to continue making use of on-premise infrastructure that current IT staff know and understand while being able to take advantage of the public cloud and associated services. While the hybrid cloud is meant to be a private cloud that expands into the public cloud, in reality it may not entail the use of a private cloud at all and may instead simply be a more traditional on-premise virtual infrastructure that connects securely with one or more public clouds to form a single hybrid entity. One example of this is the use of compute in the public cloud while retaining data on local on-premise systems. Another is the use of SaaS that integrates seamlessly with existing environments. This is now being extended to the connection of not one, but multiple clouds as various companies take the view that most organizations are likely to make use of a number of providers and that these clouds need to be connected seamlessly (Schwartz, 2015).

The community cloud is typically a private cloud in which a number of entities share the cost and benefits, while avoiding some of the concerns around security and regulation associated with the cloud. This works best when the entities share similar security, governance and policy requirements (Bond, 2015). For example, multiple government agencies may make use of a single datacenter, with the result that less of their interactions traverse the internet (Winkler, 2011). While this satisfies regulatory and compliance requirements, it is not likely elastic or even highly available, and is typically only IaaS, with managed services having to still be built and maintained. The community cloud, though, may also be

part of an external, public cloud that has been especially designed and provisioned for that purpose. The Microsoft Office 365 Government Community cloud is an example of this. It satisfies a particular set of requirements: data is stored in the United States, customer data is restricted to screened Microsoft personnel and satisfies all the requirements of US public sector customers (Microsoft, 2016).

CLOUD SERVICE PROVIDERS AND SECURITY

There is no single consistent metric for comparing and assessing the suitability and quality of cloud Service Providers (CSPs). One valued source is that of Gartner, specifically its Magic Quadrant for IaaS. In 2018, there were only three leaders worldwide in this area: Amazon Web Services, Microsoft and Google. A few smaller CSPs exist such as Oracle, Alibaba Cloud and IBM (Gartner, 2018a). Due to the rapidly changing nature of cloud computing, greater focus needs to be the portability of systems and data. This means utilizing, where possible, open rather than proprietary frameworks and standards. Tools like Docker isolates and abstracts the software away from the CSP, making it easier to migrate from one CSP to another. In much the same way, Chef, Puppet and other automation and configuration tools can be used in a variety of environments.

When organizations adopt the cloud, much of their network, systems, application and data moves out of their immediate control and becomes the responsibility of the cloud service provider, something that clearly has profound implications for security, compliance and governance (Kale, 2014). The multi-tenant model of the cloud requires customers to trust providers, and not just with the orderly functioning of their operations but often with private data and intellectual property. The responsibility for security in the cloud is shared between customer and provider. With some of the security being the responsibility of the cloud provider and some of the security being the responsibility of the cloud customer. It is important that the customer understands, this demarcation line otherwise known as the “trust boundary”, since this involves having a good grasp of the scope of management and monitoring responsibilities. Moreover, the trust boundary changes depending on the service delivery model, the service level agreement and the provider’s approach to security (Mather, Kumaraswamy, & Latif, 2009).

Cloud security is still perceived by some as a barrier to cloud adoption. Most scholars believe CSPs run secure clouds (Scott, 2018) and this is likely true since large cloud providers can attract and retain the best security expertise and ensure that they adhere to best practice. The picture among consumers of the cloud customers, though, is quite different. A poll of IT leaders in European, Middle Eastern and Asian (EMEA) organizations found that 64% of IT leaders thought data security was the responsibility of the CSP. This is problematic as it suggests widespread misunderstanding and a lack of knowledge of the trust boundary, the line that demarcates the responsibility of the provider from the responsibility of the customer in cloud computing (Correia and Otiopong, 2017). In another survey of the top 10 emerging risks is “unauthorized access to sensitive or restricted information or the cloud provider is unable to provide access to information as a result of disruption to their own operations” (Gartner, 2018b).

With data being handled and stored by third parties, security, regulation and compliance considerations are vital. One widely-used standard is the Payment Card Industry Data Security Standard (PCI DSS), which applies to organizations that handle credit cards and specifies how personally identifiable information (PII) is stored and accessed. Another is the Health Insurance Portability and Accountability Act (HIPAA), which now designates providers as business associates of customers and therefore requires them to also be HIPAA compliant. These and other standards ensure operations are more secure but at some point, organizations also have to trust the cloud provider. Security is often cited as a barrier for

adopting the public cloud, and certainly in the past many customers have struggled with this (Carstensen, Morgenthal, Golden, 2012). This, though, is changing. As Rob Alexander, chief information officer of Capital One put it, “We can operate more securely on AWS than we can in our own data centers” (Krazit, 2015). The major issues for organizations are now instead a lack of resources and expertise (RightScale, 2016).

Organizations need not only specialist advice on the relevant legislation but also to make use of data classification framework so as to distinguish more sensitive data from less sensitive data. There is no standard that should be applied to all organizations since some are more tolerant of risk than others. The European Union, like many organizations, has adopted a cloud first strategy. This entails outsourcing IT delivery to a cloud service provider in order to reduce costs and enable innovation (Gleeson & Walden, 2016). As a result, costs switch from capital expenditure to operating expenditure, and as such makes it possible for organizations to adapt quicker to market conditions and organizational requirements.

FUTURE RESEARCH DIRECTIONS

Some scholars have expressed reservations and concerns that cloud computing both raises difficult questions related to security and relies heavily on a small group of large cloud providers, and that this threatens the essential openness and innovative nature of the internet (Anderson & Rainie, 2010). These kinds of questions do need to be investigated, as do how providers can best interface not just with customers’ devices but also with one another, because increasing numbers of customers’ systems and infrastructure utilize multiple providers’ clouds. These questions have not been entirely resolved, but what is clear, though, is that demand for and use of cloud services is rapidly increasing. Within a short time for instance few organizations will run their own email systems and most email will be stored in and accessed from the cloud. In addition, an increasing number and range of products from health monitoring implants to sensors in cars and buildings will rely on cloud computing.

One of the critical areas requiring scholarly attention is how government can create a sufficiently robust regulatory environment that will adequately protect customers, even though systems and data in the cloud traverse national boundaries and jurisdictions. These are as much philosophical as they are technical questions, but they demand urgent study and investigation. While many of the broad philosophical issues and challenges still need to be addressed, progress is being made with the development of approaches, frameworks and standards, including a unified cloud security taxonomy (Kumar & Goyal, 2019).

CONCLUSION

There is, strictly speaking, no such thing as “the cloud”. There is not one but many clouds, with providers aiming to make customers more effective and competitive through a wide range of services, including account management and billing, identity and access management, databases, developer tools, monitoring and a range of applications. Increasingly the cloud is mission critical for customers, whether these are individuals, small and medium-sized businesses or large corporations. It started mostly with test development environments and its use is expanding to increasingly diverse range of uses. The cloud increases access to resources that scale, but also masks even eliminates for customers much of the technical complexities and drudgery of running on premise infrastructure. Customers no longer need to manage hardware and licensing and have only to pay for the resources they use while being able to operate ef-

ficiently through the use of automation (Winkler, 2011). They can also immediately leverage large cloud providers' infrastructure to deploy applications easily and rapidly across multiple geographic regions. In 2014, there were twenty times more active VMs in the public cloud compared to 2011 (Bittman, 2015), making it clear that while the use of on-premise infrastructure and private clouds has increased, the greatest growth is from customers seeking to move new workloads to the public cloud.

When organizations adopt the public cloud, not only are they able to reduce the complexity and cost of operations, they also gain, through the provider, much greater flexibility, elasticity, and scalability. Storage, compute and networks can be "rapidly provisioned and released" (Mell & Grance, 2011) because interaction with the provider is minimal and operations are streamlined to maximize efficiency, including typically the use of standard service terms, service-level agreements (SLAs) and limitation agreements. This increased flexibility does raise challenges in terms of data security and access control because users store data and then share it with others who are not necessarily in the same trusted domain, but then staff managing on-premise infrastructure face the same kinds of challenges, often with a great deal less support from third parties. As one provider put it, the reason to move to the public cloud is "to lower costs, reduce complexity, and increase flexibility" (AWS, 2015). These factors will likely continue to drive growth in the public cloud over the next few years and beyond.

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KEY TERMS AND DEFINITIONS

Cloud Deployment Models: The way in which cloud services are provision, for instance the private cloud, the public cloud, and the hybrid cloud.

Cloud Service Models: The distribution of responsibilities for technological requirements between customer and cloud provider.

National Institute of Standards and Technologies: A federal agency within the U.S. Department of Commerce that is responsible for measurement science, standards, and technology.

Service Level Agreement: A contract that defines the level of service the customer can expect from the cloud provider.

Trust Boundary: The boundary between the responsibilities of the customer and the responsibilities of the cloud provider.

Virtual Machine: A guest machine that is capable of sharing the same physical hardware with another guest machine and runs on a hypervisor.

Virtualization: The division of a computer into multiple execution environments so that one level (e.g. the physical) can be abstracted from another (e.g. the operating system).

Hatchery Unit and Six Sigma Methodology

4

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INTRODUCTION

Poultry Sector

The population of the world is growing every year at an enormous rate. Continuous efforts are being taken to fulfill the basic facilities for a healthy life. The focus is to satisfy the food requirements for better and healthier food. Previously, poultry products like eggs and chicken were considered as agricultural products. There was poultry in the backyard for eggs and chicken on a small scale. Nowadays, the poultry products are accepted as a food item worldwide as the nutritive value of the poultry products is good. So, the eggs and chicken are gaining popularity as a healthy food. The poultry products are available at a reasonable price. Thus, poultry products are in more demand because of healthy quality food and low price. The processed food items from chicken are also becoming more popular all over the world. Also, there are dynamic changes in the urban lifestyle and food habits of the human and the per capita consumption of egg and poultry products has increased. To meet the increasing consumer demands, there is a need to enhance the production of good quality poultry products. Thus the poultry sector has huge scope to grow and market potential in developing as well as developed countries all over the world. The poultry sector has more opportunities for economic growth. So, with the idea of business, the poultry sector is becoming the poultry industry for economical profits. (Baines, 2004; Qualman, 2018).

The poultry sector is the most organized sector in animal agriculture and the fastest-growing sector in the Indian agricultural system. The poultry sector helps the agriculture system to rise with improved per capita income and economy rate. India is the world's third-largest egg producer and the fourth-largest producer of broiler chicken meat. India exports poultry and poultry meat products to various countries. The good market for poultry in Asia is Japan, Malaysia, Maldives, Indonesia, Singapore, etc. In the last five years, per capita, egg consumption has almost become more than double in India. The per capita poultry meat consumption has become 3.5 kg per annum. As the consumption of poultry product in most of the developed countries is more than 250 eggs and 20 kg chicken per annum, the poultry market is growing with many opportunities. (Chatterjee and Rajkumar, 2015; Hook, 2016).

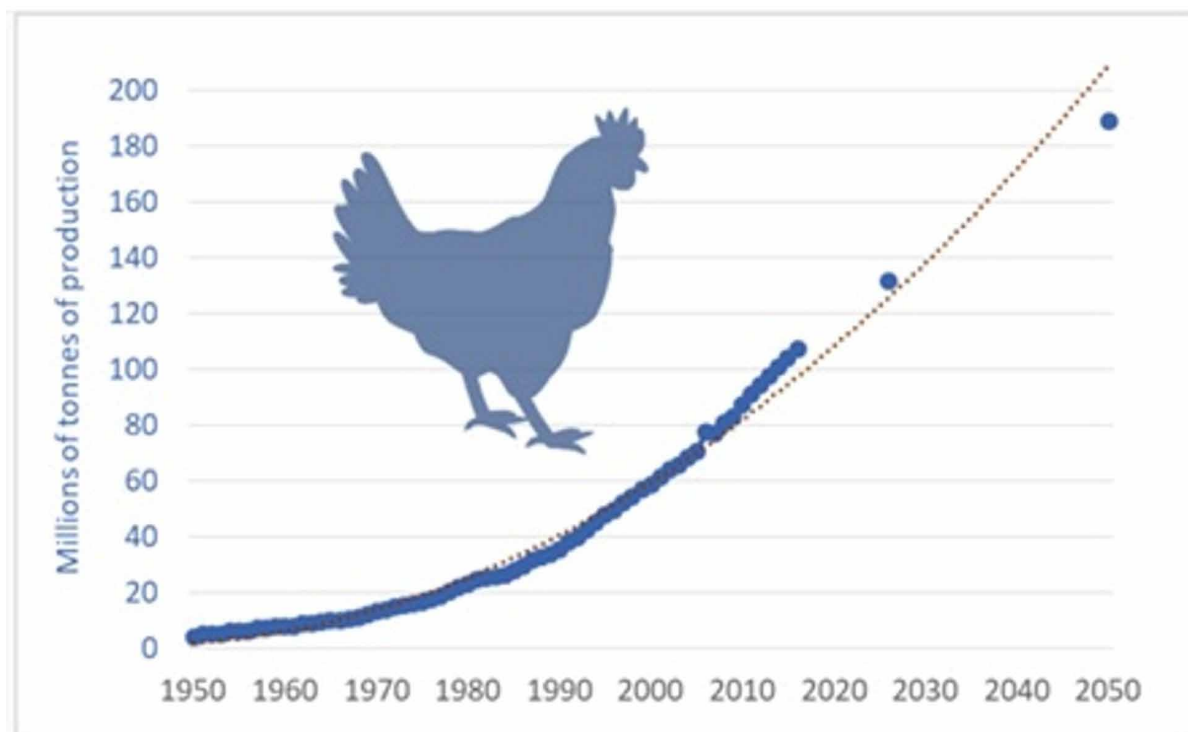
With increasing demands for poultry products, there is a need for expansion and industrialization of this sector. The poultry products provide nutritive values to humans and safe for consumption. The

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poultry sector improves the economic status of rural people. The future of the poultry industry is bright as the new opportunities and discoveries in different sections of the poultry industry are under research with the help of knowledge and challenges of this sector. (Abdul-Careem, 2015; Dhafr, 2006).

The research is going on to improve the production and quality of poultry products. Also, the scientists are working to reduce the contaminants, adulterants and to add more nutritive values to the chicken and other poultry products. With respect to the quality and health of chicken, the research work is going for improvement in the immunity of chicken and the production of healthy poultry products. The researchers are also identifying the new diseases of poultry; their causes, symptoms and treatments. There are some authorities to inspect and regulate the production of quality poultry products. The production in the poultry industry starts with the breeder farming then hatcheries. Once the hatch came out, the feed nutrition and growth of chicks is important. Then processing of poultry products like the collection of eggs and poultry meat processing is carried out. After that, the packaging and distribution of products to the customers are followed. The poultry products can further be converted into processed food and distributed to the end customers. This is the value chain in the poultry industry. (Chatterjee and Rajkumar, 2015). Figure 1 represents the exponential growth of poultry production with projected data.

*Figure 1. Representation of real and projected global poultry production
(Source: Qualman, 2018).*



CHALLENGES AND OPPORTUNITIES IN POULTRY SECTOR (Abdul-Careem, 2015; Hook, 2016).

The increasing production of poultry products is the need of an hour for over increasing demand of ever growing human population. This arouses some challenges in the poultry sector. These challenges can

be turned into various opportunities to develop this sector. The challenges can be associated with, some issues related to productivity, feed given to the chicken, storage and transportation of eggs and chicken, processing facilities and overall farm management. In spite of the challenges, the poultry sector should continue to grow exponentially over the years by innovative approaches like six sigma. There are many opportunities to improve the production of poultry products like improvement in farms, hatching units, processing facilities, storage, supply management, sanitation, skilled staff, etc. The challenges are explained in detail as below.

- **Productivity** Sometimes the facilities for production and procedures are being used to manage productivity are not inline. The low productivity of poultry is a challenge. The climatic variations in the farm can cause diseases to poultry as the mechanism to control climate are not proper. Automatic feed lines and temperature controllers can lead to improved productivity of the birds.
- **Storage Conditions and Transportation** If the poultry production is specific to a region then for the supply of eggs, live birds and chicken to other regions, good storage, and transportation facilities are the essential requirement. The unavailability of such facilities affects the quality of poultry and also creates a market imbalance. Storage and transportation of poultry birds in unhygienic conditions will also lead to low quality. Thus, the storage in cold chain, hygienic conditions should be taken care for poultry during transportation.
- **Availability of the Feed Ingredient and Quality of Feed** While considering the nutrition of birds, the supply of low quality of feed given to the poultry is becoming a big challenge and also opened lot many opportunities, nowadays. The feed provides all the nutritional values required by a chicken. If the quality of feed is not good, it will not help to produce healthier chicken with good quality of nutritional values for human consumption. So, the dietary supplements should be provided to poultry by taking into consideration of its nutritive values. There is growing competition between human and poultry for maize and soya especially. This leads to unavailability and increases feed cost.
 - **Processing Facilities** The processing facilities like feed processing unit, hatchery, other processing machineries, etc. should be provided in good hygienic conditions. The waste treatment plans should also be there in the poultry farm.
- **Farm Management** There are no specific guidelines provided by any authorities for the management of poultry farms. Farm should be managed by fully trained staff about the good quality production of poultry. The proper hygienic conditions should be maintained by expert staff by considering bio-security. The skillful and well-trained staff with knowledge of all processes and procedures will manage the farm well and meet the quality requirements of the chicken.

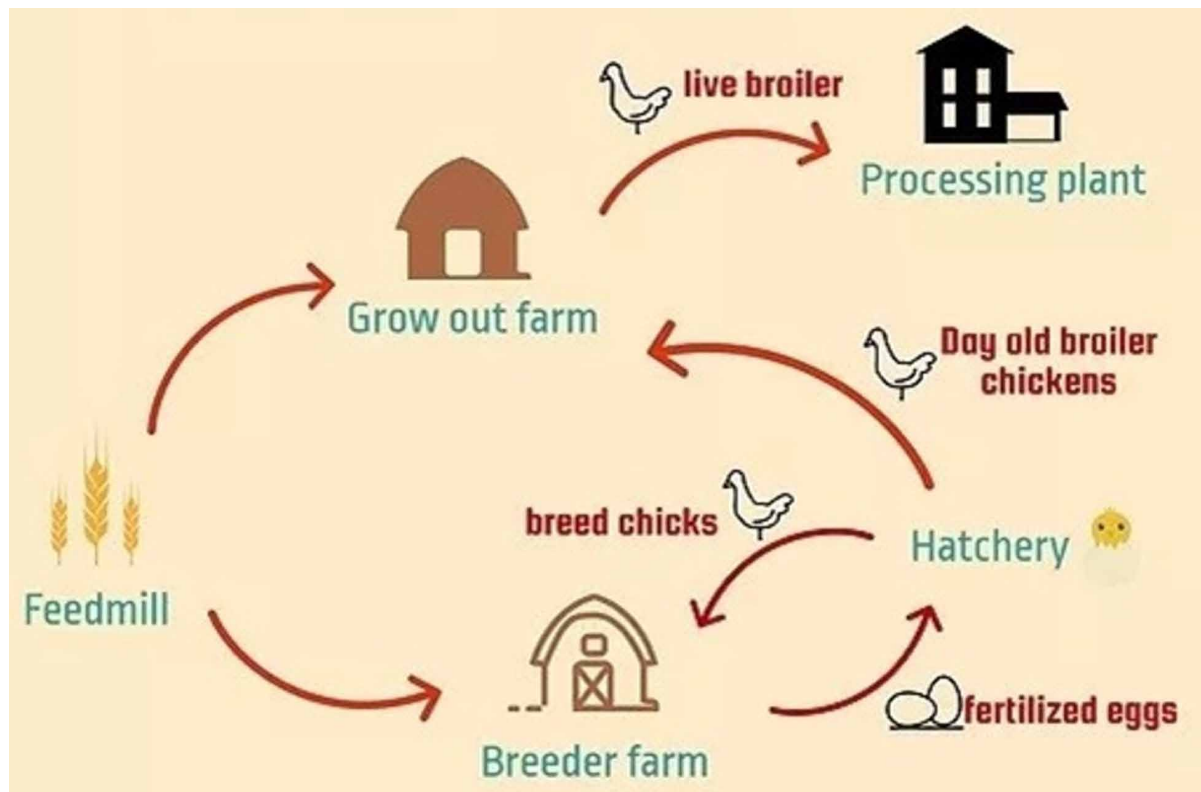
BACKGROUND

Hatchery Unit of Poultry

In poultry mostly domestic birds of various breeds of chicken; duck are kept for their eggs and meat. The eggs are kept in one room under artificial conditions to be hatched, that room is called as a hatchery unit. In India, there are more than 400 hatcheries. Out of which 160 are under Government authorization while rest others are operated by private sector.(Silva, 2016).

The veterinarian should be a technical person handling the hatchery unit. The hatchery manager is responsible for duties like to manage and co-ordinate all hatchery activities including managing the hatch schedule and other necessary records. The manager has to check and assure the quality of hatch including taking care of chicks with their packing, storage, and transportation. The manager of hatching unit should also have to manage animal welfare programs and comply with its policies, to plan budget. The manager has to maintain all the facility of hatchery unit with machines and equipments, to monitor cleaning and sanitation. The manager is responsible for supervision of all the activities and the employees for good quality production of hatching unit. (Rangoma, 2018; Ali, 2009). Figure 2 explains the flow of units in poultry.

Figure 2. Role of hatchery unit in poultry farming (Source: Darrin Qualman. 2018)



Hatchery Performance

There are some procedures to monitor the activities in hatching unit to control quality of hatch. These procedures are like fertility assessment of eggs, examination of debris of the hatch to check the developmental stages, monitoring weight loss of eggs during the incubation period, calculating chick yield, monitoring environmental conditions like temperatures, monitoring hatch window (Rangoma, M., 2018).

HATCHERY UNIT DESIGN (Rangoma, 2018; Silva, 2016; Linden, 2014; Samberg and Meroz, 1995)

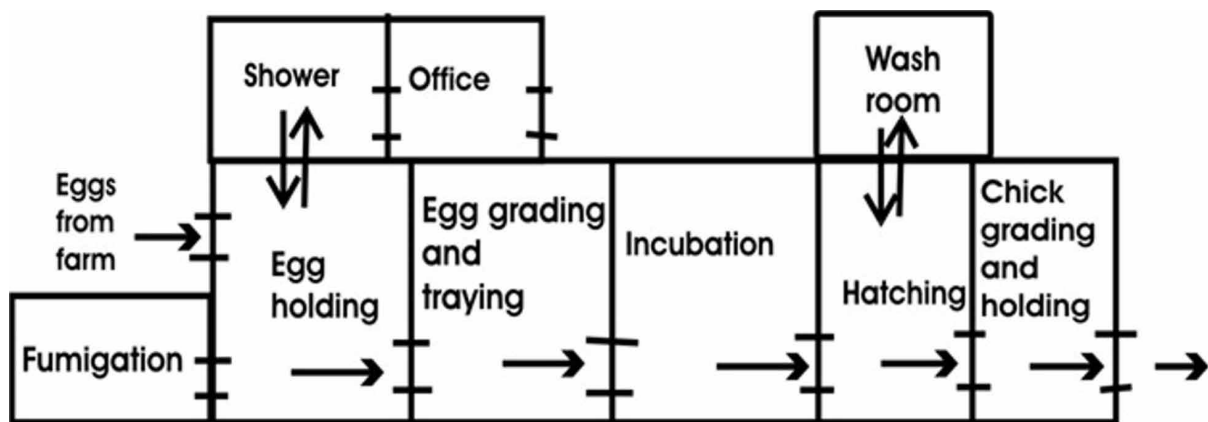
The building of hatching unit should provide the best artificial physical environment so that the optimization of efficiency of conversion of a hatching egg into a live and healthy chick can be carried out under the process of artificial incubation and hatching. Figure 3 represents a design of hatchery unit.

Location and Size of Hatchery Unit

The location of the hatchery is important in relation to bio-security. The location should be proper and away from the poultry house and other poultry farms. The location should be isolated and should have its own separate entry and exit without connecting to other areas. The dimensions of the area of the hatchery depend upon the requirement of the supply of chicks and the number of eggs to be hatched in a single hatch setting. The separation of area for every stage of the hatch should be proper. The travel of eggs in the hatching unit should be shorter and in a single direction.

Hatchery Design

Figure 3. Representation of design and flow of the hatchery
(Source: Rangoma, 2018)



Required Equipment

- Incubators
- Egg setting equipment
- Egg transfer equipment
- Chick handling and washing equipment
- Climate control equipment

The designing and construction of the hatchery unit should be in a way that the process flow is in a single direction. The eggs should be kept for the hatching at one end of the unit and chicks should be removed from another end of the hatching unit. Thus, the eggs should move from one room to next room so that

no reverse travels of eggs till the chicks and packaging of chicks. This flow avoids the human movements and interference and thus maintains the bio-security. The unit of hatchery should have a change room, egg reception room, egg setting room, incubator room, egg candling room, hatching room, vaccination room, packaging room, washrooms, store room etc. Generator is an essential requirement of a hatchery unit for the continuation of electricity supply. Generally a separate room is maintained for the generator. There are guidelines about the specifications of dimensions, the material of construction and the way of construction of the hatchery unit room. The details of areas of rooms are as follows.

Change Room

A change room is crucial in a hatchery room as it assists to maintain a microorganism free the environment. It should be carefully constructed and located at the entrance and exit of the unit. All persons entering into the hatchery unit should undergo a spray or shower and should wear clean clothes or gowns in the change room. Also, while leaving the hatchery unit; everyone should again undergo the gowning process to their appeals.

Egg Reception Room

There should be the special door and room to receive eggs for hatching as no entry is permitted into the hatchery for the personnel delivering eggs. The room should have sufficient space for collecting the eggs.

Fumigation Room

The area of the fumigation room should be compact. A fan should be circulated for air and exhaust.

Egg Holding Room

The eggs collected for hatching should be stored in an egg holding room. Its temperature and air movements should be well maintained around 12 to 16°C.

Incubator Room

It is also called as a setter room. The incubator room should have good access to personnel to other rooms. The separation should be by sliding doors. The size of room depends upon the capacity of eggs to be hatched and the equipment to be used. In the incubator temperature is kept around 36.5 –37.5°C & humidity at 45– 55% with the careful arrangement of the eggs in hatching trays. Eggs are kept at an angle of 45° with the narrow end pointing down.

Egg Candling Room

When eggs are transferred from one room to another, candling should be carried out. The room should be dark for easy candling of eggs. They are situated in between incubator room and hatching room.

Hatching Room

The construction of the hatching room should be well and with sufficient space as hatchers are kept here in this room. The hatching room should have good fittings of doors, good ventilation system. Fumigation system should have ventilators to discharge fumigants. In the hatcher, the temperature is kept around 35.5 – 36°C with humidity at around 65 – 75%.

Chick Holding Room

The chick holding room should come after the hatch room. The temperature (24°C) humidity conditions should be well maintained to avoid the excessive drying of the chicks.

Chick Sexing Room

In this room the chicks are separated according to sex. This room should be very clean, warm, properly ventilated and maintained for all the conditions. The grading of chicks carried out in this room. The material of construction of the table should be such as that it helps in easy disinfection and cleaning.

Wash Room and Clean Room

The clean area is important in sexing and grading operations of chicks in the hatchery unit. So, there are separate rooms for washing of the chicks. Necessary facilities with high-pressure pumps should be available in the room. The trays are stored after the washing. They are stored in room next to wash room called as a clean room.

Packing and Dispatch Room

The packing and dispatch room should be with an adequate space and have entry from the sexing room, the incubator room and the hatching room. The vaccination also carried out in this room before packing. The separate area should be allocated for record keeping and storage in this room. The door of dispatch should directly open outside the hatchery unit. The area for vehicle parking and transfer of chicks should be separately maintained here.

Storeroom

The storeroom should have adequate space for storage of trays, trolleys, racks, packing materials, labels, etc.

HATCHERY OPERATIONS (Smith, 2004; Linden, 2014).

The sequences of hatchery operations followed in commercial hatcheries are,

1. Securing hatching eggs
2. Traying hatching eggs
3. Fumigation

4. Cold Storage
5. Warm eggs prior to setting
6. Loading of eggs
7. Candling
8. Transfer of eggs
9. Pulling the hatch
10. Hardening
11. Grading
12. Sexing
13. Vaccination
14. Chick delivery
15. Washing and cleaning
16. Disposal of waste

The operations carried out in hatchery unit for economical large-scale production of the chick. The quality of chick depends upon the eggs selected and kept for hatching. Figure 4 explains the steps in the hatchery unit.

*Figure 4. Sequential steps involved in commercial hatchery unit
(Source: Silva et al. 2016)*

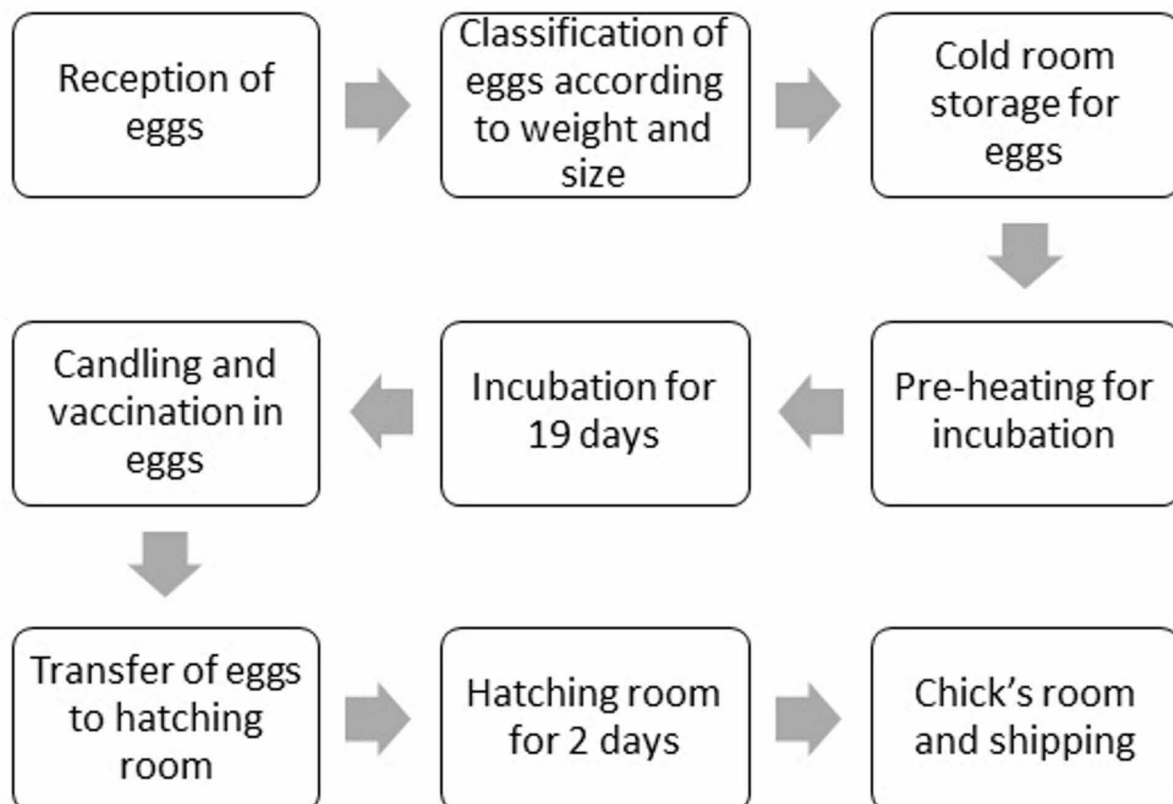
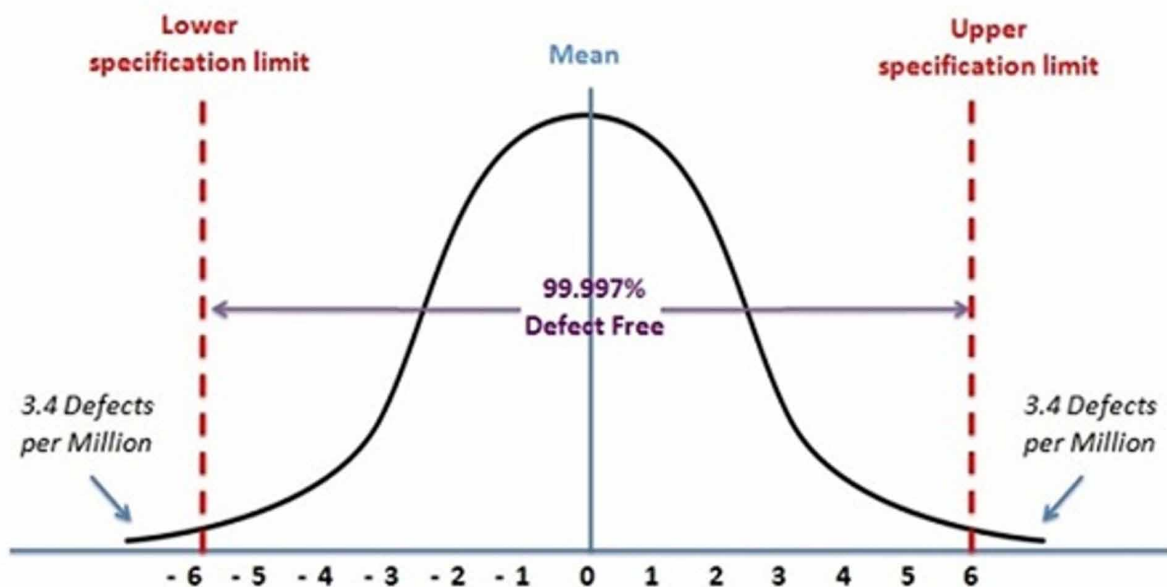


Table 2. Sigma scale of defects

Sigma level (σ)	Defects (PPM)	Cost of low quality(% sales)	Level of competition
6	3.4	<10	World class
5	233	10-15	World class
4	6,210	15-20	High Quality
3	66,807	20-30	Industrial average
2	3,08,537	30-40	Industrial average
1	6,90,000	>40	Non-competitive

The six sigma levels also can be defined by the normal distribution curve. This curve represents the defect-free area between the upper specification level and the lower specification level. Figure 5 represents the normal distribution curve. (Jagdale, S., C., et. Al., 2018).

Figure 5. Normal distribution curve (Source: Jagdale et. Al. 2018)



FEATURES OF SIX SIGMA

The main idea behind the methodology is to measure the defects by using statistics, to eliminate the defects by using some structural plan and provide the improved process with increased profits. So, the features of the methodology can be summarized as follows. (Fuentes-Pila & Monroy, 2007).

- The six sigma improves process efficiency by eliminating errors and costs involved in the process.
- The Six Sigma method requires data collection with accuracy as this is a data-based approach to solve an issue.
- This methodology follows a multi-dimensional, structural strategic plan with defined the goals, roles, and responsibilities of personnel involved in the process.
- This methodology values customer needs and intensifies the customer satisfaction.
- This approach provides more profits to businesses in terms of the commercial aspect.

BENEFITS OF SIX SIGMA

The Six Sigma offers benefits to the process to reduce defects in terms to achieve customer satisfaction. It sets the goal for staff, provides an action plan, reduces the times involved in the activities of the process, and minimizes the errors and process variability. This methodology helps in achieving targets and improves the level of customer satisfaction. The methodology improves the quality of the product which reduces the cost involved in the production and provides more business profits. (Valles, et al. 2004; Jagdale et. al. 2018).

PROCESS AND STEPS OF SIX SIGMA

The process of six sigma can be explained as the steps involved in getting more profits from the identification of the process defects up to process improvement. The sequential flow of steps in simple and general terms is identification of the issues and problems in the process, analysis of the process, collection of statistical data, analysis of collected data, identification of the defects and variations, proposal of plan to reduce defects, application of plan, analysis of process with improved plan, measuring the cost profits and achievement of customer satisfaction. (Jagdale et al. 2018; Herron and Braiden, 2006).

The roadmap to achieve six sigma levels in a process is DMAIC. The term DMAIC is derived from Define, Measure, Analysis, and Control. These are the different and sequential phases for process improvement. DMAIC is the most common approach used and implemented by companies. Another approach used as a quality improvement technique is DMADV i.e. Define, Measure, Analyze, Design and Verify. The phases of DMAIC have discussed in detail below. (Nave, 2002; Jagdale et al. 2018).

Define (D Phase)

The define phase starts with the generation of project ideas. This followed by the selection of projects, finalization of a project charter, preparation of a high level of the process map.

Measurement (M Phase)

The measure phase finalizes the project and performance of standards. Then validation of the measurement system for the selected project is carried out. This followed by the current performance measurement of the project and determination of the gap or scope for improvement of the project.

Analyze (A-Phase)

The analysis phase collects all the statistical data required for project analysis. The review of the collected data is also carried out. Thus, the analysis of the root cause of defects is carried out in this phase.

Improve (I Phase)

The improve phase works on the generation and evaluation of solutions to resolve the identified defects. Then the selection of solutions and optimization of the best solution to the project is carried out. The implementation and validation of the best-chosen solution are also done in this phase.

Control (C phase)

The control phase works on documentation of the solution and benefits offered by the best-chosen solution. A well-documented project is finally handed over to the project owner in this phase.

After completion of all the steps, the project closure is carried out.

Table number 2 explains the phases, goals and tools utilization property of six sigma.

ORGANIZATION AND HIERARCHY IN SIX SIGMA

The format of the organization for the person involved in the team is defined with their roles and responsibilities. The sponsor authorizes the project. The coach acts as a consultant. The team leader monitors the work while team members actually work on the project. Based on roles, responsibilities, expert area and competence level of members, the belts are given. The green belt is for the team leaders and members who have an expert area in basic analytical and statistical tools. The black belt is for leaders who are trained for methodologies application and analysis. The Master Black Belt is for reviewers of the project. (Fonseca, 2014; Jagdale et al. 2018).

BASIC TOOLS FOR DATA COLLECTION

The use of tools facilitates the process in a more systematic manner. Many tools are available for quality check. Nowadays, the use of tools by service providers is becoming popular. Many organizations use the tools to identify and analyze the data. The data is analyzed in qualitative and quantitative approaches. The data is also interpreted for the identification and standardization of the best solution for the reduction of defects of a process. The tools should be simple, easy to learn, easy to use, easy to understand and easy to interpret the graphical representations. The staff should easily get trained in utilization of tools. Based on the type of the utilization the tools can be classified into three categories such as quality tools, management tools, and planning tools. (Krishnan & Prasath, 2013).

For the collection of statistical data, tools are being used. Some basic tools like a flow chart, Ishikawa diagram, Pareto chart, histogram, cause, and effect diagram, scatter diagram, control charts, etc. are used for data collection. The flow chart represents all the steps of a process. Check sheet prepared from the analysis and collection of data. Pareto chart used to find out the important root cause of defects. The Ishikawa diagram is also called as a fishbone diagram or five why diagram or cause and effect diagram.

Table 3. Phases and Tools in Six sigma steps

DMAIC Phase Steps	Goal	Tools Utilized
D - Define Phase	Define the project goals and customer (internal and external) deliverables. Define Customers and Requirements (CTQs) Develop Problem Statement, Goals and Benefits Identify Champion, Process Owner, and Team Define Resources Evaluate Key Organizational Support Develop Project Plan and Milestones Develop the High-Level Process Map	Project Charter Process Flowchart SIPOC Diagram Stakeholder Analysis DMAIC Work Breakdown Structure CTQ Definitions Voice of the Customer Gathering
M - Measure Phase	Measure the process to determine current performance; quantify the problem. Define Defect, Opportunity, Unit, and Metrics Detailed Process Map of Appropriate Areas Develop Data Collection Plan Validate the Measurement System Collect the Data Begin Developing $Y=f(x)$ Relationship Determine Process Capability and Sigma Baseline	Process Flowchart Data Collection Plan/Example Benchmarking Measurement System Analysis/ Gage R&R Voice of the Customer Gathering Process Sigma Calculation
A - Analyze Phase	Analyze and determine the root cause(s) of the defects. Define Performance Objectives Identify Value/Non-Value Added Process Steps Identify Sources of Variation Determine Root Cause(s) Determine Vital Few x 's, $Y=f(x)$ Relationship	Histogram Pareto Chart Time Series/Run Chart Scatter Plot Regression Analysis Cause and Effect/Fishbone Diagram 5 Whys Process Map Review and Analysis Statistical Analysis Hypothesis Testing (Continuous and Discrete) Non-Normal Data Analysis
I - Improve Phase	Improve the process by eliminating defects. Perform Design of Experiments Develop Potential Solutions Define Operating Tolerances of Potential System Assess Failure Modes of Potential Solutions Validate Potential Improvement by Pilot Studies Correct/Re-Evaluate Potential Solution	Brainstorming Mistake Proofing Design of Experiments Pugh Matrix QFD/House of Quality Failure Modes and Effects Analysis (FMEA) Simulation Software
C - Control Phase	Control future process performance. Define and Validate Monitoring and Control System Develop Standards and Procedures Implement Statistical Process Control Determine Process Capability Develop Transfer Plan, Handoff to Process Owner Verify Benefits, Cost Savings/Avoidance, Profit Growth, Close Project, Finalize Documentation Communicate to Business, Celebrate	Process Sigma Calculation Control Charts (Variable and Attribute) Cost Savings Calculations Control Plan

It asks the five why questions to get all possible causes. The control charts used to identify defects in a particular sample size. The scatter diagram represents the graph representing the process variable relation. (Nave, 2002; Jagdale, et al. 2018).

Some advanced techniques like software are also being utilized for accurate and efficient data collection. The use of software facilitates easy analysis and interpretation of statistical data. Softwares like

iGrafx Process, Quality Tools Chart Generator, Sigma Flow, Data Lyzer Spectrum, ARIS are in use. Some Lean and DMAIC online project tools are in use like Idea Management, Financial Management, Roadmap Templates, Document Management, and Employee Workspace. (Nave, 2002; Jagdale, et al. 2018).

DISADVANTAGES

The six sigma also has some disadvantages can be listed as follows. (Coronado, & Antony, 2002).

- The administration format may cause a delay in the process
- The need for well trained and skillful staff is essential
- The internal quality of the product may get hampered
- The barriers may come into a picture while practical applicability of the theoretical solutions and principles

APPLICATION OF SIX SIGMA TO HATCHERY UNIT OF POULTRY

The six sigma approach is a continuous process improvement methodology. The six sigma approach helps to achieve better output after utilizing the inputs and transforming through processing. In a hatchery, unit eggs are the input and chicks as the output. For the conversion of eggs to chicks, there is a specific process to follow. Any variation in the process and methodologies applied in the hatchery unit, leads to reduced yield i.e. number of chicks will be small or effects the quality of chicks. This lastly effects on customer satisfaction and business in economic terms. If the six sigma model applied to the hatchery unit, it helps to reduce defects in the process and improves the overall process with the supply of good quality of output i.e. chicks. (Coronado & Antony, 2002; Lucato, 2014).

To apply this methodology for a hatchery unit, the training to all staff involved in the process is essential. The hatchery unit employees may face the problem where caution needs to be taken. These problems can be a key project for six sigma applications to hatchery units. Applying a six sigma to a hatchery unit involves many activities, utilizes time, money and efforts of employees and sigma team members. The organization needs to define the objective to implement a six sigma approach and the quality improvement of the process. It should undergo DMAIC phases and utilization of tools to derive statistical data for improved solutions. The selection and implementation of an improved plan is an important phase. The training of staff for implementing six sigma derived solutions is necessary. (Lucato, 2014; Radha Krishnan & Arun Prasath, 2013).

In order to maximize the supply of disease-free day-old chicks from a hatchery unit, it is necessary to take care of various processes. The control of the staff and vehicle movement in and around the hatchery unit ensures the maximum hygienic conditions and maintenance issues related to bio-security. The single direction flow of eggs through the hatchery ensures the production of clean hatching eggs with an output of healthy day-old chicks. (Fuentes-Pila & Monroy, 2007; “*Sistema de produção ensuete*” 2016; Salloom & Al-Juboori, 2016)

The traditional and manual incubation and hatching processes are based on experience. The manual settings of machines, equipment, controlling climatic conditions are difficult and time-consuming processes. Automated hatchery units with sensors are easy to process and optimize hatchability. The six

sigma methodology helps in maintaining the hygienic conditions and bio-security involves the choice of suitable location and site of a hatchery unit, designing of hatchery building, maintaining the one-way flow of eggs through the hatchery till the production and dispatch of chicks and routine cleaning procedures. A proper ventilation system, a maintenance of temperature and humidity conditions help in hatching the eggs. The maintenance of the equipments and regular monitoring of the microbial load minimizes the contamination. The six sigma approach implementations to a hatchery unit can improve the process by resolving the issues which hamper the quality of chick. This increases customer satisfaction and more business. (Ketsarapong & Ketsarapong, 2016; *Sistema de produção enxuta*, 2016; Kaizen Institute, 2014).

CASE STUDY

A case study conducted by Kaizen Institute, India to reduce the egg damage showed improvement in the hatching process. It improves the hatching process from 90% timely delivery to 99%. (Kaizen Institute, 2014).

BENEFITS OF SIX SIGMA APPLICATIONS TO HATCHERY UNIT OF POULTRY (Salloom & Al-Juboori, 2016; Ketsarapong & Ketsarapong, 2016)

The benefits offered by six sigma methodology implementations to the hatchery unit of poultry can be summarized as follows.

- Improvement of bio-security issues as the cleanliness and hygienic conditions
- Reduction of damage to the eggs
- Improved hatchability of the eggs
- Improvement in the end to end flow of eggs i.e. receiving of eggs and dispatch of chicks
- Improved health quality of the chicks
- Improvement in on-time supply and deliveries of the day-old chicks without an error
- Improvement in the logistics systems like the transfer of eggs from farm to the hatchery, hatchery to customers and processing plant, farmers, etc.
 - Improved utilization of the reliability of an equipment
- Optimization of raw materials and inventory management
- Improvement in the capabilities of the employee as the goal is set.
- The discipline of an employee as roles and responsibilities are defined.
- Error-free recordkeeping.
- Overall improved performance.
- Increased business profits.

CHALLENGES

The challenges in applying the six sigma methodologies to the hatchery unit can face some challenges. (Coronado & Antony, 2002; Ketsarapong & Ketsarapong, 2016).

- Competition between different internal units in the same organization
- Time, money and focus requirements for optimization of a significant step of a process
- Lack of knowledge and training regarding the critical points of the process

FUTURE RESEARCH DIRECTIONS

To overcome the challenges mentioned above, there is a need of more researches so that the hatching process can be more efficient and beneficial in economical terms. The complete understanding, proper training and good execution of the sigma methodologies to a specific process are essential to achieve its objectives and goal. The major issues which arise during practical applicability of the process improvement methods in the hatchery industry like electricity failure, maintenance of temperature and humidity conditions, the hatchery infection need to be addressed. The more research needs in the area of sigma tools applicability and lean six sigma methods in the hatchery. Similarly, more researches are needed for six sigma methodology approaches in other units of poultry like cold storage, feed processing plant, egg powder plant, slaughterhouse, packaging plant, etc.

CONCLUSION

A hatchery unit is a production unit of disease free, healthy chicks from hatching eggs and their delivery and dispatch. The six sigma approaches in process improvement technology where with the help of statistical data the defects in the process are reduced. The six sigma approaches are focused on the improvement of the production process. For business profits in a hatchery unit, the design and management of workflow should be optimized. For improved production and good quality of chicks, the contamination should be controlled. The six sigma helps to maintain hygienic conditions in the hatchery unit as it is the prime requirement.

The application of a six sigma methodology to hatchery unit provides benefits like, decreased production cost, decreased time utilization in a process, improved quality of output i.e. supply of day-old chicks, improved productivity, reduced defects, and increased profits and at the same time meeting the level of customer requirements and satisfaction. Recent studies are carried out for the utilization of data collection tools to analyze and interpret the defects. These tools also help to propose new improved strategic plans for reduction of the variations in the process.

For the six sigma methodology implementations in a hatchery unit, it requires the training to the staff including management for process improvement, updated tools for data collection and systematic implementation of quality tools and improvement solutions. Though the applications of six sigma to poultry have some limitations, it will modify the process for improvements and more profits with good quality output. If six sigma methodology applications are implemented to other units of poultry like different farms of various breeds, feed manufacturing unit, feed processing unit, etc, then the poultry sector will grow exponentially with quality improvements. This will help the poultry industry to be a more organized sector, and business profits with excellence.

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KEY TERMS AND DEFINITIONS

Bio-Security: It is nothing but preventive measures to lower down the transference of infectious diseases in poultry birds or other livestock.

Defects: It can be defined as the problems due to which the product or process fails.

Hatchery: It is a facility in which eggs are artificially hatched.

Incubation: It is a process of evolution of an embryo. In poultry, it is carried out artificially by maintaining the favorable temperatures and other conditions.

Poultry: The facility where homely birds are kept for their eggs and meat.

Process Improvement: These are the continuous attempts made for the betterment of the process or products by reducing defects and variations.

Six Sigma: It is a statistical data-based methodology for improvement of the process.

Designing a Business Analytics Culture in Organizations in India

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INTRODUCTION

The environment in Indian organizations has changed dramatically in the past 10 years. With the advent of global operations, everyone is talking about digitization and measurements. For Analyst professionals, the job remains simple – Analysts tell stories. But their stories always match the data. Without data, there are only opinions where the person with the biggest title is always right. It has become very critical to be clear on when one has evidence and when there are only opinions because fact based decision making is the path to profitability and creating competitive advantage.

A recent research conducted by the authors concluded that Indian Organizations require heavy inputs in planning their Data Requirements and Analysis to synch them with Business Problem resolution. (Paper: Banerjee, 2017). Data Organization, Formats and Availability of data are real challenges and need careful consideration before any Methodology is applied. Although, Data Science in developed economies are more focussed on processing and methodology, there is a continuous strive towards creating a workforce that can be equipped to leverage both structured and unstructured data reservoirs driven by Better Data Organization and Technology to facilitate decision making. This has led to organizations in India create a Business Analytics culture within the company where top management believes that employees are empowered to perform better when they can confidently make data driven decisions within their respective domain of work.

BACKGROUND

A senior management team in an organization that is contemplating investing in an Analytics function may often times see such investments as a consequence of trying to organize the data overload from disparate sources. Lot of work has already been done across organizations to convert data into narratives and then communicate the story to the relevant client using visualization methods for superior engagement of the audience (Figure 1).

The authors have emphasized in their book (Banerjee, 2017) the critical factors affecting analytics adoption in organizations. The model described in the book suggests some key points that are specific to an emerging economy as shown in Figure 2. The top management of global companies, while contemplating on the need to invest into such an offshore operational unit is often unable to drive a turnkey solution and therefore begins by relying on local consultants who can explain the global benchmarks.

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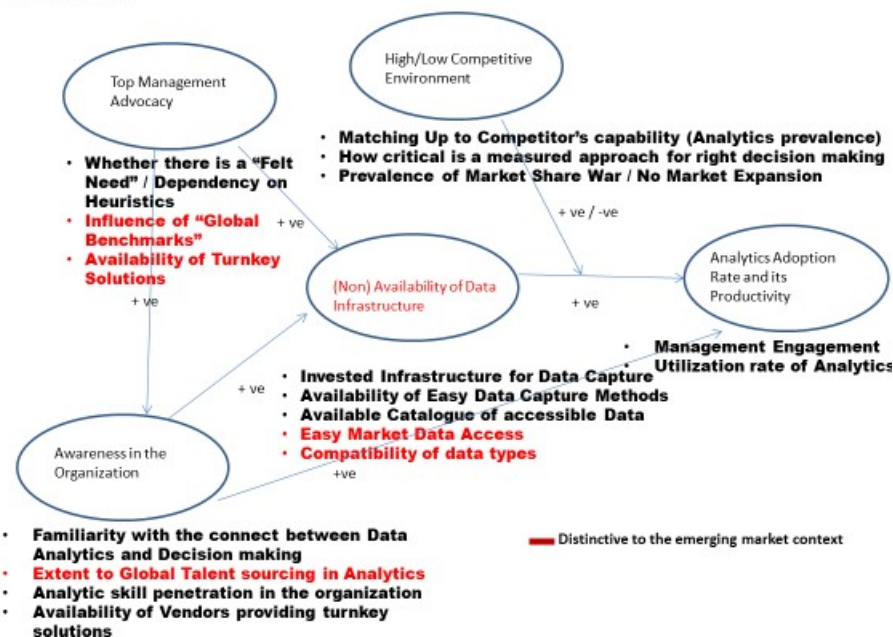
Figure 1. From Numbers to Narratives (Book: Banerjee, 2017)



There is a dearth of standardized data infrastructure due to legacy systems in place and compatibility issues. Adequate local resource is lacking and global resources may not be completely in sink with local needs for data, technology, culture and infrastructure.

Figure 2. (Book: Banerjee, 2017)

Critical Factors affecting Analytics Adoption in Organizations: with identified parameters distinctive to an emerging market context like India



RESEARCH METHODOLOGY

Building an analytics culture within organizations has been discussed in several forums, primarily with the advent of Big Data- data that is available in huge volumes; captured from multiple sources consciously by organizations or as part of an ongoing process; its availability in various forms text, audio, video,

image and online capture of data using sophisticated technology. The authors have used a case study to emphasize upon critical aspects that add value while deploying an analytics culture within an organization, with a focus on offshore operation. The case described below discusses some of these points and the methodology used for planning and implementing in a captive offshore operational unit in India.

CASESTUDY

A Global Bank's Consumer Lending USA – Operations in India

About

A global bank's top management has expressed the need to build a business analytics culture within their organization, across all office locations globally. It has presence in several countries across the world.

Its Consumer Lending (CL) arm has established an extension of its USA operations in the Global Service Center (GSC) in India in October 2019. The purpose of this CL unit is twofold:

- Support data management and analytical activities that serve as key inputs into CL's decision-making process
- Provide business insights emerging from consumer/market data analysis

The India based operation is expected to build an analytics culture and hence provide world class expertise in statistical and business analysis at a significantly lower cost. The objective for India based operation is to build a data management and analytical team in Consumer Lending to cost-effectively expand Credit Policy decision-making and ability to solve business problems. The unit is expected to have 46 resource persons across three broad functional areas (Credit Policy, CIM (Customer Information Management), and Marketing) in a couple of years time both by increasing output and enhancing the quality of work.

The four areas of focus in the next two years are:

- A. Hiring a senior Analyst to design the roadmap
- B. Designing a delivery-oriented organization structure
- C. Managing talent acquisition
- D. Managing skill upgradation and resource retention

The Roadmap Planned for Addressing the Focus Areas

As a first step Sonia Ray was hired as the senior Analyst. Sonia comes with 12 years of working experience with data management initiatives. Her experience has a mix of Business Acumen in the banking sector, good understanding of being able to plan Analytics driven initiatives (see figure 1), being able to work with technology teams to identify need for technology investments, an understanding of statistical models' outcomes, and being able to work with client teams to convert statistical outcomes to narratives that they can easily understand and implement. This touches upon the complete value chain of Business Analytics. Such a resource is difficult to find, hence she was brought into the company without much delay. After taking up the position Sonia formed a team consisting of end users, technology experts,

statisticians and analysts. As a first step, she and her team set out to gather relevant information which could provide insights about future talent demand in the Business Analytics roles in organizations in India. As a first step, she and her team studied and compared Research reports of 7 companies that provided a summary of research finding about the significance of building a skilled Analytics resource pool in India. Further, the analyst team compared the reports using text mining techniques in R software thus establishing similarity documented in the research reports. These reports describe the Analytics resource requirement by companies in India in the next 4-5 years. The seven company reports from which excerpts have been taken relevant to the topic of discussion in this paper are as follows:

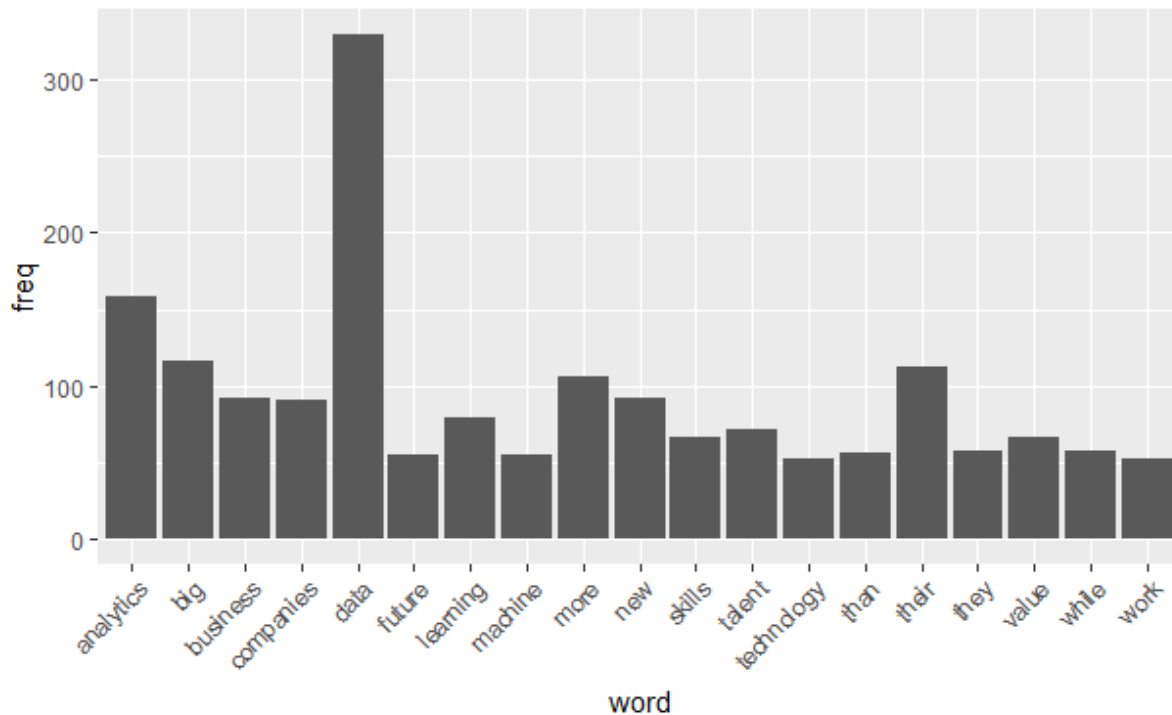
1. Indian Workplace of 2022. Are Organizations ready for the future? (PWC, 2014).
2. The Age of Analytics. Competing in a data-driven World December 2016. Mckinsey Global Institute (Henke, 2016).
3. Analytics India Landscape in India 2017 study. (Imarticus Learning, 2017)
4. Becoming an analytics-driven organization to create value. (EY, 2015)
5. Rewriting the rules for the digital age. 2017 Deloitte Global Human Capital Trends. (Deloitte University Press, 2017).
6. How the new geography of talent will transform human resource strategies. (Oxford Economics, 2012)
7. An inside look on what influences the Indian Analytics industry. (Jigsaw Academy, 2017).

The wordcloud (Figure 3) and histogram (Figure 4) generated by text mining the contents of the reports using R software indicate the frequency of appearance of certain words in large numbers such as “data”, “analytics”, “their”, “more”, “big”, “talent”, “companies”, “business”, “skills”, “future”, “work”, “new”, “value”, “learning”. Certain words appear in greater numbers compared to others. The histogram represents the same information in the form of a chart.

Figure 3. Wordcloud



Figure 4. Histogram



Using the visual representation in both the figures, the analyst was able to communicate to the management that in India, organizations are considering analytics as a means to manage their big data in the next 4-5 years. New talent and skills in this domain are being more emphasized as learning platforms to create business value in companies. The analyst further made some suggestions as stated in section B, C and D.

Suggested methods for Designing a Delivery Oriented Organization: The initial plan, as suggested by Sonia, was to set up a “Ring-Fence” model with high degree of monitoring of projects by the local supervisory team (led by CL India Head) and functional managers at the US office and with some assessment on the appropriate choice of projects to be outsourced to India.

Based on a detailed analysis, recommendation was made for a “functional silo” model for the organization with the opportunity for competency specialization across locations as against a “consulting” model. There may be an opportunity to displace significant proportions of technology-driven activities and Credit Policy functions to India. Also, a separate R&D centre to address longer-term process development issues (analytics-centric) can be housed at the India office.

The “consulting” model (internal outsourcing) may not be appropriate for two significant reasons:

- Most functional areas have assignments that require close coordination between business/market experts and data analytics experts.
- Remote locations such as the India office will not match up to acceptable levels of onsite market/business expertise to provide meaningful turnkey solutions to problems.

The functional organization model was considered to be more appropriate by Sonia Ray and her team for the following 2 reasons:

- A) In the medium term under a functional organization model, US office teams will move closer towards the following roles:
 - 1) Drive business and market understanding in developing ongoing and new initiatives.
 - 2) Develop and manage mainstream projects that have strict timelines and provide research and analytics inputs.
 - 3) Support (and to some extent drive) new R&D projects that require higher level of statistical and analytic inputs.
 - 4) Provide overall strategic direction to CL policy making.
- B) India office teams will move closer towards the following roles:
 - 1) Support mainstream projects (under strict timelines) by providing routine data analytics planning and processing support.
 - 2) Drive a significant number of green field R&D projects that require high end technical modeling and analytics inputs
 - 3) Support New CL initiative building and Policy making with insights developed through data (primarily) and market understanding.

Managing Talent Acquisition: Sonia realized that in India there is high availability of “raw” analytical resources but with on an average little or no domain / business knowledge. This is both an opportunity and a challenge as well. The reason being that although the resource pool is very strong on statistical knowledge it lacks experience with large –scaled databases. Attrition is high mainly due to low switching costs (the next job is across the street) and no long term stakes in the organization. Key differentiation between jobs is salary – most other work conditions are similar (non-standard work hours, routine work content and fairly mediocre career progression plans). Sonia wanted to create and develop resource pool that are adept at Business Analytics and are valuable for the Global bank locally as well as globally.

Road Blocks and Threats to Attaining Objectives

The GSC, the local India based operations team’s mission and operating protocol is unfortunately not synchronized to the needs of CL. Threats to attaining a world-class Analytics organization in India are due to lack of clarity on the following dimensions:

- **Accountability:** The relationship between the local and global offices
- **Organizational structure:** Definition of teams and their deliverable, need for creating virtual teams.
- **Budget authority and accountability:** What can the local office employees decide independently without the global nod.

After detailed secondary research and understanding the requirements of the organization, Sonia and her team made the following suggestions. It was suggested that the Head of Analytics Sonia Ray (India) and other India team functional managers shall be responsible for developing a training plan for Business Analytics based decision making for each India-based resource and ensuring implementation. They shall provide ongoing feedback to direct manager(s) in the US on project progress for each resource and any recalibration of deliverables. Act as the local mentor for India based resources. Identifying analytics

Table 1.

Key Area	Current Situation	Next Steps
Define roles and responsibilities of GSC	Unclear definition and roles of GSC	Senior management to negotiate with GSC global head to define a workable operating model for Bangalore operations
Designing delivery oriented organization	Evolving a satellite operation to Home Office	a) Complete assignments of projects to 90% of workforce b) Complete plans for new organization staffing requirements
Managing talent acquisition	Initiated Phase I recruitment process	a) Complete Phase I recruitment to build strength to 46 resources b) Enable team constitution and mentoring processes c) Complete basic training module for all new hires d) Initiate “Head Start” program for ongoing recruitment e) Complete review of compensation plan f) Develop plans for Phase 2 recruitment g) Complete infrastructure plan for Phase 2 recruitment
Managing Skill Upgradation and Employee Retention	Policies built for call center operations environment	a) Develop retention incentives in compensation program b) Enable team constitution and mentoring processes c) Initiate progression planning process for new hires at Bangalore and implementation of same on Phase 1 hires

development needs of local resources and ensuring early implementation of corrective action – specifically on parameters that directly affect integration of teams across remote offices.

The Functional Managers in US office will be responsible for Prioritizing Project delivery and specifying end deliverables (in consultation with the India Senior team members) that can be driven

by Business Analytics acumen. They shall conduct periodic project monitoring reviews along with the India senior team member. Additionally identify analytics training needs of its resources and developing a plan with the India team members on implementation. Flag the India Senior team on possible issues affecting long term integration of teams.

An action plan prepared by Sonia and her team is shown in Table 1.

CONCLUSION

The case study represents the challenges faced by many organizations while deploying Analytics operational teams in India. Here in particular, the case highlights the challenges for a global organization that is implementing a captive offshore operation in India. With experience and growing resource pool in India, such initiatives are developing into processes that can be replicated across organizations, albeit customized specific to the organization needs.

Future Research Direction

Business Analytics is an evolving area of study as regards to its application for data driven decision making in organization. The case described in this chapter has discussed how a business analytics culture can be created in an offshore operation of a global firm. In general Business Analytics is led by an objective to find specific insights or test and validate some hunches that the organization and its managers may have using appropriate tools and techniques. Various organization models of Business Analytics have emerged depending on utility and dependability of business on Analytics outcomes. The outcomes are presented using appropriate visualization methods supported by story telling methods. Ample opportunities exist in studying how organizations have evolved in adapting Business Analytics for their sector specific needs. Future research can be carried out in this area. Additionally, it will be interesting to determine the difference that exists in deploying Analytics culture in developed versus emerging economies across global organizations.

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KEY TERMS AND DEFINITIONS

Business Analytics: It is the process of working with factual information in organizations, using suitable tools and techniques to identify the nuggets of wisdom (insights) from them that can have direct impact on influencing good decision making.

Consumer Lending: It refers to the process by which a consumer takes loan from a bank. It is the category of lending centred around individual or household customers such as home loans, automobile loans, personal loans.

Data Science: With the increase in the amount of data captured by organizations, the various forms of structured and unstructured captured and the speed and frequency of it, significance of data science has increased over time. Data science is a methodical form of integrating statistics, algorithms, scientific methods, models and visualization methods for interpretation of outcomes in organizational problem solving and fact based decision making.

Global Services Centre: It means a central point of offering operational services for an organization. In this case, it refers to the local operations of the Global bank extended at the offshore unit of the bank in India.

Offshore: Move some of the organization's functions to a different geography than where the head office is located.

Text Mining: It refers to analysing large quantities of unstructured textual data using data analytics methods for relevant outcomes.

Wordcloud: It is usually an outcome of visualization method used for analysing textual data. It is a pictorial representation of frequency of occurrence of terms in textual documents, thus highlighting the ones that have maximum and minimum occurrence. It aids organization decision making and sensitivity analysis.

Review and Evaluation of Systems Supporting Data Journalism

4

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INTRODUCTION

In recent years, a new form of journalism has developed a strong dynamic: Journalism based on data. An important factor in its success is the availability of data from many public bodies and international organizations as part of the movement of open data worldwide. This form of journalism is based on the creation of stories that are based on data (storytelling), which are presented with attractive visualizations. Journalism of this type is practiced by both professional journalists and ordinary citizens (citizen journalism). The success of the move is so great that technologies and applications that support it have begun to emerge. Applications supporting data journaling have been developed in a wide range of domains that serve specific purposes in the data processing process and satisfy a wide range of users. Data processing involves many activities, but the key steps for completing the process are: data collection and cleaning, analysis and visualization, and ultimately the publication of the story. Although technologies are in a period of mature productivity, their evaluation is an area lagging in development. It is a fact that lack of evaluation based on a reliable methodology is evident in the literature. Finding a suitable methodology for this purpose is particularly important in order to (a) evaluate systems supporting data journalism resulting in a specific ranking of potential, and (b) make it easier for the user to choose the application that best suits his / her requirements and cognitive level. This study will attempt to evaluate specific applications with the assistance of appropriate methodology. A comparative evaluation of 9 applications related to the visual imaging component was attempted based on a methodological approach with usability and functionality criteria. The aim of this study is to provide a quick evaluation method, open to proposed improvements and further refinements, in order to establish a framework for qualitative assessment of data journalism applications.

BACKGROUND

A system's evaluation is the process of testing and validating whether the system achieves its predefined goals and in what degree. Although in literature there are several qualitative and quantitative techniques

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proposed for different kinds of systems, there is not yet enough research for data journalism systems evaluation, so a goal for the area is for an evaluation framework to be established. Relative background can be found in related areas (e.g. information visualization, HCI), while the most suitable criteria for the proposal of such a framework are: functional and usability features.

Yi et. al. (2007) have collected the techniques from various research papers by creating a classification for InfoVis (Information Visualization) related to the interaction techniques. The following three classifications focus on interaction techniques, while the fourth refers to the tasks of the system's user, i.e. it focuses on his/her goals without paying attention to the interaction. The four proposed classified techniques with their related research work are:

Low-level Techniques. Buja et al. (1996) classified the interaction techniques into three classes: *Focusing*, *Linking*, and *Arranging* views. Chuah & Roth (1996) summarized a set of basic visualization interaction (BVI) operations: *Graphical* operations, *Set* operations, and *Data* operations. Dix & Ellis (1998) condensed the different ways in which interactivity adds value and resolves conflicts in representation: Highlighting and focus, accessing extra information – drill down and hyperlinks, Overview and context - zooming and fish-eye views, Same representation / changing parameters, Same data / changing representation, Linking representation – temporal fusion. Keim (2002) proposed that in addition to the visualization technique, it is necessary to use some interaction and distortion techniques for an effective data exploration: Dynamic projections, Interactive filtering, Interactive zooming, Interactive distortion, Interactive linking and Brushing. A categorization of interactions can also be found in Wilkinson (2005). Interaction techniques are classified into seven categories: Navigating, Manipulating, Brushing and linking, Filtering, Rotating, Transforming, Animating.

Interaction Techniques. Tweedie (1997) considered interaction techniques based on the following taxonomical dimensions: Interaction types (manual, mechanized, instructable, steerable, and automatic) and Directness (direct and indirect manipulation). Spence (2007) concerned with taxonomy interaction techniques as follows: continuous, stepped, passive, and composite interaction.

Interaction Functions. Ward & Yang (2004) proposed a framework for interaction techniques, identifying distinct classes and shared concepts. The classification of interaction operations follows:

- interaction operators
- interaction operands & spaces, data value-spaces, data structure-space, attribute-space, object-space, visualization structure-space
- interaction parameters

User Tasks. Concerning the taxonomies of user tasks, Zhou & Feiner (1998) proposed that visual tasks serve as an interface between presentation intents and low-level visual techniques, they can be characterized along two dimensions: visual accomplishments and visual implications. The set of features which describe various aspects of visual organization is: Visual grouping, Visual Attention, Visual Sequence, Visual Composition, Visual Signaling. Finally, Amar et al. (2005) present a set of ten low-level analysis tasks such as: Retrieve value, Filter, Compute Derived Value, Find Extremum, Sort, Determine Range, Characterize Distribution, Find Anomalies, Cluster, Correlate.

Yi et. al. (2007) bridge these approaches and propose an evaluation scheme based on three axes for evaluating interaction models:

1. Descriptive power: The ability to describe a significant range of existing interfaces.
2. Valuable power: The ability to evaluate alternative design modes.

3. Generic power: The ability to offer help to design new interfaces.

Few & Edge (2012) list the features that visualization tools should support in certain categories: Visualizations, Interaction, Multi-Chart Displays, Statistical Calculations, Speed of Response, Data Access and Integration, Output and Content Management, Platform Options, Ease of Learning and Use, Programmability, Advanced Features.

Another approach of evaluating visualization software by Atwood & Reznik-Zellen (2018) is based on the use of Rubrics, that is, tables that contain characteristic criteria that are graded on a 3-level scale. The Rubric of writers is based on 13 criteria in order to evaluate technologies in a holistic high-level way. These criteria are divided into two categories with functional and usability features (as shown in detail in Table 1). The score ranges from 0 to 3 with 0 meaning poor, 1 modest, 2 good and 3 excellent.

For the purpose of the evaluation in this article, the approach of Atwood & Reznik-Zellen (2018) was chosen due to greater applicability to data visualization technologies. It can be broadly applied to technologies that primarily target interactive graphs, maps (mainstream), networks or combinations of them, on which we will focus on this study.

We have added one usability criterion in the original approach (No. 14 - Table 1), which refers to the ability to store on a cloud-based platform (cloud service) with some temporal/spatial restrictions and the possibility of visualizations privacy settings. This means we can discern the difference between the storage of an image file format or other type and that of cloud-based storage that is individually rated with spatial/time constraints. In this category, if the manufacturer of the application did not refer to time or storage limitation, it was considered that there is no such limitation.

REVIEW OF SYSTEMS SUPPORTING DATA JOURNALISM

Our goal is to evaluate tools that help a journalist support their own story with the means provided by technology. Because technologies are enough and cover different sectors in the field, often overlapping with each other, we have used some inclusion/exclusion criteria for the systems to be evaluated. The following software systems were selected on the basis that a data journalist should have no specialized programming skills, but he can use a tool that can learn easily, in a short time in order to bring the story to his public in the best possible way. The inclusion / exclusion criteria are as follows:

- Tools that need code input to create visualizations were excluded (e.g. google charts).
- We included tools that could be used for a reasonable amount of time without restrictions on their basic functionality either as a desktop version or as web-based applications.
- Applications to be evaluated could be made available without any financial consideration for use by interested parties for some time.

The evaluation will be done separately for each application with a description of its purpose, a brief explanation of its functions, some observations we made when testing each one in individual attributes, and the score in the attributes selected with the individual comments in each category. To control entry capacity, we used 3 xlsx files of about 5 MB (120000 lines), 9 MB (240000 lines), 30 MB (865000 lines). The evaluation of data journalism systems has been conducted by the first author of the article by testing the tools on certain tasks (specifically the creation of interactive charts, maps and network graphs) for producing journalistic stories, using the aforementioned datasets.

Next, we present a short review for the applications being evaluated in the present article: Tableau, Gephi, Cytoscape and web-based applications Datawrapper, Plot.ly, Datavisual, Infogram, Datacopia & Filtergraph.

1. Cytoscape (Desktop Version 3.6.1)

Purpose of use: An open source software platform to visualize complex networks for each type of data.

Description: Although originally developed to assist research in biology, it is also used in other areas of network analysis (Shannon et. al., 2013). It is designed to analyze and visualize large-scale networks. The input accepts a variety of file formats (sif, nnf, gml, BioPAX etc.). The network can be created either sequentially by the user with the possibility of inserting pictures, shapes or text frames, or automatically by the system by entering data from a table where the user guided by the interface defines the details of the network. Tools for handling visualization network include functions such as scale, align, rotate, distribute and a variety of algorithms for graph layout. A feature of the menu is the access to available-to-install apps that perform specialized functions. Filtering can be applied to select a subset of nodes and edges that meet certain criteria Network layout algorithms support various representations with a variety of features. The publication of visualization is supported by several options.

2. Datacopia (Web-Based App)

Purpose of use: Web application for making interactive charts.

Description: Data input is done via URL in csv or tsv format, uploading the user file in csv, tsv, txt, xls, xlsx and finally by typing or pasting data to a form denoted by commas. Visualization supports many kinds of charts (including maps). The interface automatically calculates a number of charts of various types such as scatter plots, function plots, histograms, spider charts, etc. (in our case, 189 charts) that are displayed to the user. The user can choose a chart of his / her choice that can interfere with very basic formatting parameters. Saving is performed in low resolution png. The distribution of the chart can be done through Reddit, Google+, Pinterest, Twitter, Facebook with rudimentary cloud storage support, but without interactivity and the ability to create a personal account.

3. Datavisual (Web-Based App, Beta Version)

Purpose of use: Web platform for the design of selectable charts through a collection of interface templates.

Description: The user selects the type of chart he/she wants and through the appropriate filters he/she formats the chart. The design is aided by various tools such as sliders, color pickers, on/off function buttons and text boxes. The data input is done with an excel, csv or tsv file and through a special menu he can interfere with the degree of interaction of the chart through tools such as display of information when the pointer is at some point (hover display, hover label size, etc.) and animation techniques for chart presentation (Bar duration, Bar delay, Label Duration, etc.). Storing is done in low-resolution jpeg format while other file types and web embedding are supported after upgrading the account. Only the English language is supported while the output can be saved in low resolution jpeg. No support material is available in any form, and no information is provided about the hosting conditions of the charts on the server site.

4. Datawrapper (Web-Based App Version 1.20.0)

Purpose of use: An online application of interactive charts and maps.

Description: The application has been created with the participation of a group of journalists who have worked in major media such as the New York Times, NPR, Deutsche Welle, Bloomberg, etc. It is available in a variety of versions from the trial one (free of charge and it is the one we tested) up to a business version. The free choice has the limitation of 10000 tests; the full functionality of the application (output formats and styling, etc.) is not supported, while canceling the registration can be done without limitations though the fate of visualizations after the cancellation is not specified. The user does not need a cognitive background and the result comes out through a few guided by the application steps. Account creation is required to store and share charts. The result is finalized through 4 directed steps that are: upload, check & describe, visualize and publish & embed.

Statistical analysis is not supported except a graphical trend line with 6 defaults in the Refine tab. Output formats are not supported except storage on a cloud-based platform. The version is available in 15 languages.

5. Filtergraph (Web-Based App)

Purpose of use: Web platform drawing charts and maps.

Description: Filtergraph is an interactive web-based tool for displaying large data sets. Although originally designed to meet the needs of astronomers in a wide range of projects, it can be used to manage data in any situation where large-scale visualization of data, including academic research and data-based publishing, is required. The input accepts a variety of file formats. Initially, the user has the ability to specify names and restrictions of access to the content of the portal (filtergraph.com/NameOfPortal), and also it is possible to delete all of its saved content. He can invite readers or registered users via mail using a link with view or view and edit permissions. The interface contains column data filter and the possibility to highlight them, undo function and 10 graph options (map, scatter, line, error bars, histogram, stacked histogram, heatmap, surface map, bar chart, pie chart). Storing is done in 6 different formats and a statistical description function is provided. There is a difficulty in displaying categorical data (setting capability, displaying the desired number on the axes), while hover mode is not supported.

6. Gephi (Desktop Version 0.9.2)

Purpose of use: Open source software for exploring and manipulating networks.

Description: The application runs on Linux, Windows and Mac and requires installed version of Java 7 or 8. Data entry is done with a spreadsheet, other types of graph files or via online connection to MySQL database, SQLite, PostgreSQL etc (Bastian et. al. 2009).

Gephi uses 3D graphics to showcase large networks in real time, speeding up their exploration. Provides individual functions that facilitate the import, visualization, filtering, fixation, spatial representation and output of all types of networks. The user interface consists of workspaces where individual tasks can be performed. Nodes or edges can be obtained manually or by using the filter system. Filters can choose nodes or edges with boundaries, range, and other properties. The frames of the filters are designed in a chain way so that the next frame accepts as input the output of the previous one. The graphics elements accept as input a group of nodes and modify the visualization

parameters. The architecture of the system supports graphs whose structure or content varies over time. A data source can send network data to the potential controller at any time and visualize the result in real time. Architecture is interoperable. Nine languages are supported including English.

7. Infogram (Web-Based App)

Purpose of use: Web platform for charting, maps and infographics.

Description: Use of the service requires a simple registration or use of a google / facebook account. Data can be imported using excel spreadsheets, cloud services like dropbox, OneDrive or json files. An open data finder is supported. The interface enables the creation of some type of infographic, chart or map. In the infographic option the user can select one of the available templates, add title and text, adjust the font, align, and other options that text editing software offer. In the field of charts, there is available a variety of types of charts with color adjustment functions of their size, with the addition of the labeling of axes and the appropriate range of values to the axes. The construction of maps in free version is only supported in two types: Global and United States. The result can be publicized using a hyperlink in social media or embedded on a website or blog. Five languages are supported.

8. Plot.ly (Web-Based App)

Purpose of use: Web platform creating charts and control panels (dashboards).

Description: The platform is used after signing up with a Google account, twitter, facebook, GitHub, or simple email. Data entry is done in csv, xls, xlsx, via URL, or linked to a SQL platform. A diversity of chart types is supported, which are divided into 6 main categories. Basics (scatter, line, bar, Area, pie), stats (histogram, box plot, 2d histogram heatmap, 2d histogram contour plot, parallel coordinates), scientifically (error bars, heatmap, contour, ternary plot, carpet, Sankey), Maps (Chloropleth, Atlas maps, satellite maps), 3d (3d Scatter, 3d line, 3d surface, 3d mesh), economical (range slider, candlestick, OHLC, animations). It supports filtering in the dataset with immediate overview of the changes. A wide range of formatting functions is supported. Storage in the chart and the data has privacy settings.

9. Tableau Public (Desktop Version 10.5)

Purpose of use: A software for data analysis through interactive and shared visualizations depicting trends, variations and density of data in the form of a plurality of graphs, charts and maps.

Description: The basic steps for creating a data processing report include:

1. Linking to a data source (files, SQL databases or other types of cloud-based platforms).
2. The choice of dimensions and measures (dimensions are categorical data while the measures are numerical) for the analysis.
3. Applying visualization techniques using filters, grouping, color management, captions etc.
4. Creating multiple worksheets that create different views on the same or different data.
5. Create and organize a dashboard that contains multiple worksheets that are linked to each other.
6. Creating a story based on a sequence of worksheets or dashboard that work collaboratively to transfer information.

Also, a statistical analysis of the data as well as a wide range of operators, functions and calculations in numbers, strings and dates is supported.

EVALUATION OF SYSTEMS SUPPORTING DATA JOURNALISM

Table 1 shows the evaluation criteria (Rubric) and summary tables 2 and 3 show the comparative evaluation of the applications with the corresponding score that resulted after their evaluation by the first author of the article. Figure 1 shows the bar graphs of the overall comparative evaluation.

Figure 1. Overall comparative evaluation



Total Evaluation

Desktop applications due to more and more powerful features show higher scores. The web-based applications generally exhibit lower levels of usability and functionality features as described in detail.

Note that the joint evaluation in Tableau public, Plot.ly & Datawrapper was made independently of that of Atwood & Reznik-Zellen (2018) with some differences in individual scores in the 13 common evaluation criteria. The other tools were evaluated by the author without any other similar assessment in the literature. A comparative table of scores is shown in Table 5. In Table 5, yellow color depicts our evaluation, while the pink is that of Atwood & Reznik-Zellen (2018) and the shades of green show the differences in the score. The dark shade is a difference of 3 points, the middle shows a difference of 2 points and the low is a difference of 1 point.

We list the pivot Table 4 with the scores per application.

Table 1. Modified evaluation criteria (Rubric)

No	Category	Feature	Poor (0)	Medium (1)	Good (2)	Excellent (3)
1	Usability	Ability to handle	There is no control of the output design	Low handling capacity. (modification of one or two elements)	Some ability to handle. (modification of many items but with limitations)	Full control of all aspects of the output design.
2	Usability	Support materials	There is no documentation.	Insufficient documentation with little information about key features	Almost sufficient documentation. It leaves out some features.	Well documented. Available technical support (online chat, troubleshooting, videos, webinars, etc.
3	Usability	Ease of use	Graphics and hyperlinks are not labeled; fonts are difficult to read, poor navigation, need of a cognitive background, that is, not accessible to all users.	Some available tags, navigation is not clear.	Many tags available, navigation is simple	Graphics and hyperlinks are well-marked, fonts are legible and do not require extensive knowledge.
4	Usability	Learning time	It takes a long time (> 5 hours)	It requires a moderate time (1 hour - 5 hours)	It takes less than 1 hour. (from 10 minutes to 1 hour)	It requires a minimum of time. (totally intuitive or less than 10 minutes)
5	Usability	Making use of previous knowledge	Previous experience with other software, code, or previous versions is required	Previous experience with other software, code or previous versions is recommended. Quite intuitive.	It requires little experience with other visualization platforms	Totally intuitive
6	Functionality	Processing power	Only accepts files smaller than 5MB.	It can accept files of limited size.	It can upload/download file sizes of any size with a login	User can upload any file size without limitations
7	Functionality	Login requirements	A connection is required for all functions.	A connection is required for most functions.	A connection is required for some specialized functions but access is possible for routine functions.	No connection is required for full function.
8	Functionality	File type requirements (Input)	Only accepts one or two types of files in specific formats.	Accepts only a few types of files	Accepts multiple types of files of various types.	Accepts all file types.
9	Functionality	Cost for “full” version	High cost. (over \$ 100 / year)	Medium cost. (between \$ 100 - \$ 20 / year)	Low cost. (below \$ 20 / year)	Totally free.
10	Usability	Built-in analytics	No analysis supported.	Available basic mathematical functions.	Many functions available.	Complete range of available analysis methods.
11	Functionality	Output	Output is not supported.	Limited output supported (1 or 2 formats you can export), low resolution.	Some supported output-either with many file types, but with limited numbers or with many downloads available with very limited output formats.	Many formats and unlimited downloads, high resolution.
12	Functionality	Data collection	It gathers and maintains all information that has been uploaded, allows third parties access to information.	It collects personally identifiable information.	Collect cookies.	It keeps little or no information.
13	Usability	Aesthetics	Minimalist style, few options, limited color palette, limited fonts...	Minimalist style but some flexibility, more charting choices, or style options.	Various style choices and chart types.	Many style options available, such as color, font, chart type, etc.
14	Usability	Save on a cloud-based platform for public sharing with or without limitations	Paid or no storage capability.	Free for a period of time or limited to the number of visualizations without any privacy settings.	Free for some time or with a limitation of the number of visualizations with privacy settings.	No limitations and privacy settings.

Table 2. Comparative evaluation of apps: Cytoscape (3.6.1)/Datacopa/Datavisual/Datawrapper/Filtergraph

Evaluation Feature	1. Cytoscape (3.6.1)	2. Datacopa	3. Datavisual	4. Datawrapper	5. Filtergraph
Ability to handle	Full control of all aspects of output design. (3)	Insufficient control in the output design of visualization with interference in some elements. (1)	The user has partial control over the final output of his / her work mainly in formatting the chart. (2)	The user has partial control over the final output of his work through guided steps. (2)	Some ability to handle. (Modification of many elements but with limitations). (2)
Support materials	A user manual is provided with detailed documentation, online presentations, FAQs, mailing list support (3)	Only one demonstration of the basic charts in a gallery without explanations is provided. (0)	Documentation is not supported in the basic version. (0)	A knowledge base with a search engine is supported with relevant articles on application functionality and a blog coordinated by the production team with news, updates and ideas from the community. (2)	A video and a help page are provided with detailed information about the functions. (2)
Ease of use	There are many available and comprehensible labels to facilitate navigation. (2)	Few labels without additional assistance to help navigate. (1)	Accessible to the beginner user with direct result through two steps: selecting & importing data. (2)	Very good UI, user friendly, with the ability to instantly track the changes made (3)	It takes a lot of time to familiarize the novice user with the interface menu. (0)
Learning time	It takes a long time to familiarize the average user with the capabilities of the program. (0)	Minimum time is required to visualize the data. But it takes time for selecting the appropriate graph that satisfies the user. (3)	Minimum time is required < 1 hr to fully enrich the novice user with the application interface. (2)	It requires time < 1 hr for a novice user to familiarize with its functionality through strictly defined steps. (2)	It requires moderate time. The user must experiment with the capabilities of the application in order to achieve the desired result. (1 hrs - 5 hrs). (1)
Making use of previous knowledge	Graphics of the interface are quite functional but for the navigation menu the previous experience with similar software can reduce the learning time. (1)	The construction of the diagrams is automated with few intervention options by the user so it can be described as intuitive. (1)	Intuitive to a great extent without requiring previous experience from similar applications. (3)	Intuitive to a great extent, since possible actions of the user are guided by the interface diligently. (3)	Previous experience with other software or earlier versions is suggested to allow the user to quickly use it. (1)
Processing power	Editing the graph binds memory to the user's PC, so the performance depends on the characteristics of RAM and the system graphics card. (3)	We attempted to upload the 5MB file into the application without success. (0)	A 5MB file slows the browser to a large extent, so it does not finish loading the file within a reasonable amount of time. (0)	A 5MB file is significantly slowing the browser (firefox quantum 63.0.1 64 bits), so the upload of the file is not completed within a reasonable amount of time (0)	We uploaded a 30MB file (approximately 860000 lines) successfully. (2)
Login requirements	No connection required for full operation. (3)	No connection required for full operation. (3)	Editing and formatting are done by connecting to a user's personal account. (0)	Editing and formatting are done by linking to a user's personal account. (0)	A connection is required for all functions. (0)
File Type Requirements (Input)	Although it accepts various types of files, ODF formats such as .ods spreadsheets are not included. (2)	Accepts files such as .csv, .tsv, .txt, .xls, .xlsx. (1)	Formats such as xls, csv, and tsv are supported (1)	Formats such as xls, csv, google spreadsheets, and a csv file hosted on another server are supported, with the ability to automatically refresh the file and make changes in the visualization from time to time for the month following publication. (1)	It accepts files of various types such as ASCII text files (space separated, comma separated, tab separated, and fixed length), Microsoft Excel files (*.xls, *.xlsx), SQLite files (*.sqlite), VOTable files (*.vot, *.xml), FITS files (*.fits), IPAC files (*.tbl), Numpy files (*.npy), HDF5 files (*.h5) (2)

continued on following page

Table 2. Continued

Evaluation Feature	1. Cytoscape (3.6.1)	2. Datacopia	3. Datavisual	4. Datawrapper	5. Filtergraph
Cost for “full” version	Free. (3)	Free. (3)	Free for basic version and for full (pro) 15 \$ / month. (0)	Free for single version with a limit of 1000 views for 1 user while for full (custom) 279 € / month. (0)	Free. (3)
Built-in analytics	A complete set of metric statistical analysis is available such as: AverageShortestPathLength/ BetweennessCentrality/ ClosenessCentrality/ ClusteringCoefficient/Degree/ Eccentricity/IsSingleNode/ NeighborhoodConnectivity./ NumberOfDirectedEdges/ NumberOfUndirectedEdges/ PartnerOfMultiEdgedNodePairs/ Radiality/Stress/ TopologicalCoefficient/ EdgeBetweenness. (3)	Not supported. (0)	Not supported. (0)	Only graphical display of trend lines with 6 presets (in the Refine panel with application in scatterplots type diagrams). (1)	Many available functions such as: Single variable statistics (percentiles: 5 th , 10 th , 25 th , 75 th , 90 th , 95 th , Minimum, Median, Maximum, Mean, Standard deviation, Variance, Sum), Two-variable statistics: (Linear regression, Quadratic regression, Cubic regression), Correlation matrix. (2)
Output	Many formats and unlimited downloads, high resolution. (3)	One type is only supported. (.png) (1)	Public sharing is supported through a hyperlink to the user's account in the application and low-resolution .jpeg. (1)	Only publicly shared hyperlinks to the user's account in the application or integration with code on a personal site are supported.	Many formats and unlimited downloads, high resolution. (3)
Data collection	When running Cytoscape, the usage statistics are recorded with the date, time, and IP address of the workstation running Cytoscape. This recording can be disabled when installing Cytoscape. (3)	It gathers little information for statistical purposes. (0)	Storage is based on personally identifiable information with mandatory publication on the server site (0)	Storage is based on personally identifiable information with mandatory publication on the server site (0)	It collects personally identifiable information. (1)
Aesthetics	Exceptional. (3)	Limited features and option. (0)	Various style choices and chart types. (2)	Fairly good interface with clear and comprehensible design and functionality features. (2)	Minimalist style, few options, limited color palette, limited fonts. (0)
Save on a cloud-based platform for public sharing with or without limitations	The NDEx platform (http://ndexbio.org/#/) provides an open source framework where scientists and organizations can share, store, handle and publish knowledge of biological networks. (3)	Functionality is not fully supported. (0)	Privacy settings are not supported. An account is required by the reader in order to see a user's graph. (1)	No privacy settings. Storage is done via the user's account with a limit of 1000 views for 1 user in the free version. (1)	No time or space constraints are specified. (2)

SOLUTIONS AND RECCOMENDATIONS

The presented method for evaluating data journalism systems can be used as a quick evaluation method to be used improvements should be proposed in order to achieve the ultimate goal, which is a well-established objective method for such software. A basic limitation of the method is that in its current form it is applied by a single author, which makes it a subjective opinion in some cases.

Table 3. Comparative evaluation of apps: Gephi (0.9.2)/Infogram/Plot. Ly/Tableau Public (10.5)

Evaluation Feature	6. Gephi (0.9.2)	7. Infogram	8. Plot.ly	9. Tableau public (10.5)
Ability to handle	The user has complete control during the processing of the graph (3)	There are restrictions on options that are removed only if paid. (storage options, logo removal, more types of maps, etc.) (2)	Many graph formatting capabilities are supported through the following tabs: general, traces, axes, legend, colorbars, annotation, shapes, images, themes, built in. (3)	The user has full control over the final output format of his/her work with a satisfactory format menu of the imaging features through tabs easily managed by the average user. (3)
Support material	Knowledge base is provided (wiki), forums/facebook group (with registration) & online documentation. (3)	Chat, search engine, tutorial, videos, FAQ are supported. (3)	There are detailed instructions for using the application and community support.. (2)	A wide range of support material is supported (tutorials, webinars, chatting, demos, etc.). (3)
Ease of use	The menu is easy to read and functional without demanding extensive knowledge. (3)	User-friendly interface quite intuitive. (3)	Some menu features require more specific knowledge. (analysis, grouping and aggregation functions). (2)	Very good GUI, friendly to the average user, with the ability to instantly track the changes made. (3)
Learning time	It requires time > 5 hrs for a beginner to familiarize themselves with the features and capabilities of the software. (0)	It requires time < 1 hr for a novice user to become familiar with the application's functionality. (2)	It requires moderate time. (1 hr - 5 hrs). (1)	It requires time > 5 hrs for a novice user to become familiar with its functionality, which offers a lot of experimentation opportunities. (0)
Making use of previous knowledge	Previous experience with similar graph creation software reduces learning time. (1)	The novice user can be helped with the previous experience of similar platforms. (2)	Previous experience with other software or previous versions is recommended. Quite intuitive. (1)	A previous experience on similar platforms works positively as it potentially accelerates the learning process (1)
Processing power	The processing of the graph captures memory on the user's PC, so the performance depends on the RAM and the system's graphics card characteristics. (3)	At the 5 MB limit the platform does not respond. (0)	We successfully uploaded files up to 20 MB. (1)	We tried to upload a 900,000 line file (30MB) (with line limitation for excel 2010 at 1,048,576 lines) without success. (2)
Login requirements	No login is required at any stage of network processing and storage. (3)	An account is required to use the platform. (0)	Login is required for all chart studio functions in the community plan. (0)	Editing and formatting do not require login while storage and publishing require a connection to the server. (2)
File Type Requirements (Input)	It accepts files of many and different types except .ods spreadsheets. (2)	It accepts xls,xlsx, csv, json, upload from google drive & dropbox.. (2)	It accepts csv & excel files. (0)	Formats such as xls, xlsx, csv, tab, txt, json, kml, shp, sav, R files and pdf are supported. (2)
Cost for "full" version	Free. (3)	\$228/year for the pro version. (0)	\$840/year for the pro version. (0)	Free in public edition. (3)
Built-in analytics	A complete set of metric statistical analysis of the network is available: Average Clustering Coefficient/Average Path Length/Betweenness Centrality/Closeness Centrality/Connected Components/Degree/Degree Power Law/Diameter/Eigenvector Centrality/Graph Density/HITS/Modularity/PageRank. (3)	Not supported. (0)	Many functions available such as curve fitting with choices of basic & advanced & moving average. (2)	A satisfactory set of statistical analysis is contained for all basic functions. (3)
Output	Many unlimited formats of output. (3)	Not supported. (0)	Supported export in several formats such as: Image: png, jpeg / Data: csv, xls, json, ppt / Code: R, MATLAB, Julia, plot.js, node.js / HTML: html, Zip archive, Embed URL. (3)	It is possible to output the table in csv and / or the workbook with the data (twbx format). Also visualization can be downloaded by the user in pdf, png format. (1)

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Table 3. Continued

Evaluation Feature	6. Gephi (0.9.2)	7. Infogram	8. Plot.ly	9. Tableau public (10.5)
Data collection	It maintains little or no information.. (3)	It gathers and maintains all information that has been uploaded, allows third-party access to information. (0)	It collects personally identifiable information and allows third-party access to visualizations in the community plan we evaluated. (0)	Storage is based on personally identifiable information while third party access is allowed in visualizations. (0)
Aesthetics	Many features of graph display (development algorithms) and tag and font formatting (3)	Various style choices and chart types. (2)	Many style options available, such as color, font, chart type, etc. (3)	Many style options available, such as color, font, chart type, etc. (3)
Save on a cloud-based platform for public sharing with or without limitations	There is no such possibility. (0)	Storage limit for testing is 10 projects. Privacy settings are also not supported. (1)	The community plan we evaluated offers storage space up to 25 charts without the possibility of privacy settings. (1)	The storage is done through the user's Tableau account with privacy setting capabilities. (on the user's account, it is possible to switch the display to others when viewing the user's profile or search). (3)

Table 4. Overall comparative rating

No	Feature	Tableau	Data wrapper	Datavisual	Infogram	Plot.ly	Filtergraph	Gephi	Cytoscape	Datacoplia	Category
1	Ability to handle	√√√	√√	√√	√√	√√√	√√	√√√	√√√	√	Usability
2	Support material	√√√	√√		√√√	√√	√√	√√√	√√√		Usability
3	Ease of use	√√√	√√√	√√	√√√	√√		√√√	√√	√	Usability
4	Learning time		√√	√√	√√	√	√			√√√	Usability
5	Making use of previous knowledge	√	√√√	√√√	√√	√	√	√	√	√	Usability
6	Processing power	√√				√	√√	√√√	√√√		Functionality
7	Login requirements	√√						√√√	√√√	√√√	Functionality
8	File Type Requirements (Input))	√√	√	√	√√		√√	√√	√√	√	Functionality
9	Cost for “full” version	√√√					√√√	√√√	√√√	√√√	Functionality
10	Built-in analytics	√√√	√			√√	√√	√√√	√√√		Usability
11	Output	√		√		√√√	√√√	√√√	√√√	√	Functionality
12	Data collection						√	√√√	√√√		Functionality
13	Aesthetics	√√√	√√	√√	√√	√√√		√√√	√√√		Usability
14	Save on a cloud-based platform for public sharing	√√√	√	√	√	√	√√		√√√		Usability

Comparing to the work of Atwood & Reznik-Zellen (2018), our study showed (in terms of common criteria) that although there are many subjective characteristics, the overall scores were relatively close together. The method could gain more from some improvement. Some points we can suggest are:

Table 5. Differences in both application evaluations

No	Feature	Tableau public (10.5)	Tableau public [Atwood et al. 18]	Datawrapper	Datawrapper [Atwood et al. 18]	Plot.ly	Plot.ly [Atwood et al. 18]
1	Ability to handle	√√√	√√√	√√	√√	√√√	√√
2	Support material	√√√	√√√	√√	√	√√	√√
3	Ease of use	√√√		√√√	√√√	√√	√√
4	Learning time		√	√√	√√√	√	√√
5	Making use of previous knowledge	√	√√	√√√	√√√	√	√√√
6	Processing power	√√	√√			√	√
7	Login requirements	√√	√√				√√
8	File Type Requirements (Input)	√√	√√	√			
9	Cost for “full” version	√√√	√√√				
10	Built-in analytics	√√√	√√√	√		√√	√√
11	Output	√	√		√	√√√	√
12	Data collection						
13	Aesthetics	√√√	√√√	√√	√√	√√√	√√

1. Stricter refinement of the criteria to minimize the strongly subjective nature of some such as:
 - i. Learning time that is related to the user’s cognitive and empirical level. It can be more accurately assessed if a target is set where the user-evaluator is required to achieve a visualization of specific standards based on specific data that will be given to them. Evaluation scale times may be revised because they are related to the target.
 - ii. The use of prior knowledge: this criterion should also be referred to in relation to the novice user (more in relation to their empirical level of similar applications). The user-evaluator should evaluate the criterion based on whether experience in similar applications would speed up the learning process.
 - iii. Ease of use with a novice user again and provided the necessary minimum time to familiarize with the application should not exceed 1-2 hrs.
2. The criterion “cost for full version ” must determine whether the prices are for individual, student or professional use since the prices in many of them have a big difference.
3. Additional independent comparative evaluations in order to evaluate and improve existing criteria and to possibly supplement them with new ones.
4. It should be examined whether the above methodology can be applied with credible results in other technological fields of data journalism such as applications aimed at collecting and filtering data (e.g. OpenRefine, Nomenclature), scraping technologies (e.g. Artoo.js, Elex, Zup) publishing (e.g. Listify, Tarbell) etc.

FUTURE RESEARCH DIRECTIONS

Data journalism is an umbrella term that encompasses an ever-growing set of tools, techniques and approaches to storytelling. It can include everything from traditional computer-assisted reporting to the most cutting-edge data visualization and news applications. As such, data journalism tools and technologies should be tested and evaluated more formally and by more experts in several fields, especially their final users: journalists. Moreover, future research should be directed towards three axes:

- evaluation of other components / functions of data journalism tools (apart from the visual imaging component)
- inclusion of more systems in future evaluations (without applying exclusion criteria as those described in this chapter)
- refinement of current tools and technologies, driven by formal evaluations and journalists' needs.

The goal of future research should be the establishment of a framework for qualitative assessment of data journalism applications, as well as widely accepted standards for evaluating data journalism tools.

CONCLUSION

The technologies that support this powerful and highly interesting stream of data journalism are in a phase of intense productivity. Technology users have many options to best support a story without using specialized knowledge. On the other hand, there is a lack of methodological evaluation criteria from the user's point of view in order to help those interested in finding the application that best meets their needs.

We performed a comparative evaluation of nine applications covering the thematic fields of graphs and interactive charts based on a methodological approach on the basis of 14 usability and functionality criteria. The evaluation conducted showed that desktop applications show higher scores due to more and more powerful features. The other web-based applications generally exhibit lower levels of usability and functionality features as it has been described in detail.

As a general conclusion, it is a fact that literature shows a lack of studies and methodological tools for evaluating the technologies used by data journalism, which include several different types of applications. Research should therefore continue in the direction of standardizing a commonly accepted framework for evaluating the various aspects of systems supporting data journalism (data, processing stages, methods and applications).

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KEY TERMS AND DEFINITIONS

Data Journalism: Journalism based on structured data in order to support a story that makes sense to the public.

Functionality: A system evaluation criterion aimed at identifying certain functional characteristics.

Interactive Chart: A chart on which a user can achieve a certain degree of interaction in order to reshape it, for example, hover a point, zoom, play with axis, add a button, etc. It allows the reader to go deeper in its understanding of the data, since he can customize it and try to answer his own question.

Rubric: A set of evaluation criteria that are valued based on a rating scale.

Storytelling: The social and cultural activity of sharing stories, with great application to journalism.

Usability: A criterion for the evaluation of the system aimed at identifying usability features from a user's point of view.

Visualization: The visual representation of journalistic story that aims to convey the information to the reader in the best possible way.

From the Data to the Statistical Analysis of Football: The Case of the Italian Serie A League

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INTRODUCTION

This article deals with Data Analysis and Statistics applied to football. There are many publications dealing with this topic, but here the attempt is to explain how it can be attractive for secondary school students to learn notions of statistics from the analysis of data concerning the most popular of sports. In this case the analysis focuses on the last years of the Italian Serie A League.

BACKGROUND

The statistical analysis of Big Data is probably the most advanced frontier of sport and, more recently, of football. This is true even if we must remember that analyses on the dynamics of football have been present for many years (Grehaigine, 1997; Bouthier & David, 1997), and we cannot forget that this sport has found writers who, as fans and / or sportsmen, have revived, through their writings, the charm of this game (Hornby, 1992; Soriano, 1998).

We can basically identify two components that collect data:

1. sports clubs, through a network of observatories and the use of video and computer technologies;
2. specialized companies such as Opta, Prozone, StatDNA, Wyscout, etc., which, having created large databases, can provide services against payment.

These data serve as a basis for coaches to define modules and tactics and for technical managers to guide market choices.

As declared by Davide Nicola (Corriere della Sera of 1 April 2018, page 48), one of the Italian football coaches most involved in this approach: “Everything, or almost everything, is traceable to numbers, the analysis of big data allows you to discover links between the phenomena that happen during a match and therefore to predict the future ones”.

Finally, there is a further component made up of researchers studying the phenomenon and authors of books revealing the most relevant facts to the public. The fact that the soil is fertile is demonstrated by the large number of participants in events such as the Sports Analytics Conference in Boston or, as far as Italy is concerned, the Hackaton in Trento. The winning project of this Hackathon, organized by the FIGC (Italian Football Federation) on “match analysis” mixes “subjective” elements, for example the votes given by journalists, to numbers taken from statistical sources.

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An approach based essentially on the analysis of objective data is, for example, the one known as the POGBA algorithm (Prediction of Goals by Assessing Phases) in which the available spatio-temporal data are used to evaluate the probability that a specific game situation will lead to an attempt of realization, and therefore to estimate the probability that the same attempt will lead to the expected goal (Decroos, Dzyuba, Van Haaren & Davis, 2017).

To conclude, we would like to mention an interesting point that is based on studies on artificial intelligence and neural networks; with this approach, we can segment game into sequences of situations that are discovered in an unsupervised way and we can learn *conceptors* (a mechanism of neurodynamical pattern learning and representation) that are useful for the prediction of the future of the match (Michael, Obst, Schmidberger & Stolzenburg, 2017)

The problem is that all this is reserved for a group of specialists (Hendriks, 2016) while it would be interesting to be able to transfer part of these resources to an audience of students having two objectives:

1. explain how and where information can be found;
2. provide a concrete view of some statistical concepts and probabilities.

Since the aim is to deal with a level of information specific for the high school students, it will be used a type of statistics relatively simple: percentages, averages, probability distributions, regression and correlation.

For the first two concepts there is not much to say as they are part of a knowledge already present at previous levels of school.

As far as probability distributions are concerned, we shall limit ourselves to a simple reference.

The probability distribution is a model that associates a probability to each observable mode of a random variable.

We can distinguish two types of random variables, discrete or continuous: the probability distribution is discrete when the phenomenon is observable with an integer number of modes, and continuous when the random variable assumes a continuous set of values.

The text compares the discrete goal distribution with the Poisson distribution, used to calculate the probability $P(x)$ of success of a repeated event n times in an experiment in a given unit of time. Indicating with $\lambda = np$ the average of the successes results:

$$P(x) = \lambda^x \frac{e^{-\lambda}}{x!}$$

The last two terms require, from an educational point of view, a clear distinction between function (already known) and regression. The first one indicates a precise relationship between the variables while the second one, used for economic, social, biological, studies etc., describes a phenomenon, except for a certain amount of variability that is not explained by the equation. This equation defines the curve that best approximates the data; it is called the regression curve of Y on X because the dependent variable is estimated by means of the independent one. Finally, it is possible to interpret the correlation from the point of view of regression using the coefficient of determination R^2 . This coefficient represents the proportion of the variation explained by the independent variable. The square root of this value coincides with the linear correlation coefficient.

FOCUS OF THE ARTICLE

The Sources

As previously mentioned there are many sources with a huge amount of data, the problem is that, being these paid for, it is not possible to use companies specialized in teaching. In addition to this, it is not certain that the overabundance of data is necessary at a school level.

Relatively few sources are sufficient for the stated needs. The data used for this research are indicated in the Sitography.

The Tools

Regarding tools, it is possible to limit oneself to the use of a spreadsheet, exploiting its mathematical and statistical functions and the possibility to easily construct graphs.

On the Internet it is possible to find spreadsheets programmed as BetGPS (BetGPS, Directory of Betting Resources Retrieved from <https://betgps.com/blog/betting-data.php>) that interact with the data of different leagues, the compatible database can be found at the address (European Football Results, Retrieved from <http://www.football-data.co.uk/downloadm.php>). These tools can be very convenient, but in this way, you can lose the value of teaching. Building your own worksheet is more educational, and above all more fun.

Of course, more sophisticated tools could be used (Haave & Høiland, 2017; Mackay, 2017; Nair, Salian, Dave & Kadve, 2017; Pappalardo & Cintia, 2017), but this would require teaching concepts and software tools that are not familiar to the students. The possible benefits would most likely be outweighed by the time needed for learning.

The Analysis

There are several possible questions for those who want to analyze the football phenomenon and, above all, try to make reliable forecasts. For example, we can refer to this quotation: “Therefore, given the broad subjectivity of football in general, three questions can be raised: i) How can we predict the outcomes of football matches? ii) What data should we use and how should we use it? and iii) How accurate can a model to predict football game outcomes be?” (de Sousa Almeida, 2017).

For example, there are many variables that can fit into a forecast model: difference between home and away matches, results history, team composition, influence of injuries, coaching skills, etc.

In this section we will take into consideration some of these aspects, but not only, the objective is also to analyze those components, easily measurable, that can be useful for the formation of a statistical culture of the students.

1. The Advantages of Playing at Home

One of the most common considerations among football fans is the existence of the “field factor”, that is, the belief that the team playing at home is favoured mainly thanks to public incitement. What can be said about this? If you look at the years 2011-12 to 2017-18, the advantage of playing at home is obvious. However, it is noted that, except for some fluctuations, there are no significant variations (Table 1).

Table 1. Historical comparison of the 2011-17 results

Final Score	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	Average
1	46%	47%	47%	40%	46%	48%	43%	45,3%
X	29%	25%	24%	32%	25%	21%	22%	25,4%
2	25%	28%	29%	28%	29%	31%	35%	29,3%

On the subject, numerous hypotheses (Canepa & Canova, 2016) have been made, linked to the presence of the public and its influence on the referee, or to technical, environmental or psychological issues, all credible but perhaps incomplete. Here we would like to point out an interesting approach that compares the results, once as a home team and once as a visiting team, to try to eliminate the problems related to the different strength of the teams. “The new method was presented on English Premier League, and results suggest that home team advantage is real; however, it cannot be taken for granted”. (Marek & Vávra, 2017).

2. Forecast Models

The advantage of playing at home is just one aspect to be considered. Two interesting indicators are the Euro Club Index and the Agarymathematics model.

The Euro Club Index (ECI) is a ranking of football teams that shows their respective strengths at a given time and the development of strengths over time. The ECI allows the calculation of the probability of different match outcomes (victory, draw, defeat) for future football matches.

The result of a match depends on the strength of the teams, the home advantage and the previous performance of the teams. The performance of the game will vary based on normal distribution. In this way it is possible to calculate the probability of the different results of the game.

An alternative source is, as we said, the Agarymathematics forecast model that makes predictions based on the results obtained by the teams in previous matches (Agary Mathematics, Retrieved from <http://www.agarymathematics.net/pronosticalcicio.asp>). The basic concept is the following one: as the championship goes forward, the amount of data increases. Whenever a result is added, the calculation parameters are reworked to make future evaluations more precise. The program elaborates the forecasts by considering the history of the teams examined, but also comparing the obtained results with the same teams already faced. The value that expresses the condition of the teams, and therefore the quantification of the relative strength of the contenders, is, synthetically defined by VF (Value of Form) indicated with a single number.

These two models are essentially dedicated to the prediction of the next game, but it would be interesting to see if it is possible to formulate a long-term prediction on the ground of a significant number of results. Assuming that there are situations in football where the results are driven by very simple trends (not a foregone conclusion), these trends can be grasped by basic techniques. The simplest predictive statistical technique is linear regression (Heuer & Rubner, 2014). Applying the regression to the 2014/15 Italian Football Championship the absolute difference between the real result and the forecast is sufficiently good (Jurman, 2015). The hypothesis can be easily verified by analyzing the results of the various teams, in terms of the achieved total score, and by making an estimate through the projection of the results attained in the first round. Taking into consideration the years from 2014-15 to 2017-18 and indicating with O the observed results and with S the estimated ones we obtain the following results (Table 2).

Table 2. Results of regression estimates

	2014-15	2015-16	2016-17	2017-18
$\sum O - S $	41	35	42	43
Distance	0,21	0,18	0,21	0,22

A third element that can guide us in our assessment, probably the most important, is the forecasts of those who professionally manage betting: bookmakers.

Warning: the goal of bookmakers is not to correctly predict the outcome of a game. This means that their probabilities often do not reflect a real probability distribution. Bookmakers' prices reflect their main objective: to guarantee a profit.

Let's examine a simplified version of how bookmakers set quotas. First, they collect the results of the matches of the two teams and calculate the percentages for them. They then calculate what is called the "technical picket", i.e. the probability of each of the events. This calculation is done by putting it into an equation:

- the home games played by the team;
- the difference between home games' winnings, draws and defeats;
- away matches played by the opposing team;
- the difference between the winnings, draws and defeats of away matches played by the opposing team.

In addition to the technical picket, the shape of both teams in the last 5 matches played by the two teams and the rating calculated for all matches played by the two teams in the championship (without looking at whether they are Home or Away) are also taken into consideration.

In addition to the sites of the main online betting houses, there are sites that collect the best odds. The problem is to turn these quotas into probabilities.

The odds allow you to calculate the gain related to a bet. It represents the reciprocal of the probability of occurrence of a result. A low quote corresponds to a higher chance of victory.

Note that if you turn the odds into probabilities the sum does not make 1, the difference represents the gain of the bookmaker. To obtain the correct probability, the results obtained previously should then be divided by the sum.

Example: we assume that the quotas associated with the outcome of the meeting are (Table 3).

Table 3. Example of quotas

	1	X	2
Team A – Team B	1.9	3.4	4

Table 4. Reciprocals quotas

	1	X	2	Sum
Team A – Team B	0.53	0.29	0.25	1.07

Table 5. Probability associated with possible results

	1	X	2	Sum
Team A – Team B	0.50	0.27	0.23	1.00

Let us calculate the reciprocal ones (Table 4).

The corrected probabilities will be (Table 5).

3. Probability of Victory of the Favourite Team

Suppose you've assessed with a model the probability of victory of the favorite team. What are the prospects for guessing the result of a match?

If you look at the results of the last four years of the championship of Serie A you notice that the bookmakers have progressively improved performance as they have predicted correctly 46, 54, 62 and 60 percent of results.

4. Expected Profit (Loss) From Betting on Favourite Team

Since bookmakers can be considered to provide reliable quotes (even if these change over time according on bettors' bets) based on a mixture of statistical probabilities and public opinion, a possible strategy of play could be to bet on the team considered the strongest, therefore with a lower share.

Question: If you bet 1€ on all the results with the lowest odds, for all league A matches in a year, how much can you hope to win or lose?

The answer varies from year to year, for example in the year 2014-15 there would have been a loss of 47.32 €, in 2015-16 a loss of 2.73 €, in 2016-17 a winnings of 41.89 €, in 2017-18 a winnings of 14.92 €. These data seem to contradict the predictive quality of bookmakers seen above, in reality we must take into account, economically speaking, the concept of mathematical hope. A simple example: if we bet 1 € on the favourite team that has a chance of victory of 0.45 we must expect a loss because the mathematical hope is $1 \cdot 0.45 + (-1) \cdot 0.55 = -0.1$.

5. Expected Profit (loss) by Betting on the Favourite Team Using the Odds Bias

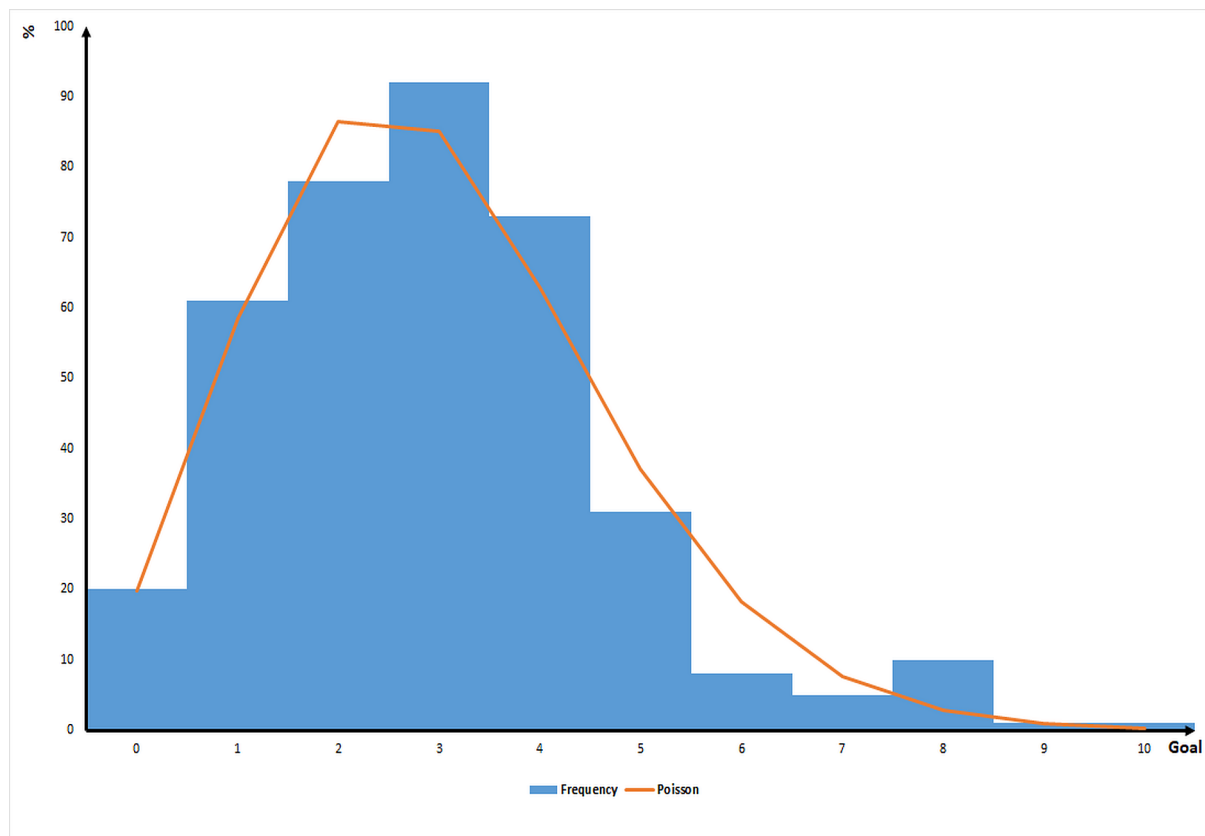
Since betting on the favorite team does not seem an appropriate criterion, can we try to improve the strategy? One proposal (Sumpter, 2016) is to exploit the strategy known as *odds bias*. For each game the differences between the two teams' chances of winning are calculated; if the result is greater than 0.4, the favourite is the target, if less than 0.15, the draw is the target.

Does this strategy improve results? Even in this case the answer varies from year to year, for example in the year 2014-15 there would have been a gain of 4.14 €, in 2015-16 a loss of 12.61 €, in 2016-17 a loss of 6.67 €, in 2017-18a gain of 8.83€. Overall it does not seem a winning choice.

6. Goal and Distribution of Poisson

In the 2016-17 season there was an average of 2.95 goals per game. Considering the duration of a game, the probability of seeing a goal in a given minute is 0.033. Using this information, we can try to superimpose the Poisson distribution on the histogram of the goals, this is a distribution of discrete probability applicable to rare events that occur successively and independently in a given time. From Figure 1 we can see the interesting correspondence between the Poissonian model and reality (Heuer et al., 2010). A football match is a random event, but it is possible to determine a precise pattern, provided that a suitable model is used. The fact that this is not a case is because the same trend can be seen in other years.

Figure 1. Goal distribution and Poisson approximation



The Poisson model can also be used to calculate the probability of goals in a given football match. Knowing the goals scored at home and away and dividing these data by the number of matches (380) you get the coefficients of attack and defense. Then you calculate the coefficients of the two teams you want to take into account: you take the goals made and suffered at home and away and divide these values for half of the total number of games (19), in this way you get the average goals made and suffered at home and away. At this point the home team's attack value is calculated (average home goals / home goals scored) and the visiting team's defense value (average away goals / away goals conceded). Multiplying these two values by the general coefficient of home victories leads to the *Home Goal Expectancy*. Similar reasoning can be done to determine the *Away Goal Expectancy*. For example, if you take 2017-18 data

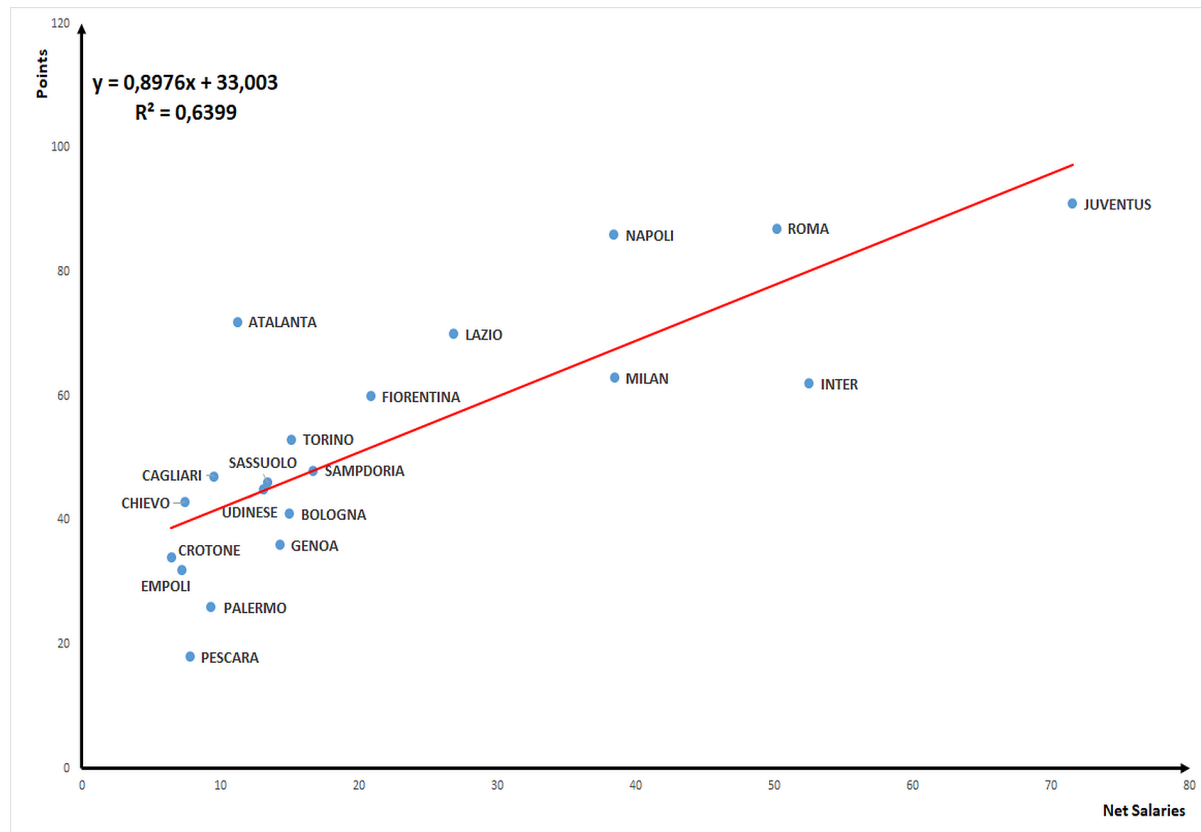
and consider the Inter-Milan derby, you'll find the values 1.83 and 1.13 that show a clear advantage for the home team. Online you can find calculation tools, such as the Poisson Distribution Calculator (Sin-ceawin, n.d.) which, given the expectation of goals of two teams, calculates the percentage probability of victory (or draw) and the likely number of goals that each team will score.

7. Relationship Between Players' Salaries and Ranking Position

Football teams are not only an organized aspect of sport, but also an economic system that moves large sums of money (Dobson & Goddard, 2001) . It is not relevant here to analyze this aspect, but only to check whether there is a relationship between the financial resources of companies and their results. This is important because the corporate objective of a football club is to maximize the number of victories (Szymanski & Del Barro, 2006).

If you look at the results of each team and compare them with the total payroll, you'll find a reasonable relationship. For the year 2016-17, the linear function $y = 0.8776x + 33.003$ is obtained with an $R^2 = 0.6399$ (Figure 2). We find similar values in other years, for example the year 2017-18 is characterized by the relation $y = 0.8747x + 32.098$ with an $R^2 = 0.7162$. We can therefore conclude that the teams that pay more, and therefore can afford top players, are favored in the race to the top places.

Figure 2. Net salaries - points



It is interesting to compare the gross amount of wages with the points earned to verify the efficiency of investments. For the year 2016-17 it appears that Juventus, winner of the championship, had a ratio of 1.57 but that at Inter (only seventh) each point cost 1.69 million euros. The best ratio was achieved by Chievo (team that refers to a district of Verona) which “paid” only 0.35 million euros every point. If 2017-18 is taken into consideration, Juventus has a ratio of 1.7 while Milan, also in seventh place, has an index of 1.8 and the palm of the team that has invested the least in relation to the points is the Crotone (the team has been relegated to the second division) with 0.3.

A particularly studied aspect is the relationship between sporting results (economists would talk about productivity) and the distribution of income within a football team. Does the equitable distribution of resources foster a better sense of group and thus improve the performance?

After collecting data on players’ salaries and the results achieved at the end of the season in terms of points, a statistical indicator capable of grasping the relationship between the two variables remains to be defined.

The choice of indicator to be used fell on the Gini index, a number between 0 and 1. The Gini coefficient is a measure used above all to measure the inequality of a wealth distribution. Low coefficient values indicate a homogeneous distribution. Most developed European countries have Gini coefficients between 0.24 and 0.36.

For Italian football teams this index is between 0.19 and 0.36 for the year 2015-16, between 0.16 and 0.26 for the following year and between 0.24 and 0.40 for the year 2017-18.

If the correlation coefficient between Gini’s index and the position in the ranking is calculated, the following values are obtained: -0.40, -0.53, 0.15.

8. Correlation Measurement

The correlation coefficient is a valuable indicator to define the strength of the relationships between goal and a series of important parameters. Let us look at some of these relationships.

A first consideration that may seem trivial, the one who scores the most and suffers the least goals wins (Anderson & Sally, 2013), but what is more impactful, prolific attacks or shielded defenses? Considering the last four championships, the correlation coefficient between scored goals and points was on average equal to 0.900, while the coefficient between conceded goals and points was -0.886. We can conclude that the winner of the championship combines both factors and that the best difference between goals made and goals conceded is an excellent indicator of balance and is sufficiently predictive of the result of the tournament.

A second question: between Corners, Penalties, Total shots, Assists, Cross, Saves, Expulsions and Offside, what is the most influential parameter in the period under consideration? The answer is Assist ($r = 0.879$) and Total shots ($r = 0.815$). For a more in-depth discussion of total shots, we can see that those who shoot more at goal are more likely to score goals ($r = 0.848$) and achieve victories ($r = 0.837$).

An interesting approach is provided by Cintia et al. (2015) of the Department of Informatics at the University of Pisa. Thanks to the availability of a large amount of data on the number of steps they have built a model that takes this factor into account. According to researchers, the team that makes more passes is more likely to win.

9. Ratio of Penalties to Balls Played in the Area

A curiosity: what was the ratio between penalty kicks and the number of balls played in the area? Looking only at the teams that have played in Serie A on a regular basis in the 2013-2016 three-year period, the ratio varies from 2 to 7 per thousand (Table 6).

Table 6. Ratio between penalties and balls played in the area

Team	Average
Torino	0,0068
Sassuolo	0,0065
Fiorentina	0,0058
Verona	0,0056
Milan	0,0054
Lazio	0,0054
Napoli	0,0051
Chievo	0,0050
Genoa	0,0049
Atalanta	0,0041
Juventus	0,0035
Udinese	0,0035
Roma	0,0034
Sampdoria	0,0025
Inter	0,0021

10. Shot Matrix Zone

Previously, we saw that it is very important to pull on goal, but it is not clear if all attempts have the same importance.

One of the most well-known studies is the Shot Position Average Model (SPAM) by Paul Riley. By analyzing the three-season shots in the Premier League, Riley has been able to determine how many shots are required to score a goal based on position: shots from outside the box, from the sides of the box and from the center of the box (Differentgame, n.d.)

This study refers to the concept of Shot Matrix Zone, a graphic representation that relates the shooting position with the possibility of scoring goals.

Applying similar principles to the Italian championship we can localize the shooting percentages from three zones: Goalkeeper's area, Penalty area, Outside area (Figure 3).

Taking into consideration the four-year period 2014-18, it is possible to compare the results (Table 7).

Figure 3. Shot Matrix Zone

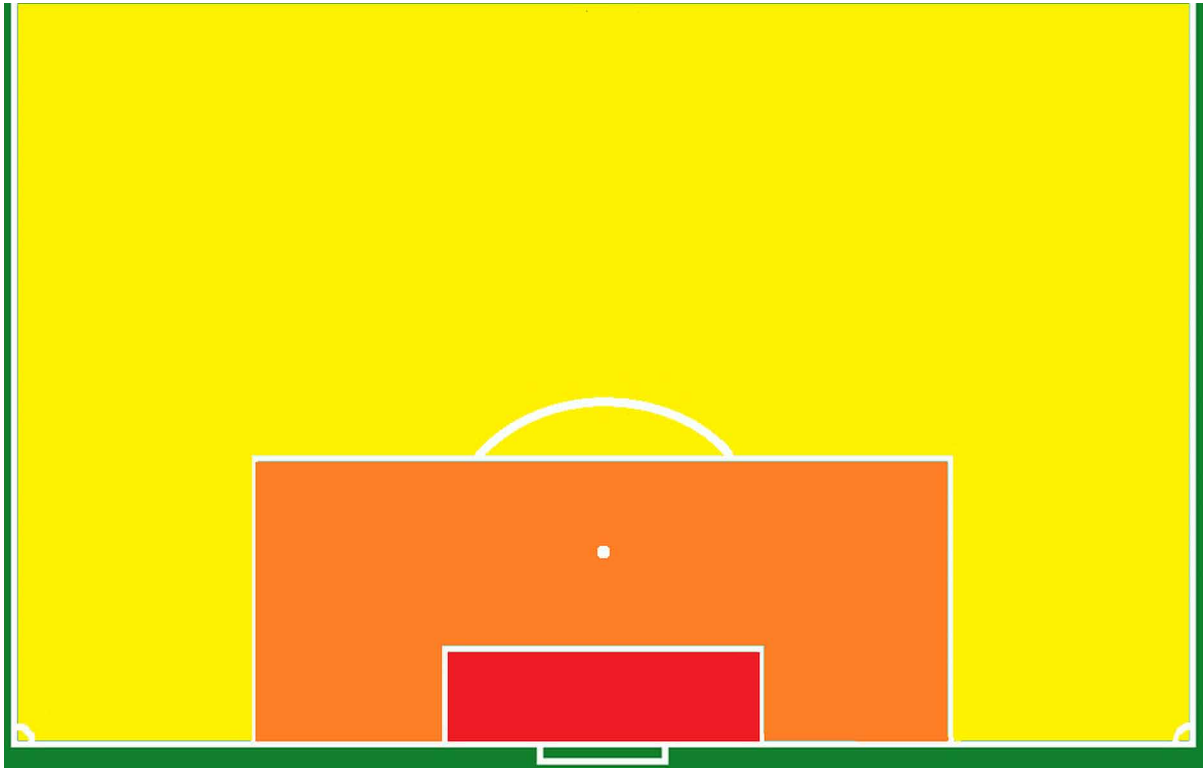


Table 7. Origin of the shoots and goal

Origin of the shoots			Origin of the goal		
Goalkeeper's area	Penalty area	Outside area	Goalkeeper's area	Penalty area	Outside area
6,2%	49,5%	44,3%	21,4%	62,9%	15,7%

SOLUTIONS AND RECOMMENDATIONS

Issues

It should be considered that football is difficult to analyse using quantitative tools. Actions are not easily segmented, and scores are low, making it difficult to use statistics such as the number of assists, goal shots or goals (Ludwig & Guerrerio, 2011).

A second problem is the amount of information collected. As mentioned earlier, scholars can have access to an incredible amount of data but, in the case of scholastic research, we must limit ourselves to an analysis of a few years and therefore it is quite problematic to generalize.

As a third problem is that it would be useful to deepen the research lengthily developed in terms of algorithms by extending the exam to the available data. There are, for example, different methods of classification for pattern recognition, which can be divided into two different types: Non-Sequential Classification Methods that include machine learning algorithms that do not consider the time factor

(e.g.: Bayesian models) and Sequential Classification Methods (e.g., Markov models) that have been developed for sequential data. Of course, we are talking about models that are beyond the objectives of the text, but which could, perhaps, be mentioned.

Controversies

The research has been oriented towards the study of statistical aspects of the game, but it is also interested in bringing out some aspects of probability. Here the discussion becomes more complex because the degree of difficulty seems to be higher.

The following quotation provides interesting points for discussion: “Probability is increasingly taking part in the school’s mathematics curriculum; yet most teachers have little experience with probability and share with their students a variety of probabilistic misconceptions. Probability is difficult to teach for various reasons, including disparity between intuition and conceptual development even if it apparently regards elementary concepts. Since an education that only focuses on technical skills is unlikely to help teachers overcome their erroneous beliefs, it is important to find new ways to teach probability to them, while at the same time bridging their content knowledge and their pedagogical content knowledge” (Batanero et al., 2005).

FUTURE RESEARCH DIRECTIONS

The text deals with statistical and probability calculation issues, and a subsequent development could widen the horizon to include other fields of mathematics.

For example, one theme may be the relationship between a player’s position in relation to the opponent’s goal. In this case, you can analyze how wide the angle of shooting is and therefore which are the positions in which the attacker “sees better” the goal. In this case, elementary trigonometry is used (MatePristem, n.d.) but it is interesting to use GeoGebra software to study the angle dynamically. This development, with the necessary simplifications, could resume the study of Expected Goals according to the model of Michael Caley (Differentgame, n.d.) The expected goals (xG) measure the quality of a shot based on different variables such as the type of assists, the angle of shot and the distance to goal (Rathke, 2017).

A second interesting aspect concerns the geometrization of the football pitch. In this respect, the penalty area can be examined as a chessboard made up of squares $18' \times 18'$ (English imperial feet, so $18'$ is 5.5 metres), this dimension corresponds to the average distance travelled by a player in a second. The square is a basic unit of a chessboard in which attackers and defenders are compared and can lead us to analyze the pattern that can be developed. In geometric terms, the defensive cover measures the defensive competence area of a player during a game. The corresponding output consists of a polygon of the defensive zone covered by the player.

A third direction of research may refer to the analysis of penalty kicks (Hughes & Franks, 2015), not only from a statistical point of view, but also in terms of mathematical equations of motion (Couceiro et al., 2013); this is a very interesting aspect, which also involves the entire conduct of the match, the study of aerodynamics (Bush, 2013) can relate football, mathematics and physics.

CONCLUSION

The proposal contained in the text may constitute a work project applicable in a secondary school. Of course, at least for the Italian context, it must be considered that not all the addresses have the same mathematical background and therefore appropriate adaptations would be necessary.

Some summaries of the empirical results have been proposed in some workshops for high school classes, especially with reference to the subjective definition of probability, and in a training course for teachers.

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KEY TERMS AND DEFINITIONS

Big Data: Term used to describe the set of technologies and methods of analysis of massive data. The term indicates the ability to analyze and relate a huge amount of data to discover the links between different phenomena and formulate predictions.

Correlation: We mean a relationship between two statistical variables such that for each value of the first variable corresponds with a “certain regularity” a value of the second.

Data Analysis: It is a process of collecting, transforming, and modeling data to highlight information that suggests conclusions and supports decisions.

Expected Goals: Assigns a value to the chances of a shot resulting in a goal.

GeoGebra: It is a dynamic software for learning and teaching mathematics that provides tools for the study of geometry, algebra, and analysis.

Gini Index: It is a measure of the inequality of a distribution. It is often used to measure inequality in income distribution. It is a number between 0 and 1.

Linear Regression: It is a linear approach for modelling the relationship between a scalar dependent variable y and one or more explanatory variables (independent variables).

Poissonian Process: It is a stochastic process that simulates the emergence of events that are independent of one another and that occur continuously over time.

Shot Matrix Zone: It is a subdivision of the soccer field into zones, each of which has a specific probability of obtaining a goal.

Automatic Detection of Semantic Clusters in Glossaries

4

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INTRODUCTION

The most important principle of the Requirements Engineering is to perform all of its activities within the framework of the clients and users culture. This is the major difference between Requirements Engineering and the system analysis, since the latter models the context in which the future software system will be inserted, using computer science techniques, models and resources (Pressman, 2005; Sommerville, 2011). To plan the functionalities that a future software system will provide, in terms of the business process peculiarities, is not an easy task for the requirements engineer. As a first step, he or she must deeply understand the peculiarities of the context in which the future software system will run. There have been proposed several approaches to elicit and model such knowledge (Castro, Kolp, & Mylopoulos, 2002; Van Lamsweerde, 2001). Creating a glossary (Weidenhaupt, Pohl, Jarke, & Haumer, 1998) of the vocabulary used in Universe of Discourse (UoD), at the beginning of the project, is one of them. The UoD is the context in which the software is developed. It includes sources of information and people involved with the software: users, software engineers, domain experts, etc.

The research, whose main results are presented in this chapter, was done in a process, which precisely begins with developing of the Language Extended Lexicon (LEL), which is by itself a sort of enriched glossary (Leite & Franco, 1993). The fact that language carries knowledge, cultural information and reflects the substantial and particular ways of thinking of people (Crozet & Lidedicont 2000; Nettle & Romaine, 2000; Salim, 2017) has allowed, along many previous studies, to accelerate and to systematize the comprehension of the context for which the system will be developed (Leite, Hadad, Doorn & Kaplan, 2000). Besides the LEL, all the remainder models needed to establish the software system requirements, are also created using natural language; this is done to improve the communication among all stakeholders.

Lately, a deep analysis of the LEL has proven that the way in which it was used, did not take full advantage of its potential. There is some sort of hidden information, not easily perceived. In the chapter “Displaying Hidden Information in Glossaries”, included in the fourth edition of the Encyclopedia of Information Science and Technology, a strategy to visualize the grouping of terms in the LEL was presented (Ridao & Doorn, 2018). Experiments performed on real world cases have shown that the clusters obtained using syntactic resources of the LEL model, coincide with information nuclei of the application domain. Such strategy was based on graphs constructed using hypertext links embedded in the LEL model. Unfortunately, graphs of a relevant quantity of LELs do not present clearly distinguishable clusters, even when groups of related terms exist, and they may be found by human observers, after a careful scrutiny. This is the weakness of relying only on the detection of groups of terms by means

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of the visual perception of clusters in the graph. Coping with this weakness was the motivation of the research project whose results are reported here.

Facing Structurally Complex Disciplines By Automatic Graph Construction

Disciplines dedicated to the understanding of phenomena whose dominant aspect is their structural complexity, instead of the essential complexity of their components, have lately acquired an increasing importance (Barabasi, 2002; Dorogovtsev & Mendes, 2003). The classic visual representation of these networks is done by means of graphs. What actually happens is that when the number of nodes surpasses a moderated limit, those graphs are no longer useful to observe the relevant characteristics of the network. This limitation may be tempered by using automatic graph construction. The automatic graph construction procures to reach an optimal nodes placement. The meaning of such optimal nodes placement may be rather different, depending on the aspects of the network that are to be emphasized. Some examples are the visualization of groupings or clusters, the emphasis on edges that disconnect the graph or the identification of nodes with few connections, among others. There are many examples, where the detection of groupings provides a notorious contribution to the comprehension of the phenomenon being studied (Mo, Cao, & Wang, 2012; Sarmah, Kalita, & Bhattacharyya, 2011; Zimmermann, Ntoutsis, Siddiqui, Spiliopoulou, & Kriegl, 2012). Most evident examples of this kind of problems are the organizational networks, social networks, bibliographic references networks and interest groups among many others. Configurations of nodes and connections also occur in a great diversity of other situations. They may represent physical networks, such as electrical circuits, roadways, or organic molecules. They are also used when representing less tangible interactions as might occur in ecosystems, sociological relationships, databases, or in the control flow in a computer program (Gross & Yellen, 2003, 2006; Kamada & Kawai, 1989).

Structural Approaches in Requirement Engineering

Several activities in different Requirements Engineering processes, take advantage of the use of graphs. For example, the requirements prioritization method proposed by Duan, Laurent, Cleland-Huang and Kwiatkowski (2009), analyzes documents of the Requirements Engineering process by means of detecting clusters of requirements. In Duan proposal, the requirements are included in clusters by means of an iterative algorithm. Those clusters are object of negotiations among the stakeholders to assign priorities. Requirements inherit the priority assigned to the cluster to which they belong.

In the specific case of the process in which this project was rooted, graph depicting may be used almost everywhere. This is because natural language models allow drawing many links from one model to another; but these links very soon will become almost useless even in medium sized projects. In other words, automatic graph construction may be useful along the whole process. However, the best results have been obtained from the graphs created from the LEL. The LEL model records the vocabulary used in the application domain. It describes the words and phrases used by clients and users with a meaning specific to the application domain.

Surveying the LEL from a structural point of view, it may be immediately seen that it can be depicted using a graph, where the vertices symbolize the LEL terms and the edges represent the hypertext links among them. From this point of view, the LEL may be visualized as a sort of linguistic network with a complex structure; in such a way that besides the explicit information stored in each symbol, there is implicit information stored in the relationships among symbols. To build and to analyze the graph of

the symbols of the LEL is a sort of knowledge mining. The most basic knowledge acquirable from the LEL graph is the existence of clusters of entries, which become roots for any taxonomy of the business process. Intuitively, it may be said that if the application domain is divided into areas of interest or organization fragments, then it may be expected some coupling among the terms used in such area.

This chapter describes a strategy to build automatically the graph of any LEL, improving its visualization, combined with an automatic detection of the existing clusters of terms.

The following section analyses the LEL. Then, a section describing force directed algorithms applied to graph visualization is included. After that, an automatic detection of clusters in the graph is proposed. Finally, some results, future work and conclusions are presented.

BACKGROUND

As mentioned, this research was inserted in a Requirements Engineering process fully based on the use of natural language models. The LEL drives the construction of a set of Current Scenarios (CS) devoted to describe the existing business process (Leite et al., 2000). Combining this set of scenarios, with the objective of the future software system, will lead to the creation of a new set of scenarios, called Future Scenarios (FS). These scenarios act as a proposal about how requirements engineers think about the behavior of the future business process. The validation with clients and users of these scenarios will become the ground for the specifications of the final set of software system services or Software Requirements Specifications (SRS). Current Scenarios tell to anybody of the developing team how things are now. Future Scenarios tell all stakeholders how things will be. Clients and users may not fully understand some of the terms used to describe the services of the software. The LEL of the requirements (LELr), is an auxiliary glossary to help clients and users in relation to this.

This process is biased to improve the quality of the Requirements by discussing all issues in a natural context for the clients and users. Such improvement requires additional efforts of the developing team, during the comprehension of the business process and later during the software design phase.

LEL and LELr terms are cross-linked since the description of each entry contains references to other symbols used in its definition. CS and FS contain internal links highlighting hierarchical relationships and external links pointing to the terms pertaining to the LEL or LELr. Finally, Requirements themselves have references to the LELr when mentioning one term included in it.

LEL: Language Extended Lexicon

The LEL main goal is to register symbols (words or phrases) which are peculiar to the application domain. Each entry in the lexicon is identified by a name or names (case of synonyms) and has two types of descriptions, as opposed to the usual dictionary, which provides only one. The first, called Notion, is the usual one and its goal is to describe the denotation (defines “What the symbol is”) of the word or the phrase. The second, called Behavioral Response, is intended to describe the connotation (describes, “How the symbol acts on the system”) of the word or the phrase, providing extra information about the context at hand. Entries are classified in four types, according to its general use in the UofD. These types are Subject, Object, Verb and State. Table 1 presents the Language Extended Lexicon Model.

While describing the symbols, two principles should be followed: the *principle of circularity* that intends to maximize the use of other symbols in the description of each symbol and the *principle of minimal vocabulary* that intends to minimize the use of symbols that are external to the lexicon. These

Table 1. The Language Extended Lexicon Model

LEL: representation of the symbols in the application domain language.
Syntax: $\{\text{Symbol}\}_1^N$
Symbol: entry of the lexicon that has a special meaning in the application domain.
Syntax: $\{\text{Name}\}_1^N + \{\text{Notion}\}_1^N + \{\text{Behavioral Response}\}_1^N$
Name: identification of the symbol. More than one represents synonyms.
Syntax: Word Phrase
Notion: denotation of the symbol.
Syntax: Sentence
Behavioral Response: connotation of the symbol.
Syntax: Sentence

external symbols must belong to a small subset of a natural language dictionary. These rules stress the description of the vocabulary as a self-contained and highly connected hypertext (Leite & Franco, 1993).

Automatic Graph Construction

Formally, a graph is an ordered pair of a set V of vertices and a set E of edges, in which an edge joins a pair of vertices. Normally, graphs are depicted with their vertices as points, circles or other simple geometric form, in a plane and their edges as straight or curve segments connecting them. There are different styles of representation, suited to different types of graphs or different purposes of presentation. When drawing graphs, some generally accepted aesthetic criteria are used (Fruchterman & Reingold, 1991):

- Distribute the vertices evenly in the frame.
- Minimize edge crossings.
- Make edge lengths uniform.
- Reflect inherent symmetry.
- Conform to the frame.

Unfortunately, these types of criteria do not contribute to the objective of visualizing the underlying structure of the object of study. Notoriously, effective graphs may be obtained using automatic Graph Drawing methods. Graph Drawing is an area of mathematics and computer science that combines methods from geometric graph theory and information visualization to derive two-dimensional depictions (Di Battista, Eades, Tamassia, & Tollis, 1999; Kaufmann & Wagner, 2003).

There are many techniques to draw graphs. Most of them are devoted to a specific type of graph such as trees, directed graphs and others. A family of techniques to visualize unspecific graphs is known as *force-directed*. Also known as *spring embedders*, such algorithms define the layout of a graph using only information contained within the structure of the graph itself, rather than relying on domain-specific

knowledge. Graphs drawn with these algorithms tend to be aesthetically pleasing, exhibit symmetries, and usually produce crossing-free layouts for planar graphs (Kobourov, 2013). These methods are flexible, easy to implement and provide excellent results (Walshaw, 2003). This sort of methods is based on physics analogies. Their main characteristics are:

- They model the graph as a physical system.
- The graph is obtained by equilibrating the system.

These characteristics define the two main components of the force-directed methods:

- A mechanical model of the graph representing the elements of the graph (vertices and edges), perhaps adding some aesthetical restrictions.
- An algorithm to find the equilibrium of the mechanical system.

Nodes are placed in an arbitrary initial disposition, and the forces move them to its final equilibrium location. The spring layout method of Eades (1984) and the algorithm of Fruchterman and Reingold (1991) both rely on spring forces, similar to those in mechanical laws. In these methods, there are repulsive forces between all nodes, but also attractive forces between connected nodes. Actually, these repulsive forces come from atomic models where nucleons have strong repulsive forces, which prevent the collapse of the nucleus. In both algorithms, only directly connected nodes attract themselves, while all nodes have repulsive forces.

Eades Formulae

The forces used by Eades algorithm are:

$$f_a(d) = c_1 * \log\left(\frac{d}{c_2}\right) \quad (1)$$

$$f_r(d) = c_3 / \sqrt{d} \quad (2)$$

Where f_a denotes the attraction force and f_r the repulsive force; d represents the distance among nodes. The constants c_1 , c_2 and c_3 should be experimentally adjusted to get a good visualization of the graph. The aim of the Eades algorithm is to place graph nodes in such a way that all the edges result in about the same length.

The repulsive force decrease continuously with the distance. The attraction force actually acts attracting two adjacent nodes when the distance between them is greater than an equilibrium distance d_e . For shorter distances, it becomes repulsive. The equilibrium distance is:

$$d_e = c_2$$

Fruchterman and Reingold Formulae

Having in mind the objective of making the length of the edges linking adjacent nodes shorter than the distance of the non-adjacent nodes, Fruchterman and Reingold proposed new formulae, for attractive and repulsive forces:

$$f_a(d) = \frac{d^2}{k}$$
$$f_r(d) = \frac{k^2}{d}$$

and

$$k = C * \sqrt{\frac{Area}{Number\ of\ Nodes}}$$

In this case, attractive forces are always attractive and repulsive forces are always repulsive. An isolated pair of linked nodes will reach to an equilibrium at:

$$d = k.$$

Both sets of formulae have similar behavior when d is near to zero, but they notably differ when d adopts greater values. Attractive forces are dominant for large values of d , being much stronger for Fruchterman and Reingold formulae.

To keep the graph within a given frame, the Fruchterman and Reingold method offer several options such as stopping on the border or the use of elastic or inelastic collisions or a line of unmovable artificial nodes on the perimeter of the frame with no attractive forces. In this way, the frame is defined by four walls that enclose the graph within them.

LEL GRAPH CONSTRUCTION USING FORCE-DIRECTED METHODS

Considering the explicit objective of Fruchterman and Reingold method, their formulae was the first choice to create a graph to help the visualization of clusters in LEL model. Some changes were soon introduced. In first place, the frame was removed, since dealing with connected graphs ensures that nodes will not run away. Then, framing the graph is just a matter of scaling. This change has an important additional advantage: there is not spurious alteration of the position of nodes due to wall influence or due to reaching the border.

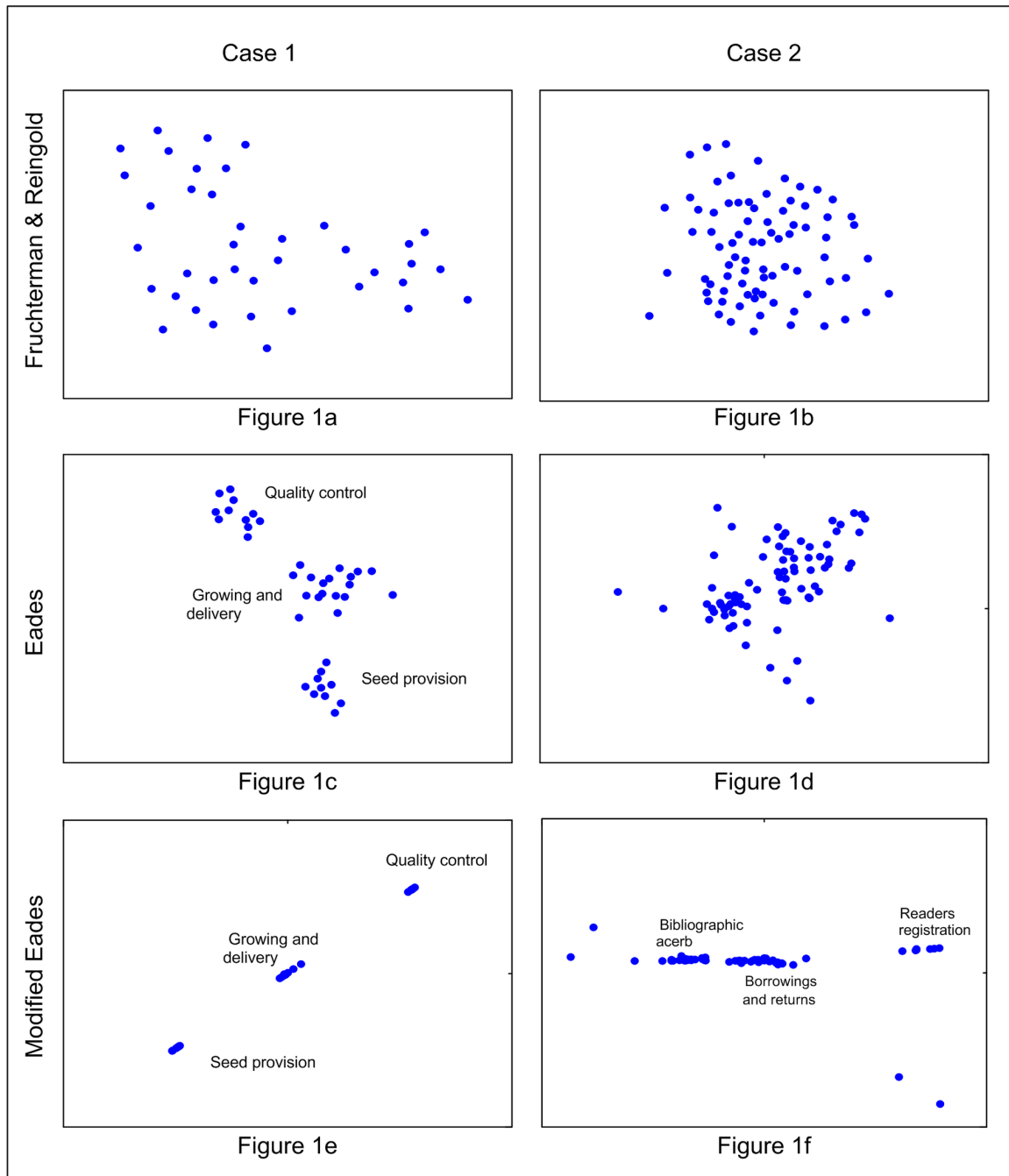
An additional precaution was taken: to minimize the risk of lack of hill climbing, each graph was created many times departing from different initial configurations. The observed result was that for each case studied, the final graphs were always notoriously similar. Hill climbing is the need of overcoming a bad configuration by moving through a yet worse configuration before reaching a better one.

Applying this method to some glossaries chosen from a repository containing LELs of actual organizations, it reveals that a substantial number of graphs did show some degree of clustering, but in many

of them, the possible clusters were hard to distinguish or they had no clustering at all. Figures 1a and 1b depicts this sort of results. Case 1 deals with the management of agrarian production contracts, while case 2 is related with the administration of a specialized library.

Applying the Eades method to the same set of cases, also with no framing wall, it becomes evident that quality of the node placement was better. The same precaution of using several different initial configurations was taken. Figures 1c and 1d presents the graphs obtained for the same cases of Figures 1a and 1b.

Figure 1. Graph of two different LELs using Fruchterman & Reingold, Eades and modified Eades methods



All clusters seen in the graphs created with both methods were carefully checked to confirm or reject they represent information clusters in the glossary. Every single verification was positive in the sense that every pair of nearby nodes represented terms of the LEL semantically related and that every pair of faraway terms represented loosely coupled ones.

Neither Eades nor Fruchterman and Reingold methods reach their objectives. Graphs obtained with Eades formulae do not have similar length in their edges, and Fruchterman and Reingold formulae fail to put close linked nodes.

The fact that Eades method produce a better node placement does not mean that the graphs corresponding to all glossaries clearly show the existing information clusters. By the contrary, the improvement in the cluster visualization fails in a still important number of cases.

Considering that the behavior of both methods is similar for smaller values of d and rather different for larger values of d , it becomes reasonable the hypothesis that emphasizing Eades behavior may lead to even better nodes placements. This supposition leads to the repulsive force formula:

$$f_r(d) = d^\alpha$$

Where α is between -0.5 and 0. This allows a f_r force slightly different from the one obtained using square root. The rational of this new formula was to obtain a weaker evolution of f_r with the distance.

As soon as this formula was applied, it was evident that clusters became notoriously clearer. In cases where previous graph contained clusters with diffuse limits, the same cluster appeared neatly defined. For some other cases where no cluster visualization were possible, they appeared. Some other details such as the relationships among clusters or internal groups were also observable.

Best results was obtained for values of α in the range of -0.2 to -0.1. Figure 1e and 1f show the graphs obtained with the new formula for the same glossaries of Figures 1a-c and 1b-d.

One more time, the evaluation of the improvements obtained with this step shows that it is a better method to visualize clusters in graphs and the existence of a smaller set of reluctant cases where clusters remain invisible. Figure 3a shows the graph obtained for one of those cases.

It seems that no relevant enhancement could be obtained by means of changes in the node placement algorithms, at least in the domain of planar graphs. However, there is a new viewpoint in this subject: not just automatize the node placement but also automatically detect the clusters themselves.

AUTOMATIC CLUSTER DETECTION

There are several notions of clusters, most of them derived from the method used for their detection. Some of them are based on the existence of a centripetal attraction (Berkhin, 2006), where the members of the cluster are located around a central or archetypical element, existent or not. Other type of clusters is characterized by the existence of several neighbors, also members of the cluster, having similar properties (Kriegel, Kröger, Sander, & Zimek, 2011). Obviously, the first type of clusters shows a quasi-circular shape and the second one may show an irregular shape.

A preliminary observation of the graphs where the modified Eades method failed to improve the visualization of clusters, led to suppose that this is due to the presence of irregular clusters.

The phrase *similar properties* is key in the activity of cluster detection. The nodes the mechanism used for comparison and for the ponderation of the differences are centrals to find clusters carrying meaning for the phenomena under study (Everitt, 2011). In this sense, it is known the wide use of the Euclidian

distance and the risk of its use when non-commensurable dimensions are combined. It may be thought that this is not the case, since the dimensions in graphs are geometrical distances. However, it should be taken into account that building a graph consist in the representation of an object of study, with an unknown number of dimensions in a two-dimensional visualization. This may be an oversimplification.

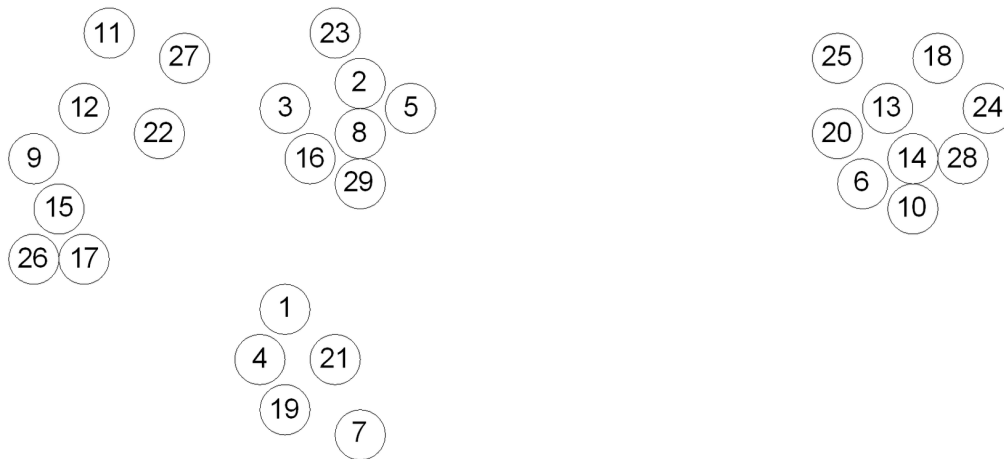
The simplest way for detecting irregular clusters is based on the search of nodes with more than a given quantity of neighbors located at a distance inferior of a threshold (Ester, Kriegel, Sander, & Xu, 1996). This approach has two parameters:

ϵ : maximum distance allowed to be considered a neighbor

k: minimum number of neighbors

The value of k should be compatible with the number of nodes in the graph. For graphs with less than 100 or 150 nodes, the value of k should be small, even $k = 2$. In all the LEL graphs studied, the value of $k = 2$ was chosen. Once the clusters are detected, they show greater values of k and just a few cases with the value $k = 3$. The value of ϵ require a more detailed analysis. For example, in the nodes placement of Figure 2, if ϵ is greater than the distance between nodes 5 and 20, the result is that there exists just one cluster. However, if ϵ is smaller than the distance between nodes 5 and 20 and greater than the distance between nodes 3 and 27, the result is that the number of clusters is 2. Smaller values of ϵ will lead to 3, 4 or even more clusters.

Figure 2. Relationship between ϵ and the number of clusters detected



There is no way to choose a value for ϵ a priori. In fact, all possible values may be correct. It is a natural consequence that an automatic clustering cannot provide a semantic vision of the object of the study. However, it reduces the analysis to a few possible combinations. Watching the set of clusters obtained diminishing the value of ϵ , the relationships among them may be seen as a hierarchy of clusters.

Larger clusters, obtained with larger values of ϵ , give some sort of information, while smaller ones are sub-clusters providing different information.

There always will be a small value of ϵ that will lead to a set of one-node clusters. This situation gives no information at all. The pragmatic small value of ϵ can be only determined by semantic considerations: when the splitting of a previously evaluated cluster does not give new relevant information. Then, a continuous diminishing of ϵ from a $\epsilon_{\max}$ giving just one cluster will produce an increasing number of clusters by means of the splitting of one of the previous clusters. The information obtained reviewing each step, will allow deciding when to stop the creation of new smaller clusters.

Departing from a value of ϵ that treats the whole graph as a unique cluster, a continuous decrease of it requires defining a $\Delta\epsilon$. If $\Delta\epsilon$ is too small the number of steps will be larger than necessary and if $\Delta\epsilon$ is too large some details will be lost, in at least one step, since will appear more than a new pair of cluster instead of splitting an existing one.

Instead, a binary search will lead to a minimum set of semantic cluster evaluation. When in a given segment $[\mathcal{E}_1, \mathcal{E}_2]$ occurs that:

- the number of clusters for $\mathcal{E}_1$ is the same than the number of clusters for $\mathcal{E}_2 \rightarrow$ the segment will not provide new information
- the number of clusters for $\mathcal{E}_1$ and the number of clusters for $\mathcal{E}_2$ differs in more than one $\rightarrow$ the segment $[(\mathcal{E}_1 + \mathcal{E}_2)/2, \mathcal{E}_2]$ should be inspected immediately and the segment $[\mathcal{E}_1, (\mathcal{E}_1 + \mathcal{E}_2)/2]$ should be analyzed later
- the number of clusters for $\mathcal{E}_1$ and the number of clusters for $\mathcal{E}_2$ differs in just one $\rightarrow$ the split cluster and both sub-clusters should be semantically analyzed.

Following this procedure a sequence of set of clusters, $S_1, S_2, S_3, \dots S_n$ will be obtained. In general, S_j will be a set of j clusters. At every step, S_j will became S_{j+1} , by means of the splitting of one of the clusters of S_j . If this division brings new information about the UofD whose vocabulary is being analyzed by means of clusters in their associated graph is a purely semantic question. Then, this procedure should stop when the new sub-clusters are meaningless.

Taking into account that the number of nodes in this sort of graphs is not very large, the detection of the clusters existing for a given value of ϵ , can be easily found by using the matrix C_ϵ :

$$C_\epsilon = c_{ij} \text{ con } 1 \leq i \leq n \text{ y } 1 \leq j \leq n$$

Where (for $k=2$):

n is the number of nodes of the graph,

$c_{ij} = \text{'T'}$ if the distance among node i and node j is smaller than ϵ ,

$c_{ij} = \text{'F'}$ otherwise.

(‘T’ and ‘F’ are the logical values of true and false).

Being C_ϵ^* the sum of the $(n-1)$ powers of the matrix C_ϵ ; each row and column of C_ϵ^* , contains the list of all nodes of the cluster to which this row or column belong. This is indicated by a T in the corresponding columns or rows. In other words:

When:

C_{ij}^* = 'T' nodes i and j belong to the same cluster,

C_{ij}^* = 'F' nodes i and j belong to different clusters.

This algorithm may be applied for $k > 2$ with a light difference in the definition of c_{ij} (Ester et al., 1996).

Table 2 shows the results given by this algorithm for a third case, related with the control of stock of a complex material storehouse.

Table 2. Results obtained for third case

Step	Left segment	Right segment	ϵ_1	$\frac{(\epsilon_1 + \epsilon_2)}{2}$	ϵ_2	Clusters size
1	$[0, \epsilon_{\max}/2]$ Further division	$[\epsilon_{\max}/2, \epsilon_{\max}]$ Accepted	56	2	1	2, 54
2	$[0, \epsilon_{\max}/4]$ Further division	$[\epsilon_{\max}/4, \epsilon_{\max}/2]$ Discarded	56	2	2	---
3	$[0, \epsilon_{\max}/8]$ Further division	$[\epsilon_{\max}/8, \epsilon_{\max}/4]$ Discarded	56	2	2	---
4	$[0, \epsilon_{\max}/16]$ Further division	$[\epsilon_{\max}/16, \epsilon_{\max}/8]$ Discarded	56	2	2	---
5	$[0, \epsilon_{\max}/32]$ Further division	$[\epsilon_{\max}/32, \epsilon_{\max}/16]$ Accepted	56	3	2	2, 6, 48
6	$[0, \epsilon_{\max}/64]$ Further division	$[\epsilon_{\max}/64, \epsilon_{\max}/32]$ Accepted	56	4	3	2, 6, 3, 45
7	$[0, \epsilon_{\max}/128]$ Further division	$[\epsilon_{\max}/128, \epsilon_{\max}/64]$ Further division	56	20	4	---
8	$[\epsilon_{\max}/128, 3 \epsilon_{\max}/256]$ Accepted	$[3 \epsilon_{\max}/256, \epsilon_{\max}/64]$ Further division	20	6	4	---
9	$[3 \epsilon_{\max}/256, 7 \epsilon_{\max}/512]$ Discarded	$[7 \epsilon_{\max}/512, \epsilon_{\max}/64]$ Further division	6	6	4	---
10	$[7 \epsilon_{\max}/512, 15 \epsilon_{\max}/1024]$ Accepted	$[15 \epsilon_{\max}/1024, \epsilon_{\max}/64]$ Accepted	6	5	4	2, 6, 2, 1, 45
...	...	...	...	...	...	...

Departing from a $\epsilon_{\max}$, which allows seeing the graph as composed by just one cluster, the first division, produced at step 1, finds a cluster composed by only two nodes (cluster A), leaving a remainder of 54 nodes. This cluster is clearly visible in the Figure 3a. Step 2, 3 and 4 reduce $\epsilon_{\max}$ to 1/16 of its initial value. With these values, it is impossible to distinguish new clusters. At step 5, a new cluster composed by six nodes was detected (cluster B). This cluster is still visible in Figure 3a. A third cluster (cluster C) composed by three nodes, found during the step 6, was divided at the step 10. It should be noted that at step 7, both, left and right-segment must be divided. The algorithm chose the right segment (larger values of ϵ) since they will provide bigger clusters. Later steps found clusters D, E, F and G.

Figures 3b through 3f depict the evolution in cluster detection. To improve visualization, the scale of these figures is different from the scale of Figure 3a. Table 3 summarizes the underlying semantic that drives the clustering of the involved terms of the LEL.

Figure 3. Some results of the automatic cluster detection algorithm

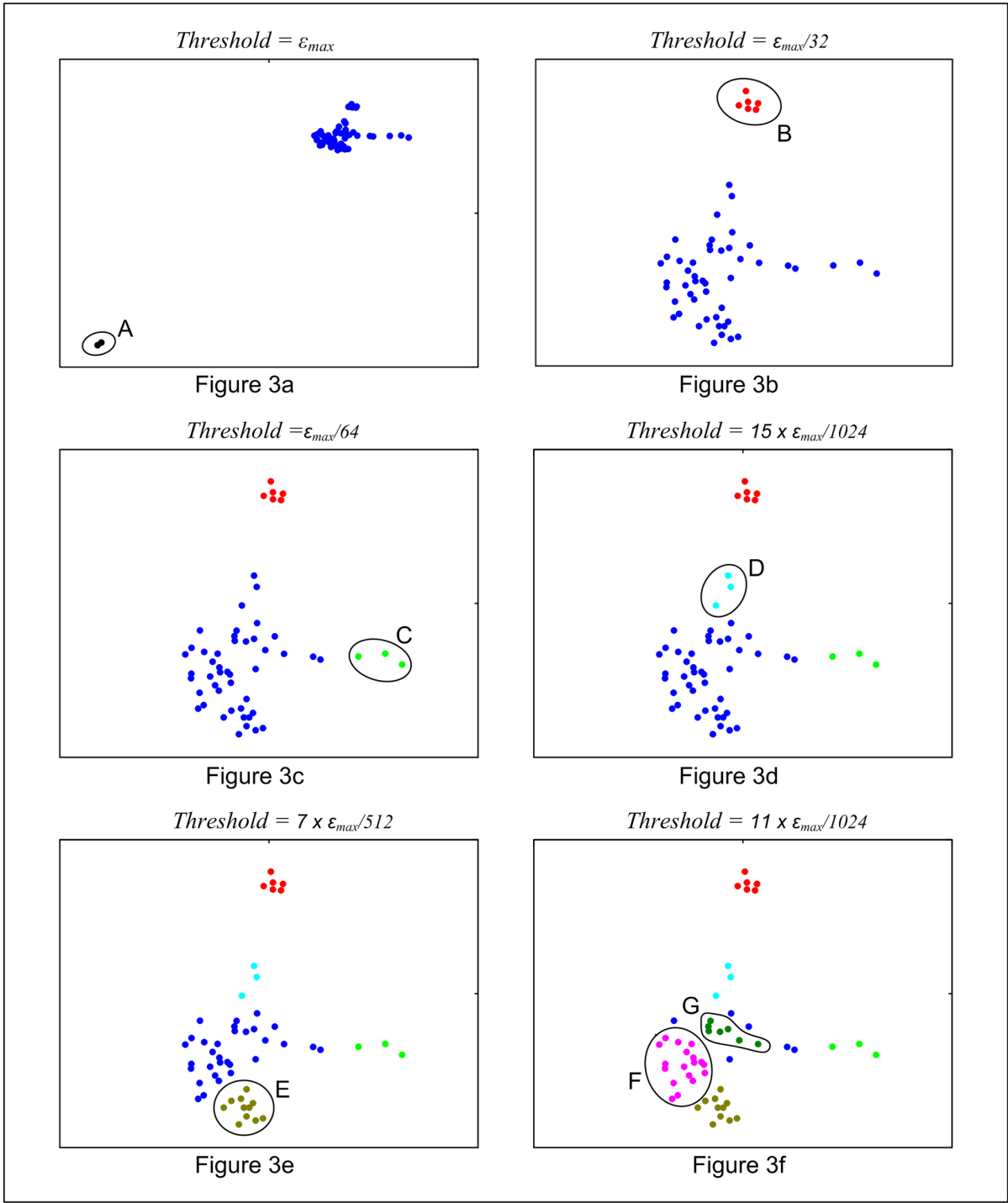


Table 3. Semantic of detected clusters

Cluster	Meaning
A	Consumables purchase order management
B	Purchase order management
C	Withdrawals management
D	Material needs forecasting
E	Receptions management
F	Control of devolutions because of quality or due to not use
G	Current and historical stock control

FUTURE RESEARCH DIRECTIONS

In the near future, several improvements and extensions will be included in the current algorithm used for graph construction. They may be sorted as:

- **Improve the interaction among the activities:** the process is now mature to begin establishing feedbacks among the activities. So far, the construction of graphs gave some extra information about the LEL and the UofD itself, but not an effective improvement of the LEL has been accomplished. The abstractions perceived by inspecting the clusters may be used to review the LEL for possible detections of essential hierarchies and composition relationships among terms, perhaps leading to the capture of missing terms, genders and specializations. The number of clusters or the number of main clusters may be considered to redraw the graph not in the plane but using a larger number of dimensions.
- **Change visualization techniques:** Considering the main clusters present in the LEL, it is conceivable to set a point of view centered on one cluster and look at the rest of the graph as a constellation around it. Polar coordinates may be a good choice for that.
- **Applying the techniques to other explicit links:** such as hyperlinks from Current Scenarios to the LEL and from Future Scenarios and Software Requirements Specifications documents to the LELr.
- **Applying the techniques to traces:** even that the traces are not implemented as explicit links, they may export from their databases the information about the source of any piece of information that configured a given requirement or which system requirement takes care of a client or user demand.
- **Improve the quality of the models:** a revision of the frontier nodes may lead to the detection of missing components. In addition, a revision of nodes not belonging to any cluster may help to find not relevant or poorly described terms.
- **Extracting more information from the model:** an inspection of the nodes that link two different clusters may help the detection of critical points in the UofD.

CONCLUSION

The location of the nodes of a graph has been improved allowing an easy perception of clusters in most of cases. For those reluctant cases where groupings cannot be seen, an automatic detection of clusters technique has been developed. This technique has shown its effectiveness even in complex graphs.

The clusters are detected in an incremental fashion, in such a way that the number of clusters is increased by one, because of the splitting of a previous larger cluster. This allows an incremental refining of the semantic of the groups. In some favorable cases, the partition gives a semantically coherent small cluster and a big rest-of-the-world cluster. When it happens, the partition behaves as extracting coherent fragments out of an amorphous block of nodes.

The number of clusters is the result of the semantic granularity desired by the user.

The construction of graphs and the automatic detection of clusters within them provides an important improvement in the exploitation of the information content of the original model.

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KEY TERMS AND DEFINITIONS

Application Domain: The context in which the software system will be used.

Graph Drawing Methods: An area of mathematics and computer science that combines methods from geometric graph theory and information visualization to derive two-dimensional graph depictions.

Force-Directed Algorithm: A method for calculating a graph layout. It calculates the layout using only information contained within the structure of the graph itself, rather than relying on domain-specific knowledge.

Language Extended Lexicon: A glossary composed by a set of symbols, words or phrases which are peculiar and frequently used in a given application domain. The symbols included in a LEL have a different meaning than the regular use. It contains hypertext links that interconnect symbols.

LEL Graph: A graph where the vertices are the LEL entries and the edges represent the hypertext links among entries.

Requirements Engineering: An area of the Software Engineering, which is responsible for acquiring and defining the needs of the software system.

Semantic Cluster: A group of terms in the Language Extended Lexicon, representing an area of interest in the business process.

An Improved Monkey Search Algorithm to Solve the Flexible Job Shop Scheduling Problems With Makespan Objective

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INTRODUCTION

Scheduling is a vital decision making processes in both manufacturing and service industries. The main objective of scheduling is to allocate the available limited resources to perform a group of tasks over a period of time to optimize some performance measures. The most important performance measures are minimization of makespan, flow time, tardiness, and lateness. A wide variety of scheduling problems were addressed by the researchers. Among them flexible job shop scheduling problem (FJSP) is considered in this paper due to its theoretical and practical significance. The FJSP is an extension of the classical job-shop scheduling problem (JSP). In the classical JSP, n jobs are to be processed on m machines and it is assumed that the n jobs have pre-determined sequences of operations and also each operation is performed on a predefined machine. In the FJSP, the operations are processed on the multiple capable machines. The FJSP is formed by assigning each operation to a machine out of a set of capable machines and sequencing the assigned operations on each machine to obtain a feasible schedule by considering a predefined objective function. The FJSP were proved to be non-deterministic polynomial-time hard (NP-hard) type combinatorial optimization problems (Garey et al., 1976). Hence, with the increase in problem size, the computational time would also increase. Therefore, the exact algorithms such as branch and bound, branch and cut, Lagrangian relaxation and dynamic programming cannot be used to solve the large size problem instances. To overcome this difficulty, researchers have developed many heuristics. However, heuristics are based on a specified thumb rule for a particular problem. Hence, many meta-heuristic algorithms are addressed in the literature. Monkey search algorithm (MSA) is one of the recently developed meta-heuristic algorithms. In this paper, an improved MSA (IMSA) is considered to solve the FJSP with makespan objective function. The main objective of the work is to develop an improved monkey search algorithm (IMSA) for solving the flexible job shop scheduling problems for minimizing makespan and validate the performance of the proposed IMSA using the benchmark problems addressed in the literature. The background of the proposed research work is presented in the next section.

BACKGROUND

In this section the literature review on the FJSP, monkey search algorithm and variable neighbourhood search algorithm are present.

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FLEXIBLE JOB SHOP SCHEDULING

The FJSP was first addressed by Brucker and Schile, 1990. They developed a polynomial algorithm to solve the FJSP with two jobs. They also proposed hierarchical approaches and integrated approaches to solve the FJSP with many jobs. However, the exact algorithms could be used to solve only smaller problem instances. The real problems are larger in nature and hence they cannot be solved by the exact algorithms. A new neighbourhood structure was proposed by Dauzère-Pérès and Paulli (1997) to solve the FJSP. The TS algorithm was suggested by them for re-sequencing and rearranging the operation. Zhang and Gen (2005) proposed a multistage operation based GA to deal with the FJSP. Gao et al. (2006) presented a General Particle Swarm Optimization (GPSO) algorithm for solving FJSP. In the proposed GPSO, crossover and mutation operations in the Genetic Algorithm were incorporated to exchange the information and search randomly. In addition, the Tabu Search (TS) was also used for the local search. The performance of the proposed algorithm was demonstrated with the benchmark problems.

Fattahi et al. (2007) developed a mathematical model and heuristic procedures to solve the FJSP. Tabu search (TS) and simulated annealing (SA) are the heuristics proposed by them. They also addressed six different algorithms to solve the FJSP. They considered both integrated and hierarchical approaches in their research. Gao et al. (2008) proposed a hybrid GA and variable neighbourhood descent (HGVND) algorithm to solve the FJSP. Two local search procedures were introduced by them. The proposed algorithm was tested on 181 benchmark problems and the effectiveness of the algorithm was proved. Pezzella et al. (2008) presented a GA to solve the FJSP by developing different strategies to generate the initial population, selection and reproduction. They compared the results, with other GAs and TS algorithms.

Bagheri et al. (2010) introduced an artificial immune system (AIS) algorithm to solve the FJSP to minimize the makespan. In the AIS, Different strategies were developed to produce the initial population and selecting the individuals for reproduction. Different mutation operators were utilized for reproducing new individuals. Xing et al. (2010) addressed a knowledge-based ant colony optimization (KBACO) algorithm to solve the FJSP. In the KBACO, the knowledge model learned some available knowledge from the optimization of ACO. The existing knowledge is then applied to guide the current heuristic searching. Yazdani et al. (2010) solved the FJSP by a parallel variable neighbourhood search (PVNS) algorithm to solve the FJSP. The proposed method increased the diversification and the exploration in the search space. Al-Hinai and ElMekkawy (2011) introduced a hybrid GA (HGA) to solve the FJSP. The initial population generation algorithm and a local search method were combined in the HGA and hence the performance of the GA was improved. The proposed HGA outperformed other versions of GA.

Yuan and Xu (2013) presented two algorithms for solving the FJSP with makespan criterion. Hybrid harmony search (HHS) and large neighborhood search (LNS) are the two algorithms. In the HHS, a local search procedure was carried out to improve the solution quality. The proposed algorithms were used to obtain the new upper bounds for the benchmark instances. A teaching-learning based optimization (TLBO) algorithm was proposed by Baykasoğlu et al. (2014) to solve the job shop scheduling problems. González et al. (2015) addressed the scatter search (SS) algorithm combined with path re-linking and TS for solving the FJSP with makespan objective. They compared the performance of the proposed algorithm with several other algorithms addressed in this literature for standard benchmark problems. A biogeography based optimization (BBO) algorithm with some heuristics was proposed by Lin (2015) for solving the FJSP. He also introduced a path re-linking technique, an insertion-based local search heuristic and an efficient machine assignment rule. Cinar et al. (2016) developed a priority-based genetic algorithm (PBGA) for solving the FJSP. In the proposed algorithm, the priority of each operation was represented by a gene on the chromosome. Iterated local search (ILS) was applied to the chromosomes at

the end of each reproduction process to improve the solution quality. The computational results revealed the effectiveness of the proposed algorithm for the benchmark problems. Li and Gao (2016) suggested an effective hybrid genetic algorithm to solve the FJSP to minimize the makespan. In the proposed algorithm, the GA is hybridized with the tabu search (TS). The GA was used for exploration, and TS was used for exploitation. Six different benchmark problems were used to evaluate the performance of the proposed algorithm.

Cruz-Chávez et al. (2017) addressed a simulated annealing (SA) algorithm accelerated by a partial scheduling mechanism and a cooling schedule mechanism to solve the FJSP to minimize the makespan. The computational results demonstrated the better performance of the proposed accelerated SA (ASA) for the benchmark problem instances of different problem sizes. Marzouki et al. (2017) introduced a multi agent model based on chemical reaction optimization with greedy algorithm for solving the FJSP. Phu-ang and Thammano (2017) developed a new memetic algorithm based on marriage in honey bees optimization algorithm for solving the FJSP. Four new features were introduced to get the global optimum solutions. An improved ant colony optimization (IACO) was proposed by Wang et al. (2017) to minimize the makespan for FJSP. A real scheduling problem and two sets of well-known benchmark instances were considered to evaluate the performance of the proposed IACO.

Gaham et al. (2018) applied an effective discrete harmony search algorithm to solve the FJSP with makespan criterion. Kato et al. (2018) solved the FJSP using a hybrid particle swarm optimization and random restart hill climbing approach. The proposed algorithm introduced new strategies in the population initialization, displacement of particles, stochastic allocation of operations, and management of scenarios partially and totally flexible. Liang et al. (2018) presented an improved hybrid immune algorithm to tackle the FJSP. A hybrid encoding method was used and based on that adaptive crossover operator and mutation operator were introduced. The adaptive crossover probability and mutation probability were used in the operation of immune for the antibody population. A hybrid algorithm based on simulated annealing algorithm was introduced to avoid the local optimization. Marichelvam et al. (2018) suggested a hybrid lion optimization algorithm (HLOA) to tackle the FJSP to minimize the makespan. A constructive heuristic was used to generate an initial solution to improve the solution quality. They conducted computational experiments with the benchmark problems and proved the effectiveness of the HLOA. Marzouki et al. (2018) developed a multi-agent model based on combination of chemical reaction optimization algorithm with tabu search (TS) to solve the FJSP.

From the above literature review, it is evident that whenever a new algorithm was developed, it was also applied to solve the FJSP with different objective functions. Moreover, each proposed approach has its own merits and demerits. Further, due to the technological developments in the computing facility, the computational time is also reduced by applying the new algorithms.

MONKEY SEARCH ALGORITHM

Monkey search algorithm (MSA) is one of the important meta-heuristic algorithms developed by Zhao and Tang (2008). It is based on the simulation of mountain-climbing processes of monkeys. Kammerdiner et al. (2009) proposed the MSA to solve the multidimensional assignment problem (MAP). Tao et al. (2010) solved the gas filling station project scheduling problem using the MSA. Wang et al. (2010) applied a discrete MSA for transmission network expansion planning. Zhang et al. (2011) developed an intrusion detection technology based on the MSA to improve the performance of Intrusion Detection System. Ituarte-Villarreal et al. (2012) proposed the MSA for a hybrid microgrid to find the proper

configuration of components to minimize the total lifecycle cost and greenhouse gas emissions. Yi et al. (2012) modified the MSA to obtain the optimal sensor placement.

Jia et al. (2015) developed a triaxial accelerometer monkey algorithm (TAMA) for solving the optimal sensor placement problems of triaxial accelerometers. Lenin et al. (2015) addressed a modified MSA for solving optimal reactive power dispatch problem to reduce the power loss. The performance of the proposed algorithm was tested with the standard IEEE 30 bus test system. Peng et al. (2016) suggested a chaotic MSA to solve the optimal sensor placement problem. In the proposed algorithm, the initial solutions were generated by using chaos variable and binary coding to enhance the global search capability. Then, a greedy strategy was adopted to improve the efficiency of local search. Zhou et al. (2016) introduced an improved MSA (IMSA) to solve the 0-1 knapsack problem. In the IMSA, the cooperation process was introduced to speed up the convergence rate of the algorithm. Moreover, the greedy strategy repair process was used to correct the infeasible solutions and improve the quality of the feasible solutions. A detailed literature review on MSA was presented by Devi and Sathya, (2017). Devi and Sathya, (2017) also proposed the MSA to solve the robot path planning and vehicle routing problems.

Marichelvam et al. (2017) introduced a hybrid MSA (HMSA) to solve the flow shop scheduling problems with multiple objectives. Minimization of makespan and total flow time was the objective function. In the HMSA, the dispatching rules and constructive heuristics were incorporated with the MSA to improve the solution quality. Recently, Atta et al. (2018) proposed the MSA to solve the incapacitated facility location problem. Elmar Kuliev et al. (2018) addressed the MSA to solve the partitioning of electronic computer equipment components which is one of the most important design optimization problems. From the above literature review, it is evident that there is no reported application of the MSA to solve the FJSP. Hence, in the present work an attempt is made to solve the FJSP using an improved MSA (IMSA). In the IMSA, the variable neighbourhood search (VNS) algorithm (Mladenović and Hansen, 1997) is implemented after the monkey search algorithm to enhance the solution quality.

VARIABLE NEIGHBOURHOOD SEARCH

The Variable Neighborhood Search (VNS) is a Metaheuristic that is associated with an iterative local search algorithm. Sevkli and Aydin (2006) applied the VNS algorithm to solve the job shop scheduling problems. Zhang et al. (2008) presented a Variable Neighborhood Genetic Algorithm (VNGA) to solve the FJSP to minimize the makespan. In the VNGA, the GA was hybridized with the VNS algorithm. Amiri et al. (2010) addressed a VNS algorithm to solve the FJSP with makespan objective function. Various neighbourhood structures related to assignment and sequencing problems were used by them to generate the neighboring solutions. Benchmark problems were used to evaluate the performance of the proposed algorithm. Pongchairerks (2014) used the VNS algorithm to solve the job shop scheduling problems. Lan et al. (2016) introduced an improved version of VNS algorithm to solve the robust job shop scheduling (JSS) problem with uncertain processing times to minimize the makespan. To obtain the advantages of both the monkey search algorithm and the VNS algorithm, both are hybridized in this chapter. The FJSP definition is presented in the next section.

FLEXIBLE JOB SHOP SCHEDULING PROBLEM DEFINITION

A set of n jobs are to be processed in the shop with m machines. Each job consists of n_j operations and each operation may be processed in any one of the machines. A job may be processed in only one machine or two machines. In some cases, a job may be processed by all the machines. The objective is to determine a schedule to minimize the makespan. Makespan is defined as the maximum completion time of the jobs in the production system. Makespan minimization is an important objective function for the effective utilization of resources. Hence, makespan minimization is considered in this chapter. The mathematical model proposed by Fattahi et al. (2007) is utilized in this chapter. It is quite common to make some assumptions in the scheduling literature. The following assumptions are considered in this chapter.

- All machines are available at time zero.
- All jobs are released at time zero.
- Each machine can process only one operation at a time.
- Each operation can be processed without interruption on one of a set of available machines.
- Pre-emption is not permitted.
- Set up times are incorporated into the processing time.
- The processing times are known in advance and deterministic.
- The order of operations for each job is predefined and cannot be modified.
- All machines are available continuously.

MONKEY SEARCH ALGORITHM

Monkey search algorithm (MSA) is one of the recently developed meta-heuristic algorithms. It is based on the simulation of mountain-climbing process of monkeys. In MSA, the population size of the monkeys is first defined. Then, the position of each monkey is represented by a vector x_i . This position is generated randomly. The position of the monkeys is changed by the step by step climbing process. The climb process in the MSA was originally designed to use the idea of pseudo-gradient-based simultaneous perturbation stochastic approximation, a kind of recursive optimization algorithm. The climbing process is used to improve the value of the objective function. After the climbing process each monkey arrive its own mountain top. Then, each monkey will look for other higher points than its current position. If a higher mountain is found, the monkey would jump thereby using its eye sight. The eye sight of a monkey is defined as the maximal distance that the monkey could watch. The position is updated. Then, the new searching domains are found by the monkeys by using the current positions as a pivot. This stage is known as somersault process, and will yield a new position for the monkeys. The objective function values are evaluated. The process will be stopped if the number of iterations is satisfied. Main processes of the algorithm are given below (Zhao and Tang, 2008; Zhang et al., 2011):

Solution Representation

Define population size of monkeys (M), for any monkey $i \in \{1, 2, \dots, M\}$ defines its position $x_i = (x_{i1}, x_{i2}, \dots, x_{in})$ which expresses one solution of the optimization problem with n dimensions.

Initialization

Generate monkeys' initial solutions randomly.

Climb Process

I. Randomly generate a vector $\Delta x_i = (\Delta x_{i1}, \Delta x_{i2}, \dots, \Delta x_{in})$, where Δx_{ij} is set as a and a is called step length of the climb process.

$$\text{II. } f'_{ij}(x_i) = \frac{f(x_i + \Delta x_i) - f(x_i - \Delta x_i)}{2\Delta x_{ij}}, \quad j = 1, 2, 3, \dots, n.$$

Vector $f'_{ij}(x_i) = (f'_{i1}(x_i), f'_{i2}(x_i), \dots, f'_{in}(x_i))$ $x_i \leftarrow y$ is called the pseudo-gradient of the objective function at point x_i .

III. Set $y_j = x_{ij} + \alpha \text{sign}(f'_{ij}(x_i))$, $j = 1, 2, 3, \dots, n$ and $y = (y_1, y_2, \dots, y_n)$

IV. Let $x_i \leftarrow y$ provided that y is feasible; otherwise keep x_i .

V. Repeat steps I – IV until there is little change on the objective function in the respective iterations or the maximum allowable number of iterations N_c has reached.

Watch-Jump Process

I. Randomly generate real number y_i from $(x_{ij} - b, x_{ij} + b)$, $j = 1, 2, 3, \dots, n$. b is called the eyesight of the monkey which indicates the maximum distance that the monkey can watch.

II. Let $x_i \leftarrow y$ provided that $f(y) > f(x_i)$ and y is feasible. Otherwise, repeat step I until an appropriate point y is found or a certain number of watch times has been reached.

III. Repeat the climb process by employing y as an initial position.

Somersault Process

I. Randomly generate a real number θ from the somersault interval $[c, d]$.

II. Set $y_j = x_{ij} + \theta(p_j - x_{ij})$, where $p_j = \frac{1}{M} \sum_{i=1}^M x_{ij}$, $j = 1, 2, \dots, n$. $p = (p_1, p_2, \dots, p_n)$ is called somersault pivot and $(p_i - x_{ij})$ is the somersault direction of monkey i .

III. Set if $y = (y_1, y_2, \dots, y_n)$ is feasible. Otherwise, repeat steps I and II until a feasible solution y is found.

Termination

The above steps are repeated until the stopping criterion is met. The number of iterations is used as stopping criterion.

IMPROVED MONKEY SEARCH ALGOIRTHM (IMSA)

In order to improve the solutions, the heuristics are hybridized with the MSA. Ziaee (2014) established a heuristic algorithm to solve the FJSP with makespan objective. In the IMSA, one of the initial solutions is generated using the heuristics. The remaining solutions are generated randomly. Moreover, the VNS algorithm is used after obtaining the optimal solutions using the MSA. A set of neighbourhood structures of the optimal solution are generated by the shaking procedure. The adjacent pairwise interchange scheme and swap (or exchange) scheme are also used in the neighbourhood search. Then, a local search algorithm is used to improve the new solution. The solution is compared with the optimal solution and based on the makespan value the best solution is obtained. This process is repeated until the stopping condition is reached. Number of generation is the stopping criterion.

IMSA FOR FJSP

In the IMSA, the required parameters are defined first. One of the initial solutions is generated using the heuristics developed by Ziaee (2014). The remaining solutions are produced randomly. To obtain these random solutions, real random numbers are generated between the interval $[0, 1]$. These random numbers are considered as random positions of the monkeys. The smallest position value (SPV) rule described by Bean (1994) is used to convert the continuous position of the monkeys into the discrete job permutation. The parameters used by Zhao and Tang (2008) is considered in this chapter. The objective function values are calculated for all the monkeys. To improve the objective function values, the climbing process is carried out by changing the position of the monkeys. In this chapter, the position of the monkeys is updated by using the velocities of the monkeys (Marichelvam et al. 2017). This is vital as the monkeys attempt to go to the top most position with certain velocity. The objective function values are again estimated for these new positions. This process is repeated until the maximum climb number is reached. Then the watch jump process and somersault process are carried out. This process is repeated until the required number of iterations is completed. At the end of the above steps, the best solution is obtained. For this best solution, a fixed number of neighbourhood structures are created. Then, a new solution in the neighbourhood of the current solution is obtained using the shaking procedure. The adjacent pairwise interchange scheme and swap (or exchange) scheme are used in the neighbourhood search. A local search algorithm is applied to improve the new solution. The solution is compared with the optimal solution and based on the objective function value the best solution is obtained. This process is repeated until the stopping condition is reached. Number of generation is used as the stopping criterion in this work.

SOLUTIONS AND RECOMMENDATIONS

The proposed algorithm is coded in C++ and run on a PC with an Intel Core Duo 2.4GHz CPU, 2GB RAM, running Windows XP. The parameters of the proposed algorithm are presented in Table 1. To validate the proposed algorithm, the benchmark problems developed by Dauzère-Pérès and Paulli (1997) are used in this chapter. The benchmark problem set consists of 18 problems. The number of jobs ranges from 10 to 20, number of machines ranges from 5 to 10, number of operations for each job ranging from 15 to 25, and number of operations for all jobs ranges from 10 to 100. The results obtained by the proposed HMSA are compared with many other algorithms such as discrepancy search (DS) algorithm proposed

Table 1. Parameters of the proposed algorithm

SI. No.	Factors	Levels
1	Population size (M)	100
2	Mutation probability	0.01
3	Climb number (N)	2000
4	Eyesight (b)	0.5
5	Somersault interval [c, d]	[-1, 1]
6	Number of iterations	500

by Hmida et al. (2010), effective genetic algorithm (EGA) developed by Zhang et al. (2011), GPSO algorithm, HGA, HHS algorithm, integrated approach using tabu search (IATS) proposed by Dauzère-Pérès and Paulli, 1997, SS algorithm and TS algorithm introduced by Mastrolilli and Gambardella, 2000 addressed in the literature. The result comparison of different algorithms is presented in Table 2. From the result table 2, it is concluded that our HMSA outperforms many algorithms DS, GPSO, HGA and IATS algorithms for all the 18 problem instances. The performance of our HMSA is similar to EGA for 7 problem instances and superior to EGA for the remaining 11 problems. While comparing our HMSA with the HHS algorithm, our HMSA provides better results for 16 problem instances whereas for two problems both the algorithms provide the similar makespan values. It is evident that our algorithm is superior to the SS algorithm for 7 problems and TS algorithm for 17 problems.

The Relative Deviation Index (RDI) is also used as a performance measure to compare the performance of different algorithms. RDI is computed by using the following equation:

$$RDI = \frac{C_{\max - Algorithms} - BKS}{BKS}$$

Table 3 demonstrates the RDI comparison of different algorithms. Lower RDI values indicate the better performance of the algorithm. From the table it can be easily concluded that the performance of the proposed algorithm is better than many other algorithms. From the RDI values, the mean RDI (MRDI) is calculated. The MRDI comparison of different algorithms is shown in Table 4. The MRDI value for the proposed HMSA is 0.96 which is lower than other algorithms. From the above result comparison it can be concluded that the HMSA is superior to other algorithms to obtain the optimal solutions. The better performance of the proposed algorithm is due to the hybridization of the MSA with the VNS algorithm. However, the computational time comparison is not considered in the present work as for many algorithms the details are not available.

MANAGERIAL IMPLICATIONS

The proposed improved monkey search algorithm is very simple and effective, and it would reduce the time to obtain the optimal schedule in any scheduling environment. The present study offers a structure for practicing engineers and shop floor managers to schedule large sized problems with less computational time. Hence, this would be very much useful to improve the productivity. The inventory may

Table 2. Result comparison of different algorithms of DPdata

Problem instances	n	m	DS	EGA	GPSO	HGA	HHS	IATS	SS	TS	IMSA
01a	10	5	2518	2516	2539	2518	2505	2530	2505	2518	2505
02a	10	5	2231	2231	2244	2231	2230	2244	2229	2231	2229
03a	10	5	2229	2232	2232	2229	2228	2235	2228	2229	2228
04a	10	5	2503	2515	2523	2515	2506	2565	2503	2503	2503
05a	10	5	2216	2208	2234	2217	2212	2229	2211	2216	2208
06a	10	5	2196	2174	2218	2196	2187	2216	2183	2203	2174
07a	15	8	2283	2217	2361	2307	2288	2408	2274	2283	2217
08a	15	8	2069	2073	2086	2073	2067	2093	2064	2069	2064
09a	15	8	2066	2066	2073	2066	2069	2074	2062	2066	2062
10a	15	8	2291	2189	2362	2315	2297	2362	2269	2291	2189
11a	15	8	2063	2063	2083	2071	2061	2078	2051	2063	2051
12a	15	8	2031	2019	2050	2030	2027	2047	2018	2034	2018
13a	20	10	2257	2194	2342	2257	2263	2302	2248	2260	2248
14a	20	10	2167	2167	2174	2167	2164	2183	2163	2167	2163
15a	20	10	2165	2165	2173	2165	2163	2171	2162	2167	2162
16a	20	10	2256	2211	2324	2256	2259	2301	2244	2255	2211
17a	20	10	2140	2109	2162	2140	2137	2169	2130	2141	2109
18a	20	10	2127	2089	2157	2127	2124	2139	2119	2137	2089

Table 3. RDI comparison of different algorithms of DPdata

Problem instances	CDDS	EGA	GPSO	HGA	HHS	IATS	SS	TS	IMSA
01a	0.518962	0.439122	1.357285	0.518962	0	0.998004	0	0.518962	0
02a	0.13465	0.13465	0.718133	0.13465	0.089767	0.718133	0.044883	0.13465	0.044883
03a	0.044883	0.179533	0.179533	0.044883	0	0.314183	0	0.044883	0
04a	0	0.479425	0.799041	0.479425	0.119856	2.477028	0	0	0
05a	1.23344	0.867976	2.055733	1.279123	1.050708	1.827318	1.005025	1.23344	0.867976
06a	1.572618	0.555042	2.590194	1.572618	1.156337	2.497687	0.971323	1.896392	0.555042
07a	4.389575	1.371742	7.956104	5.486968	4.618198	10.10517	3.978052	4.389575	1.371742
08a	0.388161	0.582242	1.213003	0.582242	0.291121	1.552644	0.14556	0.388161	0.14556
09a	0.242601	0.242601	0.582242	0.242601	0.388161	0.630762	0.04852	0.242601	0.04852
10a	5.188246	0.505051	8.448118	6.290174	5.463728	8.448118	4.178145	5.188246	0.505051
11a	2.280615	2.280615	3.272186	2.677243	2.181458	3.024294	1.685672	2.280615	1.685672
12a	3.148807	2.53936	4.113763	3.098019	2.945658	3.961402	2.488573	3.301168	2.488573
13a	4.442388	1.527071	8.375752	4.442388	4.720037	6.524757	4.025914	4.581212	4.025914
14a	0.277649	0.277649	0.601573	0.277649	0.138825	1.018047	0.09255	0.277649	0.09255
15a	0.185099	0.185099	0.555298	0.185099	0.09255	0.462749	0.046275	0.277649	0.046275
16a	5.027933	2.932961	8.193669	5.027933	5.167598	7.122905	4.469274	4.981378	2.932961
17a	2.490421	1.005747	3.544061	2.490421	2.346743	3.87931	2.011494	2.538314	1.005747
18a	3.403014	1.555664	4.861449	3.403014	3.257171	3.986388	3.014098	3.889159	1.555664

Table 4. MRDI comparison of different algorithms

Algorithm	CDDS	EGA	GPSO	HGA	HHS	IATS	SS	TS	IMSA
MRDI	1.94272	0.98119	3.30095	2.12407	1.8904	3.30827	1.56696	2.00911	0.96511

also be reduced. Finally, the total cost of the system would be reduced and the profit of the organization would be increased.

FUTURE RESEARCH DIRECTIONS

The proposed algorithm can be used to solve real industrial scheduling problems. The proposed algorithm may be used for solving the flexible job shop scheduling problems with stochastic processing times. The consideration of due date related objective functions, multi-objectives, setup time, machine break down would be some other scope of the present work. The proposed algorithm may be combined with other heuristics and meta-heuristics to enhance the solution quality.

CONCLUSION

An improved monkey search algorithm (IMSA) is presented in this chapter for solving the FJSP to minimize the makespan. The variable neighbourhood search algorithm is hybridized with the monkey search algorithm to obtain optimal or near optimal solutions. 18 benchmark problems used in the literature are considered in this chapter. The computational results reveal that the proposed algorithm is better than the hybrid genetic algorithm, enhanced genetic algorithm, simulated annealing algorithm, hybrid harmony search algorithm, scatter search and particle swarm optimization algorithms for most of the problems.

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KEY TERMS AND DEFINITIONS

Makespan: Makespan is defined as the completion time of the last job to leave the system.

Monkey Search Algorithm: A recently developed meta-heuristic algorithm to solve the optimization problems.

NP-Hard Problems: Non-deterministic polynomial time hard problems.

Scheduling: Scheduling is defined as a process of allocating resources over time to perform a collection of tasks.

MDTF: A Most Dependent Transactions First Priority Assignment Heuristic

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INTRODUCTION

In recent years, considering the ever-growing challenging and complex requirements of target users, several advanced real-time based applications are developed by utilizing the database framework and scheduling aspects of time-constrained databases (Shanker, Misra, & Sarje, 2006a). The transaction processing techniques were first studied from the real-time perspective in real time database system (RTDBS). The RTDBS is simply a database system which works up on real time transaction (RTT).

The RTTs are associated with deadlines. They may be categorized as soft, firm and hard based on the consequences of their deadline misses. The soft RTT's deadline miss means the result will have lesser value (positive but diminishing); the firm RTT's deadline miss means the result will have no value (zero value), and the hard RTT's deadline miss means the result may be catastrophic (negative value). Therefore, the soft/firm/ hard RTTs must be completed without missing their deadline to make sure the meeting of the objectives of executing it. This discussion makes one point very much clear that deadline computation of RTTs (priority assignment of RTTs) should be performed in a customized fashion considering the nature of the application to get the best possible outcome.

Several protocols were developed to improve overall RTDBS performance. Then, it is realized that most of the real-life problems related to the database are distributed in nature. For instance, a balance transfer transaction between users of two different banks. To incorporate all these requirements, a more advanced research area called distributed real time database system (DRTDBS) is evolved. The DRTDBS may be defined as a collection of a finite number of time-constrained distributed database systems (Pandey & Shanker, 2016) (Pandey & Shanker, 2018c) connected through a network. In DRTDBS, a distributed RTT is generated at the parent site. The coordinator of this transaction is then tasked to coordinate and perform changes at multiple sites atomically. In contrary to the traditional databases, the correctness of the result in DRTDBS based application depends on two things: logical computation performed, and the time when the result is produced & disseminated. Although the result produced is functionally right, it may lead to tragic repercussions, be unusable, or has less value if it is not produced in time (Shanker, Misra, & Sarje, 2001). To make it easy for understanding, a complete list of acronyms with their meaning is presented below in Table 1.

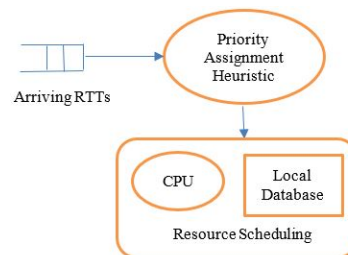
DOI: 10.4018/978-1-7998-3473-1.ch054

Table 1. Table of Acronyms

Acronym	Meaning
RTDBS	Real Time Database System
RTT	Real Time Transaction
DRTDBS	Distributed Real Time Database System
RTS	Real Time System
EDF	Earliest Deadline First
AED	Adaptive Earliest Deadline
AEVD	Adaptive Earliest Virtual Deadline
AAP	Adaptive Access Parameter
UD	Ultimate Deadline
ED	Effective Deadline
EQS	Equal Slack
SS	Slack-time Slice
EQF	Equal Flexibility
PSS	Proportional Slack-time Slice
NL	Number of Locks
MNL	Modified Number of Locks
MDTF	Most Dependent Transactions First

The role of priority heuristic is vital in time-constrained databases from the transaction scheduling perspective. The same can be easily understood with the help of Figure 1 which gives an abstract view of the logical transactional environment at site S.

Figure 1. Role of Priority Assignment Heuristic in RTT Scheduling



The primarily focused task in DRTDBS is to reduce transaction miss percentage. This may be done by ensuring the efficient scheduling of concurrently executing transactions (global and local). The success of transaction scheduling algorithms largely depends on the method employed to assign priorities of transactions. The concurrency control protocol and the priority assignment heuristic both have their collective and dependent responsibility of appropriately scheduling system resources mainly data items and CPU. In distributed RTT processing systems, the priority heuristic has a very close interaction with concurrency control schemes. The concurrency control protocols are widely researched topics while

very little attention has been made in designing priority heuristics. This makes it highly pertinent to thoroughly investigate existing priority heuristics which is an obvious step to further improve the system performance by coming up with an efficient priority heuristic. Though there exist few priority heuristics specifically designed for the DRTDBS in past, they mostly consider only one thing in deciding cohorts' priorities — real-time constraints of cohorts (Lee, Lam, & Kao, 1999). Still, there are many unresolved issues requiring further investigation. Thus, this book chapter first discusses the merits and demerits of existing priority assignment heuristics and then proposes a new contention-aware distributed heuristic for the priority assignment of cohorts. Here, our work specifically focuses on the following problems that are still unsolved.

1. How is 'the heuristic integrated with the concurrency control protocols' effect the system performance with reference to the problems of the data contention, cyclic restart, and deadlock (Lee, Lam, & Kao, 1999).
2. If a higher priority transaction requests to access the data item already locked by another lower priority transaction, the transaction currently holding the data item should be aborted, permitted to inherit the higher priority of lock requesting transaction or simply be blocked.

BACKGROUND

To solve the single-processor multi-program scheduling problem, two techniques were suggested in Real Time Systems (RTS) (Liu & Layland, 1973). The aim was to improve the processor utilization by assigning priorities of the tasks. This was one of the first research papers discussing the importance of deadline-based task priority assignment.

Priority Heuristics for RTDBS

The need for coming up with a priority heuristic is first felt by database researchers when they started working on the RTDBS. The simplest priority heuristic to assign priority to the transactions is by using the classic earliest deadline first (EDF) scheme. The priority is inversely proportional to the deadline. So, the highest priority is assigned to the transaction with the earliest deadline. The transaction with an earlier deadline has the advantage of accessing the data/resources first over the transactions with longer deadlines desirous to access the same data item. However, the transaction scheduled first may not necessarily be the most urgent/important one in the system. It is also found that EDF does not perform well in case of heavy load situations and leads to degradation of the system performance. This is mainly due to its nature of assigning a high priority to the transactions that are highly prone to the deadline miss. Such deadline misses lead to the wastage of the system resources, and thereby delay other concurrently executing transactions (Yu, Wu, Lin, & Son, 1994).

To overcome the above problems, an adaptive earliest deadline (AED) policy has been introduced which stabilizes the performance of EDF under overload through an adaptive admission control mechanism (Haritsa, Livny, & Carey, 1991). In AED, each incoming transaction is assigned to either HIT or MISS group and the capacity of the HIT group is adjusted dynamically through feedback. Moreover, transactions in the MISS group receive processing only if the HIT group is empty. Although AED policy provides better performance results as compared to the EDF due to its adaptive admission control mechanism, it also fails to address the fairness issue with longer transactions.

To address the fairness issue with AED, an adaptive earliest virtual deadline (AEVD) has been proposed which computes the virtual deadline of a transaction using two parameters i.e. arrival time and deadline (Pang, Livny, & Carey, 1992). The only difference between AED and AEVD is the way in which transactions in the HIT group are prioritized. The AED policy prioritizes transactions by inverting their order of deadlines. On the other hand, AEVD uses a virtual deadline in place of the absolute deadline and prioritizes transactions in the inverse order of their virtual deadlines. Here, the virtual deadline is computed in a way, so that, the longer transactions in the system can also get a fair chance to complete their execution. The simulation results confirm that the AEVD policy provides better performance as compared to AED. The AEVD policy is further extended by Dutta et al. (Datta, Mukherjee, Konana, Viguier, & Bajaj, 1996), and Adaptive Access Parameter (AAP) method has been introduced based on explicit admission control.

Priority Heuristics for DRTDBS

The above discussed EDF, AED, AEVD, and AAP schemes are developed for RTDBS based applications and they are strictly based on the assumption that the deadlines of transactions are known, and they truly reflect the urgency. Although such an assumption suits well for the RTDBS, it may not be valid with the DRTDBS. The core reason behind our intuition is that the database is distributed over more than one site in a partitioned way in the DRTDBS. A transaction may either require accessing the requisite data items from only a single site (local transaction) or from multiple sites (global transaction). Global transactions are generally longer than local transactions since executing them requires coordination between multiple sites. The execution of cohorts of a global transaction may either take place in a serial fashion or in a parallel fashion. In our study, serial execution is considered.

Although the end-to-end deadline of a global transaction can be easily determined using EDF, it may be impractical to use this policy to assign priority to cohorts since the system designer doesn't have enough information to determine individual cohort's deadline. This is mainly due to the distribution transparency (number of cohorts and their locations are not known until runtime), and the presence of triggered transactions (Xiong, Sivasankaran, Stankovic, Ramamritham, & Towsley, 1997). Furthermore, some research studies claim that assigning priorities to the cohorts equal to that of their coordinator gives poor DRTDBS performance (Kao & Garcia-Molina, 1997). Such results outline the need for designing efficient priority heuristics to assign a virtual deadline to the cohorts of a global transaction (Lee, Lam, & Kao, 1999). Some existing priority heuristics in DRTDBS assign virtual deadlines — that is computed based on the end-to-end deadline of their global transaction — to cohorts. Moreover, even if some cohort misses its virtual deadline, it doesn't directly affect the destiny of the global transaction to which it belongs. Such a cohort needs not to be restarted after its deadline miss; obviously, it may get aborted in case of data conflict. The only purpose to assign priority to the cohort is to increase the chance of successful completion of the parent transaction. The serial execution of transactions is assumed in the study done in (Lee, Lam, & Kao, 1999).

The simplest method to assign a virtual priority to the cohort is to let it inherit the priority of its parent transaction. The first policy, i.e., Ultimate Deadline (UD) (Lee, Lam, & Kao, 1999) is proposed to address the priority assignment task with cohorts using the above obvious approach. The problem with the UD is that it only considers the currently executing cohort with respect to the end-to-end deadline of some global transaction T_G however, doesn't consider the amount of time that must be given to the remaining cohorts ($T_{n+1}, \dots, T_s$) for their successful execution. To resolve the above problem, an Effective Deadline (ED) policy is proposed that doesn't add the amount of time required for the execution

of the next remaining cohorts in calculating the virtual deadline of the current cohort. The above two policies have been mathematically represented as given below.

$$\text{UD: } \text{Deadline}(T_n) = \text{Deadline}(T_G) \quad (1)$$

$$\text{ED: } \text{Deadline}(T_n) = \text{Deadline}(T_G) - \sum_{j=n+1}^s \text{Pex}(T_j) \quad (2)$$

The $\text{Pex}(T_j)$ is a predicted execution time required by cohort T_j for its execution. Both UD and ED have an intrinsic problem of allocating all the slack time (or remaining slack time, in case some of the cohorts of a global transaction has already been executed) to the currently executing cohort. As a result, subsequent sub-transactions may find that they do not have sufficient slack for their execution. In other words, these policies are biased towards the cohorts that execute earlier.

An Equal Slack (EQS) policy is proposed to address such a biased distribution of slack time within cohorts of a global transaction. It equally divides the slack time among all the cohorts of a global transaction. The EQS policy has been mathematically defined as given below.

$$\text{Equal Slack: } \text{Deadline}(T_n) = \text{ar}(T_n) + \text{Pex}(T_n) + SS \quad (3)$$

$$\text{where } SS = \frac{\text{Deadline}(T_G) - \text{ar}(T_n) - \sum_{j=n}^s \text{Pex}(T_j)}{s - n + 1} \quad (4)$$

Here, SS is a slack time slice which is equally distributed among all the 's' cohorts of a given global transaction T_G . Note that $\text{Deadline}(T_n)$ is assigned dynamically to the cohort T_n at run time, just before it is submitted for execution. The term SS is directly affected by the $\text{ar}(T_n)$ i.e. the arrival time of currently executing cohort T_n . If T_n gets restarted in the future, it will be assigned another virtual deadline which will be naturally tighter than the previous one because of a recompilation of SS using increased arrival time. The EQS heuristic is one of the widely used priority heuristics for assigning virtual deadlines to cohorts of a distributed RTTs. But, EQS severely suffers from the problems of intensive data contention, deadlock, and cyclic restart.

Equally distributing slack to all the cohorts results in the biasness towards the cohorts with comparatively smaller predicted execution time. To overcome this problem, an Equal Flexibility (EQF) priority assignment policy is proposed that distributes the slack amongst cohorts proportional to their predicted execution time. EQF has been defined mathematically as given below.

Equal Flexibility:

$$\text{Deadline}(T_n) = \text{ar}(T_n) + \text{Pex}(T_n) + PSS$$

where

$$PSS = \left(Deadline(T_G) - ar(T_n) - \sum_{j=n}^s Pex(T_j) \right) * \left(\frac{Pex(T_j)}{\sum_{j=n}^s Pex(T_j)} \right)$$

Here, PSS is a proportional slack time slice which is variably distributed among all the 's' cohorts of a given global transaction T_G based on their predicted execution time. It has been claimed that EQS and EQF improve the DRTDBS performance in terms of the number of transactions missing their deadlines as compared to UD and ED by precisely measuring the progress of cohorts. These heuristics (EQS & EQF) avoid the ill-judged delay in completing the first couple of cohorts of any global transaction that are mistakenly considering that they have larger phantom slack time; and therefore, results into a higher percentage of transactions missing their deadline.

While the above cohort virtual priority heuristics (ED, EQS & EQF) except UD, focus on assigning virtual deadline to cohorts in order to better track the progress of the global transaction, it is also equally important to efficiently handle data contention resulted in the system due to the application of such dynamic deadline assignment approaches. Although HP-2PL integrated with EQS gives considerably good performance in the DRTDBS environment, its dynamic cohort deadline assignment approach leads to the following undesirable problems.

1. Intensified data contention
2. Cyclic restarts, and
3. Deadlocks

On the contrary, data contention can be efficiently reduced using a priority heuristic based on the number of locks. The Number of Locks (NL) policy (Lee, Lam, & Kao, 1999) assigns priority of the transaction equals to the total number of locks held by all its cohorts. Although the NL policy suits well with RTDBS, it does not give better performance when applied with DRTDBS due to its inherent nature of assigning a high priority to the cohorts that arrive at a later stage of the execution of a global transaction. In simple, the NL policy is biased towards the cohorts that arrive at the later stage of distributed transaction execution and does not consider the transaction's importance in priority computation. It means that this policy favours longer transactions over shorter transactions. Moreover, NL policy is introduced for the serial execution model.

Further, a modified NL (MNL) policy (Shanker, Misra, & Sarje, 2005) is proposed for DRTDBS based applications. Here, the priority of all the cohorts associated with a global transaction may be different based on the number of locks held by them, and the priority of a cohort does not depend on the priority of any other cohort executing to complete the same global transaction. This policy is introduced for the parallel execution model, where all the cohorts of a global transaction execute in parallel to complete their data processing tasks. Therefore, it is not possible/logical to compare these two policies from a performance point of view. One simple way to handle/reduce the data contention is by using a number-of-locks based priority heuristic. The Number of Locks (NL) heuristic says that the priority of transaction is equal to the total number of locks held by it. The main reason behind the non-acceptability of NL in the DRTDBS environment is in the notion that all the locks are held by RTT in one attempt. The NL heuristic, when applied in the DRTDBS environment, assigns higher priorities to cohorts of a global transaction that arrive at a later stage of the execution. This means that the NL heuristic is biased towards the cohorts that arrive at the later stage of distributed RTT execution. Moreover, this heuristic is incapable of controlling the real data contention level as it relies purely on the number of locks held by

distributed RTT for priority computation of cohorts. In simple, this heuristic favours longer distributed RTTs over shorter distributed RTTs.

To overcome the above problems associated with the EQS and NL heuristics, the Most Dependent Transactions First (MDTF) heuristic is proposed which specifically aims at minimizing the wastages of the system resources by avoiding deadlock and cyclic restart via computing deadline of cohorts by considering data contention level; thus, minimizes DRTT miss ratio. The MDTF heuristic efficiently reduces the data contention among concurrently executing DRTTs by injecting the number of dependent DRTTs with all direct DRTTs requesting access to the conflicting data item during their priority computation.

MDTF: A Contention-Aware Priority Heuristic

The existing priority heuristics can be improved by assigning realistic virtual priorities to cohorts of a DRTT by paying special care towards the data contention problem. The Most Dependent Transactions First (MDTF) heuristic discussed below addresses the above issue.

MDTF Heuristic

The MDTF heuristic is a contention-aware priority heuristic. Each directly competing RTT has information associated with it, i.e., the size of dependent RTTs. Suppose that more than one RTTs are directly competing to access the conflicting data item. Here, the RTT with the largest number of dependent RTTs is given access to the data item. In this way, the MDTF heuristic reduces the data contention among concurrently executing RTTs.

Here, each data item has its associated linked list of waiting transaction(s). To resolve the data conflict between waiting transactions, the MDTF uses explicit information associated with the conflicting data item. Instead of using the information of the number of locks associated with a transaction, the priority is decided based on the more detailed points contributing to data contention. The transaction contributing highest in increasing the data contention level will be given the highest priority. If RTT requests to access the data item, its priority will be re-computed every time. The MDTF says that the priority of the transaction is assigned dynamically considering the number of transactions directly or indirectly waiting for the release of the locks already held by it. The informative aspects of assigning priorities to RTTs help in completing their execution with an optimal strategy of data contention control.

The MDTF heuristic reduces the data contention level by precisely analyzing whether the lock held by RTT is contributing to the data contention or not. The RTTs lock data items before accessing them. A data item held by some RTT is said to be unpopular if no other concurrently executing RTTs have requested for the grant to access it. The unpopular data item does not contribute to data contention. Moreover, if the lock held by the RTT contributes to the data contention then the next thing is to what extent it adds to the data contention. The data contention resulted due to competition to access the data item is quantitatively computed by finding out how many transactions require to access the given data item at a time in a conflicting mode. The MDTF heuristic can be mathematically defined as given below.

Priority (RTT 'T') = Number of Dependent RTTs on RTT 'T'

Moreover, in case of a tie, the priorities of conflicting RTTs are assigned using the FCFS scheme.

DISCUSSIONS

The discussions section is dedicated to the analytical study of the MDTF heuristic. Suppose that two RTTs T_1 and T_2 require to access the data item in an exclusive mode. The RTT T_1 has locked the data items d_1 and d_2 , and only d_2 has its associated linked list of four waiting RTTs. So, T_1 has four dependent RTTs. The RTT T_2 has locked the data items d_3 and d_4 both the data items have their associated linked list of one waiting transaction. It means that T_2 has two dependent RTTs. So, one can easily say that T_1 has larger number of dependent RTTs as compared to that of T_2 .

On using the NL heuristic in the above scenario, priorities of RTTs T_1 and T_2 will be two. In case of a tie situation, access of data item is granted using First Come First Serve (FCFS) policy. Such decisions may sometime result into the increased data contention level. For instance, when RTT T_2 wins the race and is granted lock to data item, allowing T_2 to execute while putting T_1 in a waiting state is not a wise decision from data contention point of view since T_1 contributes more in increasing the data contention. Thus, this heuristic does not fairly address the data contention problem.

As evident from Figure 2, RTT T_1 has 4 dependent RTTs while T_2 has only 2 dependent RTTs. Therefore, T_1 is generating larger contention in the system as compared to T_2 . According to the MDTF heuristic, the priority of T_1 is 4 and that of T_2 is 2. As a result, access to the data item may be granted to T_1 . In this way, the MDTF heuristic may better handle the data contention level in the system as compared to the NL heuristic.

Figure 2. Transaction Dependency Graph

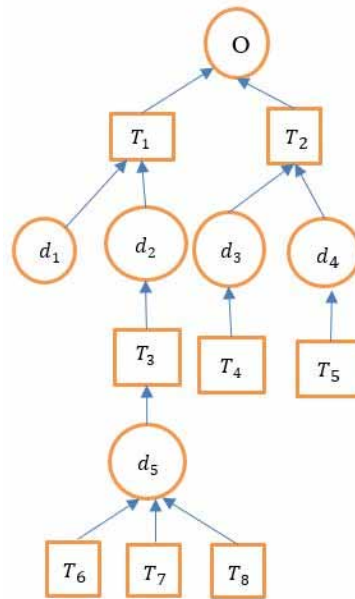


Table 2. DRTDBS Model Parameters with their Default Values

Parameter	Meaning	Default Setting
DB_{Size}	Size of Database (No of Pages in databases)	2000 data items/site
N_{db}	No of database Sites	12
C	Number of Sub-transactions	4
AR	Transaction arrival rate per site	0-4 transactions/ sec (Uniformly Distributed)
	Communication delay among transactions	Either 1 ms or 10 ms
N_{op}	No of operations in a transaction	4-20 (Uniformly Distributed)
SF	Transaction Slack Factor	1-4 (Uniformly Distributed)
$P(w)$	Probability of write operation	0.30
	Number of disk units	1
	Number of CPU units	1
	Processing time required by CPU for accessing a data item from disk	10ms
$Local_{frac}$	Fraction of local transaction	0.60

The MDTF heuristic involves no extra message overhead in communicating the information of dependency size to the subsequent cohorts during the execution of distributed RTT; obviously, this information is sent for first-time after the execution of cohort residing at a site where distributed RTT is generated. This information is sent using a piggybacking approach. The dependency size information is piggybacked with the fork-off message and the resulting message is sent to the site where the newly generated cohort physically resides.

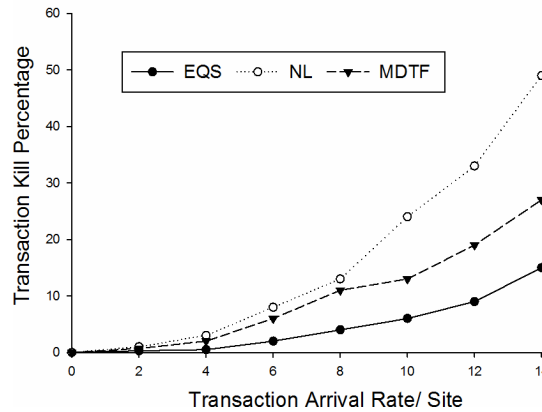
Performance Evaluation

Although it may be better to evaluate the performance of proposed MDTF heuristic using some practical benchmarks, there is no hands-on simulator available in DRTDBS research community or in market to assess the performance of the proposed protocol (Ulusoy, 1995) (Bestavros, Lin, & Son, 2012) (Lee, Lam, & Kao, 1999). Therefore, a DRTDBS including N number of sites was simulated in accordance with the environment assumed in earlier studies (Lee, Lam, & Hung, 2002) (Shanker, Misra, & Sarje, 2006b). An event-driven simulator is developed in C++ language. For each set of experiments, the results were calculated as an average of 10 independent runs and in each run, 20000 transactions were initiated. A mild level of resource and data contention has been ensured during performance evaluation.

DRTDBS Parameter Settings

In our experiments, each database operation is either read or write (read-then-write) operation with a probability of write operation set to 0.30. A database operation operates on a randomly chosen database page, (i.e., disk block) from the database. Default number of database pages is 2000 per site. Accessing a page from the disk requires 10 milliseconds. A range of operations from 4 to 20 are introduced that are uniformly distributed. In the default setting, it is also considered that every global transaction

Figure 3. Comparing MDTF with EQS and NL using Transaction Kill Percentage: Local Transactions



is divided into only 4 sub-transactions. The processing time required for accessing the data item from disk is assumed to be 10 milliseconds. Table 2 presents different parameters used in a simulation study with their default values.

The performance metric for the experiments performed is “Kill Percentage”, since the main goal of DRTDBS is to reduce the number of transactions missing their deadline. In case of firm real-time application, missing a deadline means that the transaction is required to be killed. Mathematical calculation of kill percentage is done as follows.

$$\text{Kill Percentage} = \left(\frac{\text{Number of transactions aborted}}{\text{Number of transactions in the system}} \right) * 100$$

Transaction arrival follows the Poisson distribution and each transaction is associated with a deadline. The Two Phase Commit (2PC) protocol is used for commit processing.

Simulation Study and Performance Results

The simulation study is performed with disk resident databases. The MDTF heuristic is compared with EQS and NL heuristics. As mentioned in Table 2, the setting represents an environment where the probability of write operation is 30%. The global transactions are in minority ($Local_{frac} = 0.60$) and are not too large ($c = 4$). Data contention is thus mild.

Figure 3 compares the MDTF heuristic with EQS and NL for local transactions using transaction kill percentage. Local transactions rarely fall under the category of lengthy transactions. The NL heuristic does not work well for local transactions since they do not lock larger number of data items during their executions. Therefore, NL heuristic is biased towards prioritizing global transactions over local ones. The NL and MDTF heuristics are purely contention-based heuristics and does not consider deadline values in priority computation of transactions. This in turn lead to the situation where the EQS policy performs better than the NL and MDTF since it considers the deadline values of local transactions for deciding their priorities. Moreover, the MDTF heuristic performs better than the NL heuristic since NL is more biased towards global transactions as compared to the MDTF heuristic.

Figure 4. Comparing CA-EQS and MDTF with EQS and NL using Transaction Kill Percentage: Global Transactions

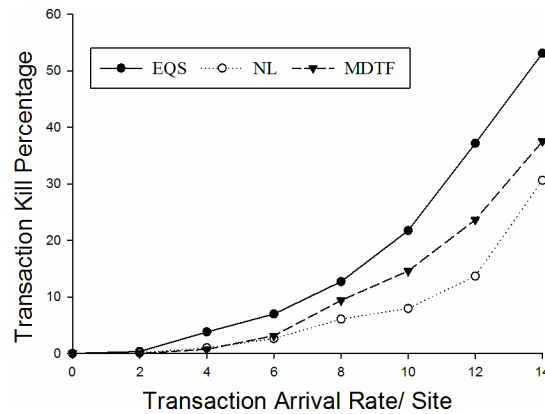


Figure 4 compares the transaction kill percentage of the MDTF heuristic with EQS and NL for global transactions. Global transactions contribute to higher data contention as compared to local transactions because of considerably longer data item access list containing remote data items. As a result, the transaction miss rate is high for all the heuristics (NL, MDTF, and EQS). The transaction kill percentage with MDTF is higher as compared to the NL heuristic as it is exceedingly biased towards global transactions. At the same time, MDTF heuristic possesses better performance results as compared to the EQS heuristic. The proposed heuristic is a fairly balanced one with almost no biasness towards global or local transactions.

Figures 3-4 show the transaction kill percentage with different transaction arrival rates. As expected, the system misses more deadlines when the transaction arrival rate increases. This is due to the reason that a heavier workload leads to a larger number of data item access requests, longer queuing time, higher data conflict probability, higher probability of transaction blocking, and therefore, fewer transactions complete successfully (i.e., within deadline constraints). In other words, heavier workload leads to a decrease in a number of transactions that can progress concurrently without being blocked which in turn increases transactions miss percentage.

In nutshell, the proposed heuristic performs better than the EQS and NL heuristics. The performance improvements are primarily because of better assessment of contention in the system.

FUTURE RESEARCH TRENDS

Future time-constrained databases may be operative in an unpredictable environment and will need flexible run-time systems that can handle an unknown and varying number of concurrently executing transactions efficiently (Shanker, Misra, & Sarje, 2008). The point-to-point insight about future research opportunities is provided below from the DRTDBS perspective.

1. **Priority inversion:** The executing-committing conflict, during the concurrent execution of distributed RTTs, can be handled by exploiting either priority inheritance approach (Pandey & Shanker, 2017b) (Pandey & Shanker, 2018b) (Pandey & Shanker, 2018c), or lender-borrower approach (Shanker,

Agarwal, Tiwari, Goel, & Srivastava, 2010) (Shanker, Vidyareddi, & Shukla, 2012) (Pandey & Shanker, IDRC: A Distributed Real-Time Commit Protocol, 2017a) (Pandey & Shanker, 2019), or both in an integrated way (Pandey & Shanker, 2018a). These approaches have their own positive and negative aspects (Haritsa, Ramamritham, & Gupta, 2000).

2. Only a few research works have been done in the context of the handling of non-database operations; though, research in this direction may be useful to improve underlying system performance. The Non-Database Operations Aware Priority Ceiling Protocol (N-DOAP) is a recent effort in this direction (Singh, Pandey, & Shanker, 2019). In the N-DOAP protocol, the database operations are given preference over non-database operations. Consideration of the aspect of non-database operations resulted in the improvement of performance.
3. Considering the wide-spreading impact of database system based applications in recent days, researchers also started working to improve the performance of conventional databases systems by improving classic 2PC and 2PL (Gupta & Sadoghi, March, 2018) (Gupta & Sadoghi, 2019) (Pandey, Pandey, & Shanker, 2019) (Harding, Aken, Pavlo, & Stonebraker, 2016).

CONCLUSION

This book chapter studied the deadline based priority assignment heuristics in time-constrained databases and concluded that such heuristics can not significantly reduce the percentage of transactions missing their deadlines; fail miserably at high data contention. Therefore, to address the issue of data contention, the Most Dependent Transaction First (MDTF) heuristics have been suggested. The MDTF injects the size of dependent transactions of all directly competing transactions in their priority computation. It reduces the data contention by precisely analyzing the locks held by RTTs contributing to the data contention. The RTT, which contributes more to the data contention, is given higher priority so that its early completion may help in reducing the data contention level. The performance studies have shown that MDTF provides a trade-off between the NL and EQS heuristics from performance perspective due to its better handling of data contention.

Future research in the direction of advancement of existing state-of-the-art transaction priority assignment heuristics is required to come up with advanced user-oriented commercial products/services.

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KEY TERMS AND DEFINITIONS

Distributed Real-Time Database System (DRTDBS): The DRTDBS consists of multiple data sites that are connected through an underlying computer network specifically used to run applications based on distributed real-time transactions.

Earliest Deadline First (EDF): As per the EDF heuristic, priority of a task is inversely proportional to its deadline. So, the highest priority is assigned to the task with the earliest deadline.

Firm Distributed Real-Time Transaction (Firm DRTT): The firm DRTT is killed in case it misses its deadline because its outcome has no value after deadline miss.

Hard Distributed Real-Time Transaction (Hard DRTT): The hard DRTT must be finished before its deadline; otherwise, it may lead to potentially catastrophic consequence.

Priority Assignment Heuristic: Act as a base for all other DRTT processing components, i.e. concurrency control and commit processing; therefore, largely affects the DRTDBS performance.

Real-Time Commit Protocols: Ensure that either all the effects of the DRTT persist or none of them irrespective of any such failure.

Soft Distributed Real-Time Transaction (Soft DRTT): The soft DRTT is not killed/aborted in case of its deadline miss because the result has some value (obviously degrading) even after the deadline miss.

Section 5

Business Policy, Ethics, and Law

What Is a P2P Business Model?

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INTRODUCTION

Since 2005, crowdfunding has disrupted the world of financing by nonconformist strategies, as carpooling, online dating, home exchanges, etc. have done in other sectors. These alternative business modes, generally called P2P for peer-to-peer, have not only disrupted the conventional sectors, but also, considering their success, have attracted at the same time new competitors. The resulting intensified competitive game has pushed these platforms to look for distinctive advantages to better position themselves in the emerging alternative modes.

Despite the growth, the concepts and models aimed at strategy and management of these P2P activities are limited. Ideas are often imported from other sectors and do not specifically include the characteristics of P2P activities. This gap leads to costs and bankruptcies. The term “business model” is one of these concepts which suffers from not having a reliable definition.

The term appeared for the first time in the ABI/Inform database in 1975 (Zott & Amit, 2009). It became a buzzword in the mid-1990s with the emergence of the e-commerce (Leiner et al., 2014). The term’s occurrence in academic work has exploded since 1995. A search in Google Scholar for research papers with “business model” in the title provides statistical evidence: respectively 1980, 1900, 1940 and 1300 since 2015.

Despite the high number of occurrences of “business model” in titles, there is still not a commonly accepted definition for it (Osterwalder & Pigneur, 2002). It is used to imply different terms such as strategy, corporate ownership of fiduciary value, stakeholder relations management, profitability and partner relationships (Ghaziani & Ventresca, 2005; Zott & Amit, 2009).

The variety of terminology used to describe business models makes the identification of an appropriate one extremely challenging in emerging sectors of P2P activities. In this paper, we conduct a literature review to build a conceptual one for P2P activities. We will then test the validity of our model with case studies research focused on crowdfunding.

BACKGROUND: REVIEW OF LITERATURE ON BUSINESS MODELS

To propose a theoretical and operational reference business model for P2P activities, the review of literature opts for a funnel approach, starting with general concepts before focusing on specific aspects.

First, we position the business model in relation to strategy because the two concepts are often mis-treated as equivalents. Second, we examine the taxonomy of business models to identify the one that corresponds to P2P activities and its theoretical foundation. Third, we look for the components of the economic model in the literature.

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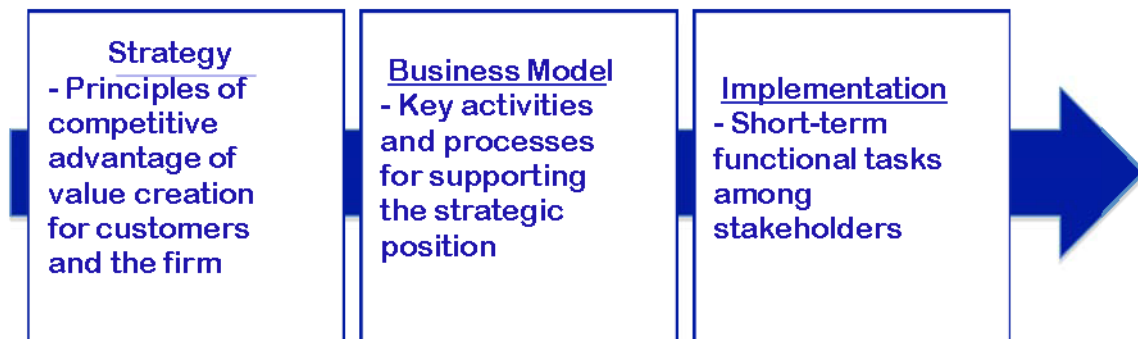
Strategy and Business Model

What is a business model? Etymologically, the term “model” means schematic description of the relationships between a set of entities, which can serve as an example to follow. As a result, a business model can describe the link between a company’s resources and skills to create value for both target markets and business owners.

Authors disagree on the relations between a business model and a strategy. Alike strategy, Applegate (2000) believes a business model defines a structured relationship between its different components to respond to the real world. Similarly, Magretta (2002) defines a business model as a statement about how a company operates its activities within an industry to create value. Thompson and Strickland (2001) argue that a business model is only the revenue stream and financial sustainability of a strategy

Following the above, we argue that strategy and business model are not identical, but intertwined, complementary and needed for the success of P2P platforms (Mansfield & Fourie, 2004). A strategy defines the competitive advantage for obtaining an auspicious position from rivals while a business model outlines the necessary resources, activities and processes to support and ensure that position. A strategy maps the foundation for a company’s value creation, while a business model provides arrangements to create that value.

Figure 1. A business model’s role and mission



This suggestion of strategy-business model relations is in line with what many authors who believe: a strategy states a competitive position, whereas a business model is assessed by the wealth that it creates and resources it exploits (Mansfield and Fourie, 2004; Elliot, 2002, Zott and Amit, 009). In this perspective, a business model can be considered as the link between strategy and business procedures (Mansfield and Fourie, 2004; Osterwalder and Pigneur 002, 2013). Figure 1 illustrate the links between strategy, business model and final operational activities.

Research on business models progressively explores relations with emerging topics such as extended ecosystems, digital technologies and sustainability.

For ecosystems, Hacklin et al (2018) demonstrate that business models that cope the intrinsic elements with the external environment, instead of adding new accompanying business models, positively affect value migration in (computer and telecommunications) industries. Li et al. (2018) find that busi-

ness models that leverage direct contacts in a cooperative arrangement improve their competitive position and centrality in the network. Snihur et al. (2018) study how a disruptor's gambit might dislodge powerful incumbents and shape new ecosystems through business model innovation and satisfaction of customers and partners.

Considering digital technologies, Díaz-Díaz et al. (2017) discover through a benchmarking of eight urban services in the city of Santander in Spain, that smart cities' business models that integrate the urban service of Internet of things provide positive impacts on cost reduction, energy consumption, environmental and social issues and incentivized citizens (Díaz-Díaz et al., 2017). Figueroa and Pérez (2018) consider the role of big-data within ecosystems and its impact a firm's operations, management, distributed collaboration and the valorization of collective intelligence and learning.

Sustainability is also regarded. Pedersen et al. (2018) query 492 managers within the Swedish fashion industry and find that companies with flexible business models support more efficiently corporate sustainability. Robertson (2017) argues that business model innovation can have greater long run success than product innovation because it is harder for competitors to emulate.

The Two-Sided Market as a Conceptual Basis for P2P and Crowdfunding Platforms

Once the business model is positioned with respect to the strategy, it is necessary to determine the peculiarity of online P2P business models. Tapscott et al. (2000) identify intermediation platforms for digital collaboration as a human capital extension beyond a company's conventional boundaries. Mahadevan (2000) distinguishes market-makers which link potential buyers and sellers. Assadi (2004) singles out the facilitators who accelerate, simplify and coordinates exchanges between peers. These models reinforce the major trait of online P2P platforms that neither buy nor sell, but effectively tie supply and demand by lowering transaction costs of information search, alternatives evaluation, and bargaining.

Like many researchers (Weyl, 2010; Hass et al., 2014), we postulate that the theory of two-sided markets (Rochet and Tirole 2006) constitutes the theoretical basis of the economic model of P2P platforms. The concept of two-sided market appears when two actors' demands are interdependent, i.e. the demand of one incites that of the other (Rochet and Tirole 2006). The product is useful to one party only if it is used by the other.

A credit card is only useful for consumers if it is accepted by merchants and vice versa. P2P activities which connect two sets of clients are perfect examples of two-sided markets. Applicants come on a crowdfunding platform only if there are enough contributors to meet their funding needs. Reciprocally, fund providers come only if there are enough suitable projects. Other types of this movement are auctions, "file-sharing", group buying, bartering, etc. often referred to as "Uberisation". Though we prefer the expression of "spontaneous online interactions between peers".

Yun and al. (2017) find that business models on multi-sided markets around ecosystems of platforms such as Apple App Store, Booking.com, Google Play and Hotels.com shift from focused to multiple areas, from hierarchy to networked firms, and from scope to scale economy and finally lead to regional development (as in Daegu, South Korea).

Value on two-sided markets is created by enabling direct interactions between the actors. The benefit for participants on each side of the market depends on the number of participants on the other side and the pricing decisions of the platform.

Components of a Business Model on the Internet

For Venkatraman and Henderson (1998), the three founding components of any business model are: consumer interaction, asset configuration and the knowledge leverage. For Mahadevan (2000), the value proposition for buyers, the revenue stream, and the logistics flow are. Assadi (2004) also adopts the customer value proposition and the revenue stream but considers Mahadevan's logistic as limited for building a business model and instead recommends the component of technological infrastructure. Customer value proposition, profit calculation besides resources and organizational processes are the main components for Johnson et al. (2008). The two elements, resources and processes, correspond to the concept of technological infrastructure proposed by Assadi (2004). Osterwalder and Pigneur (2002) name value for consumer segments, sustainable income streams, network of partners as components of a business model. Gassman et al. (2013) propose a triangle of questions to define the business model: "What do you offer your customers? (customer value), "How is the value proposition created?" (processes, activities and capabilities), "How is revenue created?" (income).

We believe the above-mentioned elements can be regrouped into three basic components of a business model: customer value, revenue streams and technological infrastructure. In addition to these components, some academics implicitly refer to interdependent relations between a firm and its partners and the flows of products, services, information, capital, capabilities, charges, revenues and profits among them (Timmers 1998, Afuah and Tucci 2000, Applegate 2000, Weill and Vitale 2001, Eisenmann 2002, Elliot 2002, Zott and Amit, 2003, 2009, 2010). These allusions showcase importance of ecosystems for a firm.

Figure 2. A business model's components

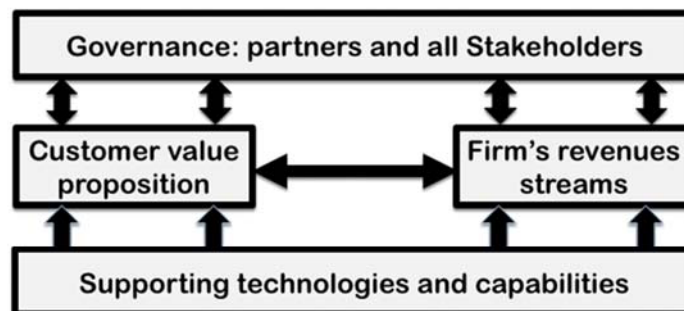


Figure 2 presents all the components of the model that we explain in the following.

Customer Value Proposition (CVP)

A customer value (CV) is the answer to the question "why" customers should pay for a firm's offering: because it meets their needs (Woodruff, 1997). CVs take diverse forms and depends on a consumer's perception of not only features of an offer, but also of the social and personal values it provides.

The CV a firm offer is not viewed in isolation. Consumers always compare and rank the different competitive offers to match or exceed their needs (Woodruff, 1997; Anderson & Narus, 1998; Slater & Narver, 2000; Anderson et al., 2006; Smith & Colgate, 2007, Yrjölä, 2015). Anderson et al. (2006) state

that a higher CV is not the result of all the differences from the competitors, but one or two points which give the greatest value to the customers' requirements (resonance value proposition).

Since enjoying CVs requires that customers pay not only monetary charges, but also temporal, physical, and energy dues (Christopher, 1996), we distinguish between CVP and CV. CVs are benefits such as an offering's quality, uniqueness, durability, customer service, ease of purchase, etc., regardless of monetary and non-monetary expenses a customer should pay to obtain them. While a CVP is the customer's subjective assessment between all gains and required sacrifices in return. The benefits answer to the question "Why does the consumer accept the product?" and the costs responds to "What should the consumer give to have the product?" Costs for the consumer also include opportunity costs when they miss the higher value of competitive offers.

In line with the above, we define CVP for P2P activities as the values that the two sets of customers perceive from a P2P platform's offering. This perception is a function of the overall benefits they estimate obtaining, less the sum of the pecuniary costs and non-pecuniary sacrifices they incur in return.

Revenue Streams

As every business has to ask: "For what type of value is each customer segment willing to pay?" the flow of income and the CVP have strong interactions and influence each other within a business model. A revenue streams (RS) represents a flow of earnings to individuals or organizations against CVPs they provide (Osterwalder & Pigneur 2002, Morris et al. 2005).

Assadi (2004) suggests nine sources of revenue: sales, cyberspace rental, subscription, affiliation, commission, license, databases and profiling, maintenance and market value. It places particular emphasis on the revenue-generating potential of profiling and market valuation which are often ignored in the online literature on revenue streams. Amit and Zott (2012) mention subscription fees, advertising rights, fixed transaction fees, referral fees, fixed or variable sales commissions, and margins on direct sales of goods as revenue generation methods. Fransson and Wählstrand (2018) indicate upfront payments and monthly payments as the basic revenue streams for the services that the emerging Internet of Things provides. A firm's net earning can also increase by reducing its operating costs as IBM saved \$ 350,000 in travel expenses and productivity by hosting a virtual meeting with 200 members around the world (Morrison, 2009).

An isolated source of income is often modest, so it is often necessary to combine different RSs to generate significant revenue, ensure sustainability and reduce economic risks (Eurich et al., 2011, Zheng 2015, Li 2015).

In phase with the above, we define the RS as generating regular income over a period of time for the CVP a business proposes. In this perspective, P2P platforms envision obtaining incomes from their two sets of clients. Platforms might fix a flat or zero price for one set of clients, free content for readers for example, and charge rather the other set such as advertisers (Weyl, 2010).

Infrastructural Technologies and Competencies

A business model can be considered as a heuristic scheme that unlocks the latent economic advantage of a technology to create value in accordance with the reference strategy and with partners value chains (Chesbrough and Rosenbloom, 2002). The third component of an economic model includes the resources and skills that enable a business to operate the flow of goods, information and cash to create a (unique) customer value and a sustainable competitive advantage over time (Prahalad & Hamel, 1990).

For online P2P activities, the Web 2.0 technologies and the resulting social media are the reference founding tools because they reduce transaction costs and allow users to interact spontaneously on an unprecedented scale (Surowiecki 2004; McAfee, 2006; Tapscott & Williams, 2006).

We emphasize the importance of the Web 2.0 technologies and skills as the third infrastructural component of our suggested business model for P2P activities. To our best knowledge, this is the first academic paper which highlighting the importance of Web 2.0 technologies in the emergence of P2P platforms for encouraging and facilitating horizontal transactions between peers, according to the search engine Google.Scholar.

Governance of Relationships and of Transactions Among Participating Parties

The fourth component of our suggested economic model relates to the governance of the ecosystem that affects and is affected by an organization's functioning.

Since value creation now goes beyond the dyadic “business-customer” relationship to multiple economic and social networks (Harrison and Carson 1993, Siebdrat et al., 2009, Watkins 2013, Neeley 2015), we believe the governance of these extended relations should be integrated in a firm's business model. Especially as digital technologies deploy and reduce transaction costs, firms concentrate on their core-activities and outsource the others. Sarma and Sun (2017) highlight the crucial role of the co-evolution of institutional entrepreneurs on the different stages of the (semiconductor) fabless business models. Snihur et al. (2018) show how a disruptor's innovative business model might dislodge powerful incumbents and shape new ecosystems of customers and partners. This trend is confirmed even more for P2P platforms, whose main mission is to get the most distant partners interested in direct interactions.

This extended territory of governance can legitimize a company on the market, lower its indebtedness interest rate and improve its stock valuations (OECD 2004). As a result, many oversight bodies progressively open their doors to activists for different causes such as consumer panels, environmental advocates, gender equality advocates, and workers' representatives (Hitt et al., 2012).

We posit that the extended ecosystem for online P2P activities regroups four circles of stakeholders. The first circle is internal and composed of shareholders, executive managers and employees. The second circle is that of the two sets of clients of the P2P platforms. The circle aims at partners who directly participate to the P2P platform's value chain. The forth circle is composed of government agencies, unions, communities and activists of different causes who are concerned by, however do not commercially deal with the P2P platform.

THEORY-TESTING WITH CASES

We adopt the research method of case studies to test the external validity and explanatory potential of the quadripartite paradigm we suggest against the genuine crowdfunding platforms.

The method of case study particularly satisfies our research inquiry and objectives as it supports theory building (Yin, 1981, Eisenhardt, 1989). Løkke and Sørensen (2014) affirm case studies constitute a conventional manner of testing theories since the 1970s. For more examples, one can refer to Kozinets (2002), Amit and Zott (2002) and Ashta and Assadi (2010).

The underlying principle for selecting cases within in this approach is not size, randomness nor representativeness for making inferences about the parent-population. The principle is picking a sufficient number of real cases to provide insightfulness (Eisenhardt, 1989, Patton 1990, Yin 1994). Yin (1994)

recommends one or more of the three justifications for selecting a case: critical, extreme or unusual cases. Guba (1985) and Eisenhardt (1989) endorse adding to the sample until the theoretical fullness or the experiential redundancy are reached.

In this perspective, we select 12 cases of real platforms (Table 2) originating from different countries (France, USA), dating from the beginning of the activity up to the present date, operating in different types of crowdfunding (credit, donation, equity, reward) and specialties (science, pornography, food, fashion, charity, creative industries, real estate, etc.).

Table 1. Sample of crowdfunding platforms

Credit-based	Kiva (2005, USA), Prosper (2005, USA), Babyloan (2008, France)
Donation-based	Gofundme (2009, USA), Babeldoor (2010, France)
Equity-based	Sowefund (2014, France), AngelList (2010, USA), Kiosktinvest (2014, France),
Reward-based	MyMajorCompany (2007, France), Indiegogo (2007, USA), Kickstarter (2009, USA), Ulule (2010, France)

We directly collect data from the content officially communicated on the selected platforms, and not from the interpretations or opinions, expressed in the cyberspace or else. For doing so, we explore through “back-and-forth” the platforms with an observation guide corresponding to the peculiarities of each component of our suggested pattern of business model. A good deal of data derives from the FAQ sections. However, we look also through all different pages to complete required data.

The data analysis in the approach of case studies is rather interpretive than frequencies counting (Perry et al., 1999). It relies on a constant iterative between data collection and data analysis in order to compare emerging insights with evidence from selected cases (Eisenhardt, 1989, Galunic and Eisenhardt 2000). In this process, the collected data are regrouped into categories (Miles and Huberman, 1994). In the research on hands, the categories represent the components of our suggested model: CVP, revenue streams, technological infrastructure and governance of interrelations. Within each category, we compare collected data from different platforms and induce insights.

DISCUSSION OF RESULTS

We thereafter report and discuss the content analysis of the selected platforms according to the components our theoretical quadripartite business model. All the analytic and comparative tables in this section are self-created with the data collected on different platforms as previously explained. However, their content are sometimes shortened for the sake of typographic requirements.

Customer Value Proposition on Crowdfunding Platforms

Table 3 reports the CVPs that our sample platforms declare providing for both initiators and contributors. From the common CVP of reducing transaction costs, the platforms provide more specific CVPs to each of the protagonists.

For funds seekers, the most specific CVP that online crowdfunding platforms provide is having direct access to alternative sources of funding for modest entrepreneurs (Kiva, Babyloan), individuals in financial instability and/or looking for loans at lower rate (Prosper), leaders of unconventional and

Table 2. CVPs generated by online crowdfunding platforms

	CVP for project initiator	Platform	CVP for contributors
Credit	Funding the poor's projects from all the world	Kiva	Having the possibility of truly empowering people
	Debt consolidation, easy processes, flexible payback, lower irates	Prosper	Lending from \$2,000 to \$35,000, borrowers' credit scores, searchable
	Access to loans, Empowerment	Babyloan	Supporting social causes, Select criteria
Donation	Social media coverage, small fee	Gofundme	Label of « Certified Charity »
	For social utility projects	babeldoor	Taking part in the social construction
Equity	Institutional investors support, Equity-based	Sowefund	Tax deductibility, Registered at public certifier)
	Important investments	AngellList	Equity and share for contribution
	Assistance in different categories	Kiosktoinvest	Equity-based, Tax deductibility, filtering search
Reward	Free submission, accompanying, social media, intellectual property,	MyMajorCo.	Rewards, previewing, Secured, Possibility of withdrawal
	Social media coverage, Tips and advices	Indiegogo	Supporting causes, easiness, Certified by TRUSTe
	Ownership of the project, feedbacks, Survey tools	Kickstarter	Rewards, Searchable projects through 15 categories
	Forums, social media, 7 languages and 23 currencies	ulule	Rewards, following up, filtering, 7 languages and 23 currencies

innovative projects (Kickstarter, My Major Company, Experiment). As, the decision of providing money or not depends on many contributors instead of one, the chances of having access to funds considerably increase for solicitors.

In addition to giving access to funds, crowdfunding platforms provide other CVPs to project initiators such as coaching, training, tutorials, workshops along with market recognition and connection with supporters. Most supporters often dispense valuable ideas and feedbacks on marketability of sponsored projects. Indiegogo pioneer in January 2015 to deliver the service *InDemand* that permits project creators take pre-orders from supporters (or else) after the deadline of their fund-raising campaigns. By doing so and for a fee of 4% plus processing expenses, they can directly sell through Indiegogo and avoid the hassle of creating and promoting a separate web storefront (Shchetko, 2015). With such services, initiators can raise money even after the funding deadline. However, this raises the question of a crowdfunding platform's mission. Some argue there are inherent differences between shopping and match making missions. Crowdfunding is basically an entrepreneurial initiative, and as such, its technical and commercial feasibilities are at stake. While pre-ordering is rather a marketing question, once an entrepreneurial project is achieved. Using the latter to support the former might be misleading.

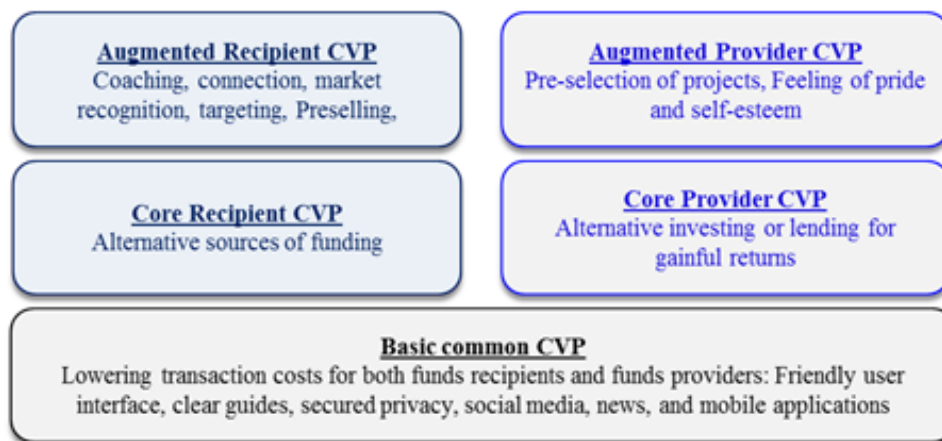
Field targeting is also another CVP some platforms provide a more pertinent matching. Examples are AngellList, Kiosk to invest and StartNext, dedicated to startups.

For contributors, the most visible CVP on crowdfunding platforms resides in an *alternative* way of investing or lending for gainful returns. In this perspective, some websites such as Zopa increase the chances of earning by proceeding to pre-selection of projects based on reliability and feasibility. Filtering brings about further confidence and attracts more contributors. Another valuable CVP for contributors

is providing the feeling of pride, fulfillment, and self-esteem by supporting well-intentioned and praiseworthy ventures they emotionally relate to.

The figure 3 recapitulates the different levels of CVPs that the crowdfunding platforms provide. As previously mentioned, a customer value is the positive difference between the benefits associated with a product and the costs (or sacrifices by) the customer bears to obtain it. Here, the different levels of CVP represent what the recipients and providers of funds expect to enjoy on the platforms, in fine, after comparing all the objective and subjective benefits and costs. It is worthy to remind that the drastic reduction of transaction costs between project leaders and backers is the founding and fundamental crowdfunding's CVP.

Figure 3. Scale of CVPs on Crowdfunding Platforms



Revenue Streams on Crowdfunding Platforms

Our analysis of the sample members shows that income streams are generally similar and mainly include commissions, processing and financial transfer fees. However, amounts might vary.

Because crowdfunding platforms essentially function as market makers, linking offer and demand, their principal revenue stream originates in commissions, payable in the case of successful fundraisings. They generally present a wide array of explanations about the commissions to make the process smoother. Rates of commission vary among websites, from usually 3 to 5 points of percentage (Experiment or AngelList) to 10 (MyMajorCompany). StartNext displays a special case. It does not set a commission but leaves the compensation for its services to the willingness of project initiator.

For projects exceeding 500,000€, Ulule charges only 5.4% with 0.25€ per transaction. However, Ulule is more expensive for campaigns of less than 500,000€ and for payments done by other means than PayPal. For instance, it charges 14.67% of the principal for a successful project of less than 100 000€, paid by credit card.

Many crowdfunding websites charge fees as well for financial processing and operations (Indiegogo, babeldoor, Startnext). Other examples of income streams are: selling regular, additional and premium products and services.

Many platforms, in particular those based on donations also look for aids from sponsors (Kiva, Babyloan for example). However, some equity-based platforms whose specialty is investing in film production similarly solicit for donations.

In the table 4, we include mainly revenues which originate in services rendered to project leaders and contributors. Therefore, revenues such as sponsorship and volunteering are not considered.

Table 3. Income streams of online crowdfunding websites

	CVP for project initiator	Platform	CVP for contributors
Credit		Kiva	No charge, donation
	Borrowers: 1 - 2% on loans	Prosper	Investors: 0.5-0.1% on credit grades
	Lenders: depending on loan amount	Babyloan	
Donation	Project initiators: 5%	Gofundme	Project initiators: fees
	Project initiators: 8%	babeldoor	Project initiators: 3% transaction
Equity	Initiators: 10%	Sowefund	Investors: 1.5%, fees
	Initiators: 5–20%	AngelList	
	Initiators: 7–9%, fees for listing	Kiosktinvest	Investors: 4%, 25€ per investment
Reward	Music 40%; others: 10% of revenue	MyMajorCo.	Contributors: 3% of payment
	Initiators: 4% on funds raised	Indiegogo	Fees: 3 – 5%
		Kickstarter	
	Initiators: 5-8% on funds raised	ulule	Contributors: Fees on transactions

Technological Infrastructure and Competencies of Crowdfunding Platforms

We have previously mentioned the importance of the Web 2.0 technologies in the infrastructure of the P2P platforms. In the analysis of the third component of infrastructural technologies and supporting competencies, we put emphasis on social media which support the crowdfunding platforms' mission of intermediation on the two-sided markets between distant recipients and providers of funds. The social media not only facilitate interactions among peers, but also contribute to the reputation of the platforms.

The members of our sample unsurprisingly promote linking between platforms and peers, but also between peers on social media such as Facebook, Google+, Instagram, Pinterest, Twitter, YouTube, etc. However, the degree of adoption and exploitation of the social media varies among platforms.

In the analysis that follows, we consider the most important current social media, Facebook, Twitter and YouTube, and distinguish between the official pages created and run by the platforms of our sample, and the unofficial or independent pages, created by independent individual who publicly express their contempt and discontent about the respective platforms.

On Facebook, platforms (Indiegogo, Kickstarter, Kiosk to invest, Sowefund, touscoprod, Ulule,) mainly report on crowdfunding in general and on their successful projects in particular. Some also do marketing promotions. The platforms regularly update Facebook pages, however some feed less their pages. The high number of “Likes” is an indicator for assessing the relationships the crowdfunding platforms manage to have with partners (Kiva, Babyloan, Indiegogo, MyMajorCompany, Ulule). There are also some independent pages for some brands on Facebook (Kickstarter & Indiegogo Worldwide

Community, Sauvons Ulule). It is also possible that a crowdfunding brand is quoted on some independent generalist Facebook pages for exemplary cases (FoodRaising on Christmas for All).

Twitter is also massively adopted by the platforms under study. Some of them have even separate Twitter pages in different languages such as Ulule, which runs its Twitter pages in English and French. This social media is often analyzed in terms of number of followers and that of tweets (messages). At the date of our study, in December 2018, the number of followers in comparison to that of February 2015, was quite impressive on Propser (20,7K; 13K), Kickstarter (1.06M; 952K), Indiegogo (341K; 202k), and Ulule (28.5K; 7K). Some others enjoy less followers in December 2018: Kiosk to invest (717). The number of tweets per follower in December 2018 has increased in comparison to February 2015, the two dates of observation, for Ulule (1,2; 0.32), and Kickstarter (48; 0,009), and decrease Kiosktoinvest (0.78; 1,05) and Sowefund (0.80, 1.11). Besides the two factors that we have analyzed here, the number of re-tweets can also be analyzed. It shows the commitment and dynamism of the followers on a brand's Twitter page. For example, on Kiva and Babyloan, similar platforms for non-interest loans to the poor entrepreneurs, the number of re-tweets seemed to be low at the time of investigation.

The sample members generally use Twitter, as they use Facebook, for informing on crowdfunding, reporting on successful projects, and in a lesser extent for promoting some particular initiatives. There are also some independent Twitter pages that juxtapose the official ones like Best of Kickstarter and in particular MMCCrazymobile that provides applications for advertising on MyMajorCompany.

YouTube, the social media of video sharing, is used by the platforms of the sample for chiefly explain crowdfunding and their concepts of crowdfunding. However, those who have channels on YouTube generally update them less than their pages on Facebook and Twitter –with the remarkable exceptions of Kiva and Indiegogo. There are many independent films on YouTube as tutorial for launching projects on different platforms such as Kickstarter, Indiegogo and ulule.

There are also independent videos for showing scams and flops.

Governance of Transactions and Relations Among Crowdfunding Actors

The crowdfunding platforms, like other cyber-merchants, considerably depend on external specialized partners for being able to focus on their core business. Without appropriate governance, platforms have to internalize diverse activities and expose to bureaucratic burden or run the risk of high costs of transactions with many external partners. In addition, the two-sided market peculiarity of crowdfunding platforms underlies even more the importance of governance. We observe different stakeholders of the platforms of our sample in four concentric circles.

If as previously mentioned, governance aims to encourage some specific behaviors and relations among stakeholders, then we can distinguish two kinds of functional and emotional relations in crowdfunding. The first one supports relations for running routine business operations. The second relates to emotional and even sensational relations around crowdfunding projects. Ignoring the specific motivation of contributors in crowdfunding can be fatal as in the examples of the American Oculus VR and of the Swedish Mojang AB which ended in public outcries in social media-despite outstanding initial success of raising funds on the Kickstarter platform.

In this perspective, we mainly focus on the second circle out of the four previously explained.

The second circle clusters project initiators and contributors for donation, lending, equity and reward crowdfunding. They are significantly different in profiles and motivations from one platform to another. Project initiators vary from scientists and researchers (Experiment), artists (MyMajorCompany), startup entrepreneurs (Angellist), musicians or even charities. Contributors also vary among platforms. They

might be donors (Experiment), professional investors, good-doers (Babyloan), reward recipients (Kickstarter, Indigogo) and professional investors (AngelList, Prosper).

We believe recognition in governance of crowdfunding platforms is crucial since even in equity and credit-based crowdfunding operations which enable considerable ROI, the primary impetus of many contributors is not profit as it is the case for professional investors. They invest or lend because they relate to and are passionate about specific exposed causes or initiatives. Motivations of stakeholders in crowdfunding are hard to detect, and treacherous to ignore. However, understanding and accommodating them is required for successfully attracting and involving them in the crowdfunding process. In this perspective, Francis Fukuyama (1992, 1995) and Axel Honneth (1996, 2002) have developed the philosophical concept of recognition.

Fukuyama's theory (1989, 1992) depicts the interplay between humans' economic desire of satisfying material needs, and the idiosyncratic desire of being recognized by other human beings at their own sense of self-worth.

For Axel Honneth (1996, 2002) the human flourishing depends on self-confidence, self-respect, and self-esteem that derive respectively from three patterns of recognition: self-confidence emerging from love in parent-child and friendship relationships, self-respect resulting from law of equal rights and self-esteem originating in solidarity and acknowledgement of personal difference and individuality.

FUTURE RESEARCH DIRECTIONS

Several research projects can support and complement the main proposal of this paper.

A first line of research will focus on projects that have raised considerable funds despite questions about their technical feasibility (Shchetko, 2014). This topic deals with the issue of governance between partners by examining how to control *ex ante* and *ex post* opportunism between initiators and contributors and how to define the responsibility and the role of the platform in this perspective.

A second line of research will look at the motivations of funders and contributors who often put more importance on the non-financial returns of the projects they support.

While researchers and observers have mainly focused on successful crowdfunding projects, a third research endeavor will explore aborted projects and identify the reasons for doing so. The hypothesis is that one learns from failure and that knowledge gained may open the door to possible future successes. The research question will be: What are the failure factors of crowdfunding? The Kickscammed platform is currently tracking problem financing projects (Fraudulent projects? Failed projects? It is not clear.).

Finally, a fourth research project will examine the impact of non-economic variables such as photo, music, and smell on the behavior of contributors.

CONCLUSION

The purpose of this paper is suggesting a theoretical business model for P2P activities and to test its validity against current platforms of crowdfunding in particular. We believe the objective is attained.

First, we identified that the P2P business model of crowdfunding is a kind of two-sided market, often called for online P2P platforms market maker, exchange facilitator, or intermediation agent.

Secondly, we proposed a quadripartite business model based four components: Customer value proposition, revenue stream, technology and competency and governance of interactions among stakeholders. The governance element is absent or discussed only briefly in the literature.

Third, we tested this theoretical model and its components against the main platforms. Observation and exploratory analysis of platforms showed that customer value is explicitly defined for project initiators and contributors on all cases. The income stream is mainly based on the commission of successful projects. The infrastructure relies heavily on Web 2.0 technologies like social media. Finally, outside of the shareholders-managers ratio, the governance of P2P platforms targets relationships between several types of partners such as owners, employees, project initiators and contributors, contractors, and public authorities.

This generic business model has important implications for P2P activities and crowdfunding. Its quadripartite framework provides a coherent way to identify the different actors that can potentially contribute to value creation and the establishment of a competitive advantage.

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KEY TERMS AND DEFINITIONS

Business Model: A business model states key activities and processes to support the principles of competitive advantage the strategy defines for a firm. While a strategy defines the foundations for effective value creation, a business model outlines the specific way of creating value for them. A strategy and a business model are complementary rather than identical and required for success of P2P platforms.

Customer Value Proposition (CVP): A CVP is the worth (satisfaction, value, utility) a consumer perceives as the (positive) difference between the total benefits s/he obtains from a vendor's offering, minus the sum of pecuniary costs and non-pecuniary sacrifices that s/he has to give up in return. Customers continuously take into account competitive alternatives along with their relative benefits and costs. A CVP is always subjective and includes not only an offering's features, but also personal and social values.

Governance: Governance aims to encourage some specific behaviors and relations among stakeholders and avoid some others and relies on a third-party authority to oversight how a firm manages the interests of and relations between different internal and external parties.

Infrastructural Technologies and Competencies: A business model's component of technologies and competencies allow a firm to operate flow of goods, information, and money for delivering customer value and support competitive advantage. The Web 2.0 technologies and the competencies of using them have played a significant role in development of P2p activities by reducing the transactions costs between distant peers.

Revenue Stream: A revenue stream defines a mode of regular flow of earnings (cash-flow) that come into an organization in a period of time. Firms generally mix different income streams (revenue mix) to finance operations, investments, and rewarding shareholders and stakeholders.

Strategic Foresight Tools for Planning and Policy

5

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INTRODUCTION

Many people in organizations believe they can foresee developments in their industry or sector. Yet, the most critical threats or greatest opportunities often emerge in other industries or sectors. Brand new trends, developments, or phenomena can emerge in adjacent fields or in society at large. Although in the beginning they may seem disconnected, they are often the drivers of change that will eventually affect one's own future, in dramatic ways.

Organizations from both the private and public sectors must improve strategic decision making to succeed in the challenging environment of today to overcome emerging complex problems, for success in an increasingly uncertain future. Strategic Foresight enables organizations to envision a range of possible future environments. Scenario-based planning then enables organizations to develop an adaptive strategy for success as the actual future unfolds.

Major corporate companies have been leveraging the power of Foresight for years. During the oil crisis of the late 1960s, Shell altered its strategy and successfully propelled itself to the top of the industry, a move credited to the use of scenario planning. Today, organizations like Intel, Ford, and Disney have joined Shell in employing futurists to leverage foresight tools for organization-wide strategy development and innovation.

Most recently, Foresight has emerged as a key instrument for the development and implementation of forward-looking research and innovation policies. Some activities show an interesting mix of approaches combining three types of elements: prospective studies of long-term opportunities and alternatives, participatory networking, and policy orientation

Strategic Foresight is well-established in many advanced economies, including the European Union, Japan, and Singapore. Among the BRICS nations (Brazil, Russia, India, China, and South Africa), Foresight programs at the government level are increasingly common.

Moreover, Strategic Foresight is about improving a leader's decision making and their ability to implement change. The practice of Strategic Foresight affects the behaviors of planning goal setting and decision-making.

Strategic Foresight enables organizations to envision a range of possible future environments. Scenario-based planning then enables organizations to develop an adaptive strategy for success as the actual future unfolds.

This paper will examine the Strategic Foresight and Scenario Planning.

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Background

Strategic Foresight is a branch of strategic thinking, which have long been practiced in military, politics and business management for as long as the disciplines existed (Kuosa T. 2016).

The beginnings of strategic foresight military planning, strategic study and planning can be considered one of the central branches of politics and political theory. Niccolo Machiavelli can be considered as one of the first modern political strategists.

Strategic foresight was held in high esteem in Sun Tzu's book "Art of War" when he wrote, "Foreknowledge enables a wise general to achieve things beyond the reach of ordinary men".

The use of Strategic Foresight and Scenarios, in particular, to explore the future goes back to the work of Herman Kahn at the RAND Corporation in the 1950s. Kahn used scenarios to investigate different military strategies for engaging the Soviet Union during the Cold War. He became known for communicating about the future through stories told in the future.

Scenarios have been famously used to guide government policy and plans. In 1991-1992, the Republic of South Africa engaged a team from RDS to help them envision the future of RSA post-apartheid. Named after the resort where the exercise took place, four Mont Fleur scenarios were developed. The team then reverse engineered (or backcasted in futurists' terms) the decisions required along the way to achieve the future state most preferred by all stakeholders.

Strategic Planning vs. Strategic Foresight

Strategic Planning looks at what you've historically offered to members and asks, "How can we do this a little better, faster or more efficiently? How can we improve or expand upon what we're currently doing?"

Strategic Foresight looks 10 or 20 years into the future and asks, "What will our future pool members value? What kind of products and services will our members need, and how can we best serve them?"

Many Foresight professionals agree with the statement "the future does not exist" and "it is impossible to predict the future". What may fill some people with optimism, maybe a deeply depressing prospect to others? While some may focus on technological developments others may look at demographic shifts (Van der Duin P 2016).

Strategic Foresight contains a set of tools and processes for gathering systemic, participatory intelligence by pulling together a set of emerging trends underlying recent developments in a range of different sectors, together with their interactions and begin to collectively make sense of them.

Strategic Foresight and Scenario Planning

Strategic Foresight and its most common tool, scenario-based strategic planning, have been used successfully for decades in corporate planning. The most famous example is provided by the energy and petrochemical giant Royal Dutch Shell (Cardoso and Emes 2014). During the oil crisis of the late 1960s, Shell altered its strategy and successfully propelled itself to the top of the industry, a move accredited to the use of scenario planning. Today, organizations like Intel, Ford, and Disney have joined Shell in employing futurists to leverage Foresight tools for organization-wide strategy development and innovation.

Figure 1. Strategic Foresight

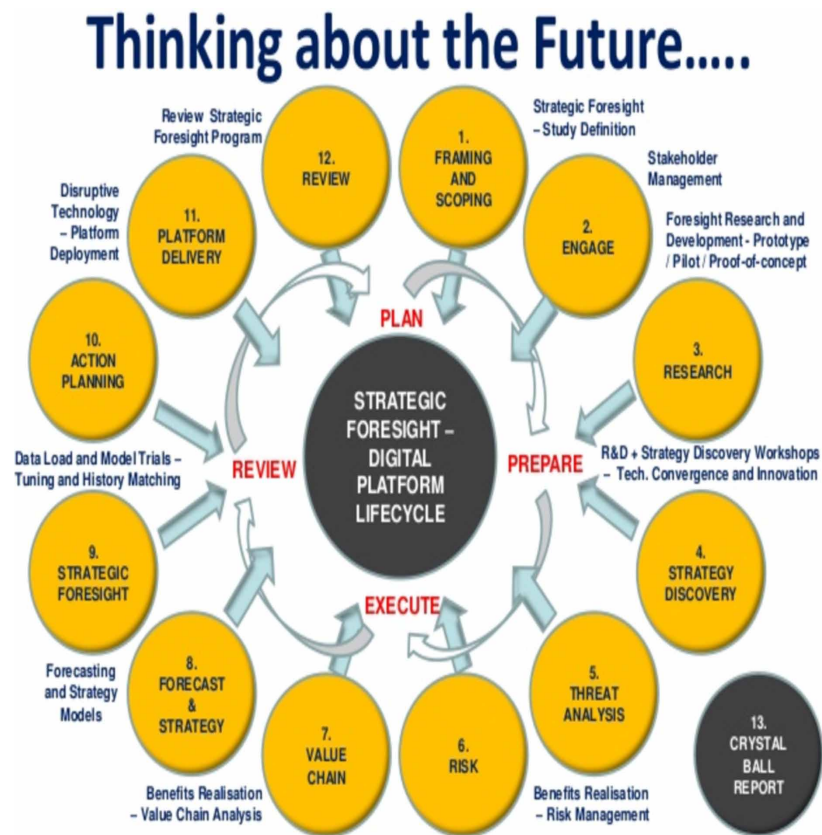
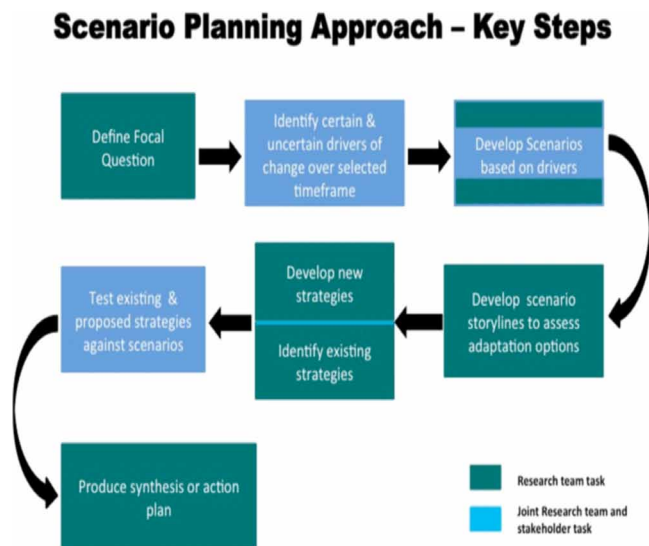


Figure 2. Strategic foresight and scenario planning



Strategic Foresight vs. Forecasting

Strategic Foresight should not be confused with Forecasting, which can create a narrow view of the future. “Long-term forecasting has increasingly become discredited because more often than not predictions have proved to be incorrect” (Berkhout, 2002).

Foresight is not the same as futures research or strategic planning. It encompasses a range of approaches.

- **critical thinking** concerning long-term developments,
- **debate** and for some futurists who are normative and focus on action driven by their values who may be concerned with the effort to create a wider participatory democracy.
- **shaping the future**, especially by influencing public policy.

Strategic Foresight in Practice

Strategic foresight encompasses a variety of methods, processes, and tools that assist decision makers to make sense of their complex problems with a view to guiding future-orientated decisions and planning (Vecchiato and Roveda 2010).

You gather a set of emerging trends underlying recent developments in a range of different sectors together with their interactions and start to collectively make sense of them. A vision and strategy are developed enabling leaders to make tough decisions with the future in mind.

Scenario Planning: A Strategic Foresight Tool

Foresight tools, such as scenario planning, facilitate future-orientated awareness that works by overcoming pre-existing biases, simplifying complexity, and reducing uncertainty with the aim of fostering faster and more effective decisions (Bootz 2010, Ringland 2010). Scenario planning has been used in corporate decision-making processes since the late 1970s and has been found to help make sense of uncertain environments, overcome their cognitive limitations and improve mental agility (Vecchiato 2012). Scenario planning brings together decision makers with key stakeholders who generate insights through a workshop type process as they explore the development of alternative futures (Horton 1999). Military planners even used the method in World War II to develop a series of alternative futures in an attempt to make sense of potential enemy actions (Bradfield et al 2005).

Scenario planning is a process used by organizations that wish to evaluate their readiness for the future by developing and examining the implications of a range of possible alternative futures. Scenarios are extrapolated from a detailed systematic analysis of the driving forces of change that an organization may face over the next 15 to 30 years. Strategic planning decisions are strengthened by going through the process of envisioning how current strategies and operating models would perform under different future scenarios. Crisis managers have found scenario planning a useful tool for managing uncertainty, risk, and opportunity because it provides a well-tested framework for understanding future needs and prioritizing near-term actions. Scenario planning is also a tool that places participants in a tacit knowledge environment, outside their present frame of reference, and requires them to create codified knowledge as they struggle to make sense of a new environment.

The selection and application of different scenario planning processes depend on the main characteristics of an organization’s business environment and on available expertise (Cardoso & Emes, 2014).

Strategic Foresight Methods are used in particular situations that are characterized as a Volatile, Uncertain, Complex and Ambiguous context (VUCA). Together these characteristics make the world largely unpredictable, and the future fairly unknown. In a VUCA world, traditional planning approaches do no longer provide reliable outcomes. Strategic foresight methods are designed to deal with VUCA environments.

Volatility

Volatility means that change goes up and down, just like a roller-coaster. more volatility. Second, the change can spread out to different dimensions in an unpredictable manner.

Uncertainty

In a VUCA world, there is an increase in the uncertainty about the future outcome. There are many unknowns about what will happen next. For instance, there can be uncertainty about the impact of new technology. Even with the knowledge of all the experts in the world, it is difficult to predict the outcome in uncertain instances.

Complexity

Complexity refers to a situation wherein multiple drivers of change are affecting each other. The cause and effect of change are unclear. It is unclear how the changes really interact. Complex problems tend to be wicked problems, which are ill-formulated and have incomplete and contradictory requirements. An example of a complex problem might be the war on terrorism.

Ambiguity

Ambiguity refers to the lack of clear meaning or the occurrence of mixed meanings. It is accompanied by a great potential for misreads of the situation. In sum, ambiguity is about facing the unknown.

Identifying and Mapping Change Drivers – the key trends and factors shaping the long-term development of the policy area – sits at the core of most Futures and Foresight work. Change drivers are typically characterized as the political, economic, societal, technological, legislative or environmental factors (**PESTLE**). Strategic foresight may be used to anticipate the future, innovate new products or services, or strengthen membership advantages. Strategic Foresight may be used as part of an annual Board planning meeting. Others have used it to guide work on a very important or targeted project (like starting a new line of coverage).

Approaches to the Future

Different time preferences are shown in three different approaches to the future. Predictive, explorative, and normative (Vergragt and Quist 2011); Borjeson et al; 2006). The predictive approach to the future relies heavily on historical data and projects patterns into the future. The explorative approach assumes that the future is not an automatic continuation of the past and focuses on what could happen in the future.

The normative approach is dissatisfied with the current state of affairs and views the future above all as a possibility to repair things. These three approaches are connected to cynically.

Figure 3. Scenario planning



The emergence of social media such as Twitter and Facebook illustrates the cyclical interaction between past, present, and future. This can be viewed as a historical pattern, with communication becoming ever more interactive and individual. Based on that one can think of possible future forms of social media (Duin P 2016). For instance, the Internet of Things means not only do people send tweets but objects such as cars also send tweets about their maintenance status. This image, in turn, impacts the present because businesses have to incorporate these functionalities into their existing innovation processes.

Traditional media (radio Television and newspapers) are considered fewer networks oriented and based primarily on broadcasting, whereby the past, present, and future are connected cyclically and thereby perplexing.

How Do Public Entity Pools Use Strategic Foresight?

Table 4. Strategic Foresight Six Steps: Frame the domain, scan for trends, forecast scenarios, envision the future, backcast, and implement

1. Frame The domain what is the domain you will explore?	2.Scan for forces & Trends Whom will you invite to scan? What will your scan include?	3.Forecast Scenarios what are the plausible futures in your domain?	4. Envision The future what does success look like for your domain?	5.Backcast What are the milestones you must complete to ensure success?	6.Implement what must you start now to secure your domains future?
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WHAT FUTURE? FRAMING THE DOMAIN

1. Define the future you want to explore for your pool or for a specific pool initiative you want to bring focus to. Futurists call this “framing the domain.” Biting off too large a foresight project can lead to burnout.
2. Think carefully about the subject of your inquiry. What specific areas do you want to explore?
3. Three and five-year time horizons are usually too short for a foresight project to be truly strategic. Ten years is better. Twenty years is ideal. Twenty years is long enough to stretch people’s thinking and is also the length of a generation. If you are examining the future of your pool twenty years from now, you are working in a truly strategic way.

The Foresight Process: Trends Not Opinions

- (1) A trend must be increasing, decreasing, or changing in some fundamental way and must be documented by a credible source.
- (2) Engaging in deeper, unbiased thinking and might take longer than you initially anticipate.
- (3) Researching trends to be sure they’re valid, verifying a trend’s direction, and creating a solid list of trend citations can be a lot of work – but it’s important to work that pays off in terms of outcomes.

Identifying Trends: The STEEP Approach

A **STEEP analysis** is conducted when members are unsure about how the market will react to changes in particular elements.

STEEP is commonly used to gain an insight into the past, current, and future of the external environment developments during times of uncertainty, times of information overload and times of disorganization.

Figure 4. Steep approach

STEEP ANALYSIS				
Social	Technological	Economic	Environmental	Political
• Demographics • Lifestyles • Religion • Cultural values • Consumer behaviour • Advertising	• Innovation • Transport • Energy • Communication • R&D • Patent regs • Product life-cycle	• Interest rates • International trade • Taxes • Savings • Inflation • Subsidies • Employment • Entrepreneurship	• Water • Wind • Soil • Food • Energy • Pollution • Environmental regs	• Political stability • Regulation of monopolies • Tax policies • Price regulations • Consumer protection • Jurisdiction • Trade unions

SCENARIOS AND THE CONE OF PLAUSIBILITY

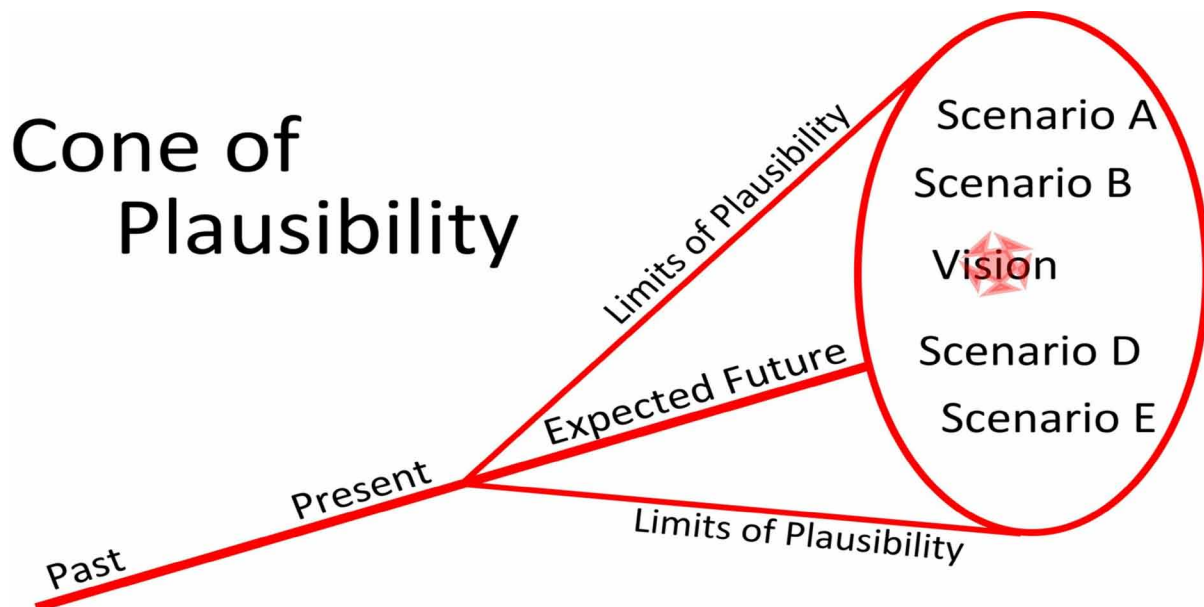
The Cone of Plausibility is another tool used in Foresight to help users understand that the scenarios they develop need to fall within the upper and lower limits of plausibility. If your scenarios aren't plausible, they won't be credible with your audience. Boards and management teams should ask themselves, "What scenarios are plausible?"

When the scenarios are completed, the future begins to come into view. Other questions to ask:

1. What issues or factors show up in two or more scenarios?
2. Which of these things is within our pool's control or sphere of influence?
3. Which of these things, if we managed them well, would mitigate risk or help us gain an advantage in some way?

The issues or factors that meet these criteria are your pool's transformational factors. Because they are common among multiple plausible futures, and because you can influence them to at least some degree, concentrating on these factors will help your pool no matter which possible future turns out to be closest to your actual future.

Figure 5. Scenarios and cone of plausibility



BACKCASTING: MOVING FROM THE FUTURE TO THE PRESENT

1. Begin with the end in mind
2. Move backward from the vision to the present
3. Move step by step towards the vision

The Vision

Example: By 2036, organization A will be the best place to work, recognized for its high levels of trust and collaboration among employees, members, and partners. will celebrate their tenth year in a row of being a “Best Place to Work.”

Their pool’s employee retention (not including retirements) will be 90 percent or higher. >

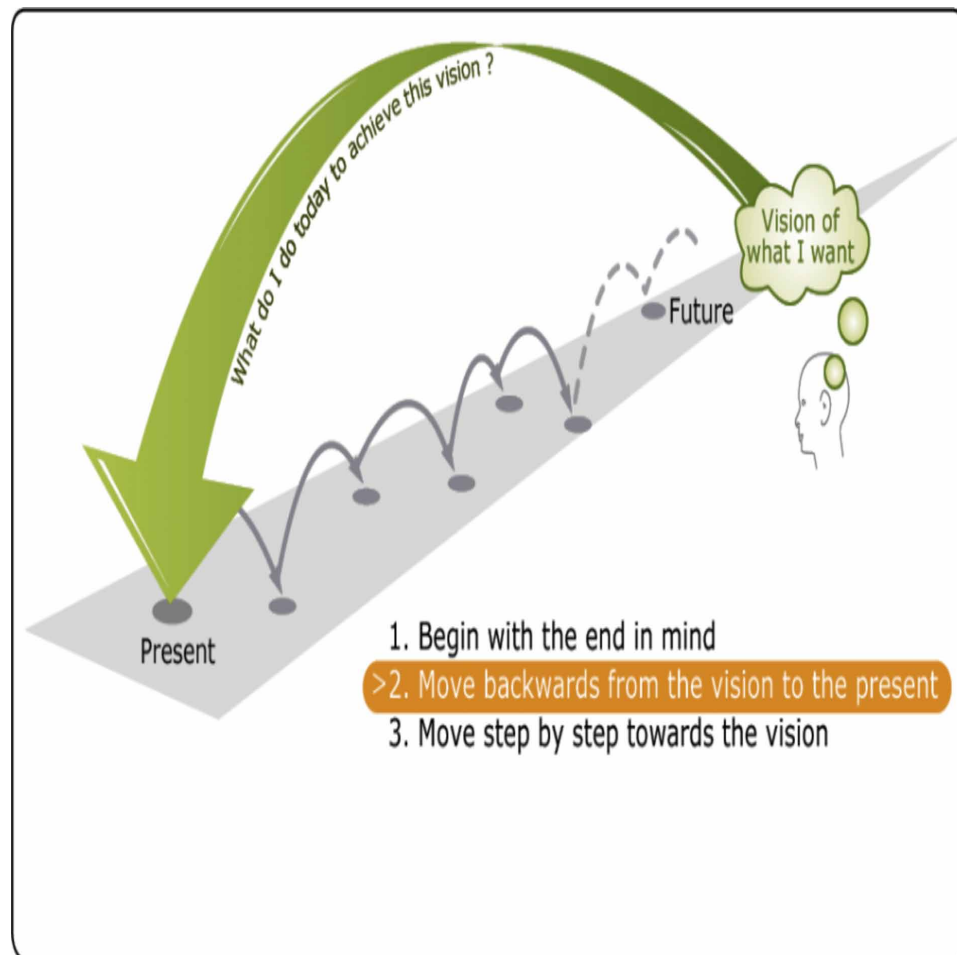
All member growth and retention metrics will be defined and targets will have been met for at least five consecutive years.

THE FUTURE STARTS TODAY

After backcasting and identifying milestones, next comes implementing.

For most pools, this is the easy part. Pools are experienced planners: identifying objectives, strategies, and tactics and reporting quarterly, semi-annual and annual results. Some pools use Peter Drucker’s MBO (Management by Objectives), or George T. Doran’s SMART goals (Specific, Measurable, Assignable, Realistic, and Time-related). Others might implement with a more home-grown approach.

Figure 6. Backcasting



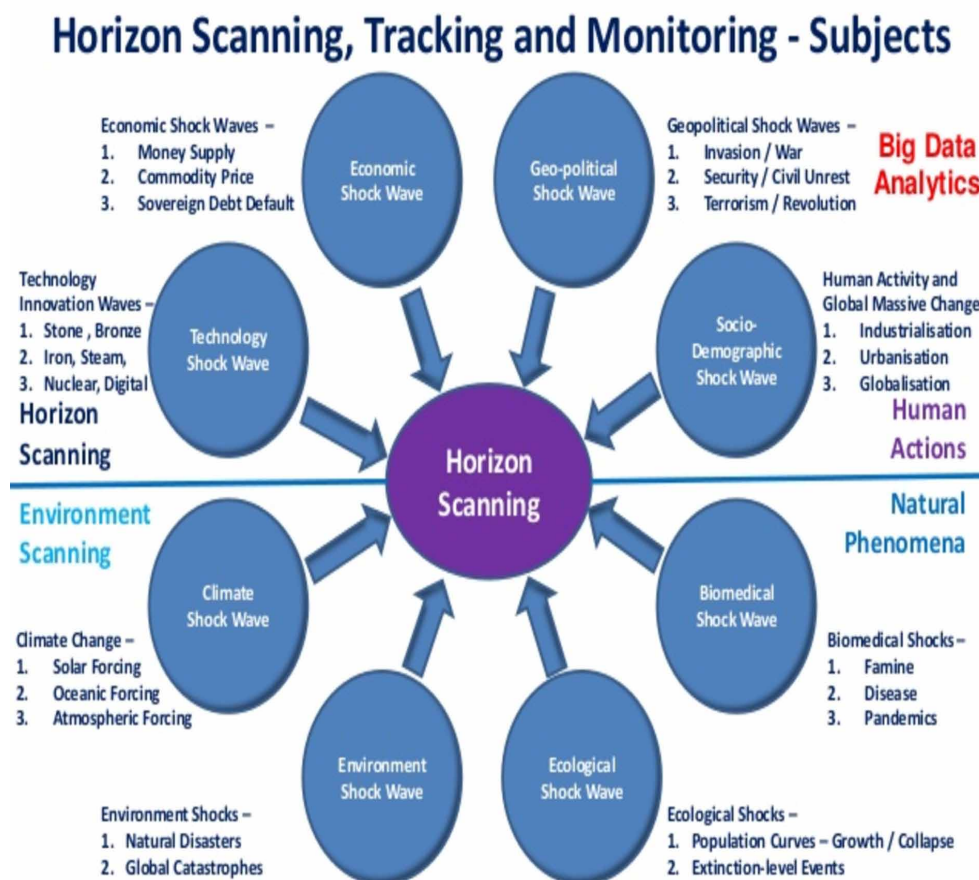
COLLECTING INFORMATION OR SCANNING

Horizon Scanning and Searching for Weak Signals

Almost all Foresight activity starts with or involves **Horizon Scanning or Environmental Scanning**. It is a process of looking outwards, at the trends and drivers that are currently shaping the world, including those within and outside a given context. Horizon scanning is often based on desk research, helping to develop the big picture behind the issues to be examined.

Desk Research involves a wide variety of sources, such as the Internet, government ministries and agencies, non-governmental organizations, international organizations and companies, research communities, and online and offline databases and journals. Thorough horizon scanning that is both wide and deep, produces a pool of insights that form one big knowledge base about the future. Interpreting data and formulating versions of the future: This step generally consists of applying a combination of techniques and practices such as identifying weak signals or emerging strategic issues, causal layered analysis, wildcard exercises, participatory methods, road mapping, scenario planning, the **Delphi method** and so on.

Figure 7. Horizon scanning



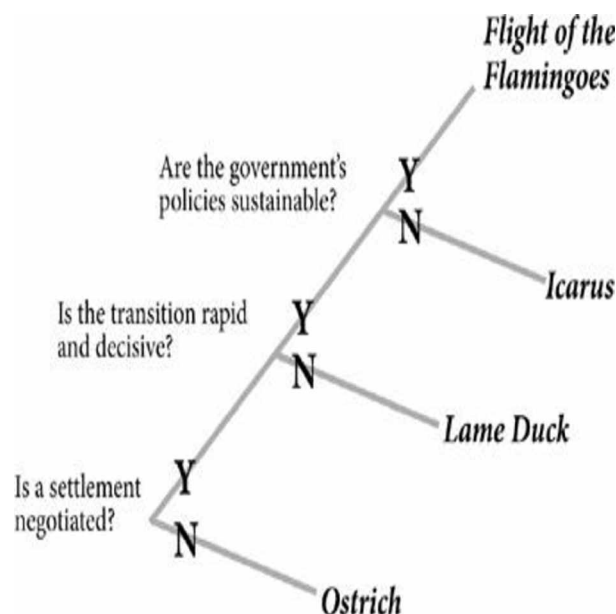
Scenario Thinking

Scenario thinking is increasingly being used as a tool for strategizing in private and public sector organizations. The “Mont Fleur” scenario exercise, undertaken in South Africa during 1991–92, was innovative and important because, in the midst of deep conflict, it brought people together from across organizations to think creatively about the future of their country.

Transformative Scenario Planning in South Africa

Nelson Mandela was released from prison in 1991 and the negotiations to end apartheid had begun. In the midst of deep conflict, the **Mont Fleur Scenario** was an opportunity for people from different organizations and political and ideological landscapes to engage in dialogue and think creatively about the future of their country. A team consist of 22 participants South African leaders from the opposition and the establishment (left and right, black and white), business people, politicians, academics, trade unionists and community workers that imagined four scenarios in response to the question: “How will the South African transition go and will the country succeed in ‘taking off’?” In a set of informal meetings and open conversations, the scenario process enabled participants to create common ground and contributed to establishing mutual understanding. As a set, the scenarios provided a provocative roadmap for the country’s transition away from apartheid. This exercise also helped to avert an economic disaster by shifting the economic thinking and action of the African National Congress (ANC) and cementing strict and consistent fiscal discipline. Mont Fleur is a wonderful example of transformative scenario planning providing “a way for people to work with complex problematic situations that they want to transform but cannot transform unilaterally or directly” (Kahane, A). The project was important in understanding its impact. It took place during the period between February 1990, when Nelson Mandela was released from prison, and the African National Congress (ANC), Pan African Congress(PAC), South African Communist Party (SACP), and other organizations were legalized, and April 1994, when the first all-

Figure 8. Transformative Scenario Planning



race elections were held. During these years, dozens of “forums” were set up in South Africa, creating temporary structures that gathered together the broadest possible range of stakeholders (political parties, civic organizations, professional bodies, government departments, trade unions, business groups, etc.) to develop a new way forward in a particular area of concern. There were forums to discuss education, housing, economic policy, constitutional matters, and many other areas. They ranged from informal, off-the-record workshops to formal, public negotiations. The Mont Fleur project was one type of forum that, uniquely, used the scenario methodology.

The purpose of Mont Fleur was “not to present definitive truths, but to stimulate debate on how to shape the next 10 years.” The project brought together an adverse group of 22 prominent South Africans—politicians, activists, academics, and businessmen, from across the ideological spectrum—to develop and disseminate a set of stories about what might happen in their country during 1992–2002

The Five Stages of Transformative Scenario Planning

Step One: Convene a Team From Across the Whole System

Getting the right people in the team is crucial. The makeup of the team will, to a large extent, determine whether or not the project is successful.

Step Two: Observe What is Happening

The facilitators invite people to observe what is actually happening. This part can be challenging.

Step Three: Construct Stories About What Could Happen

The facilitators encourage people to construct scenarios about what they think **could** happen. Not what people predict will happen, should happen or believe will happen. As in most classic scenario planning, people are encouraged to explore the possible ways forward and the consequences.

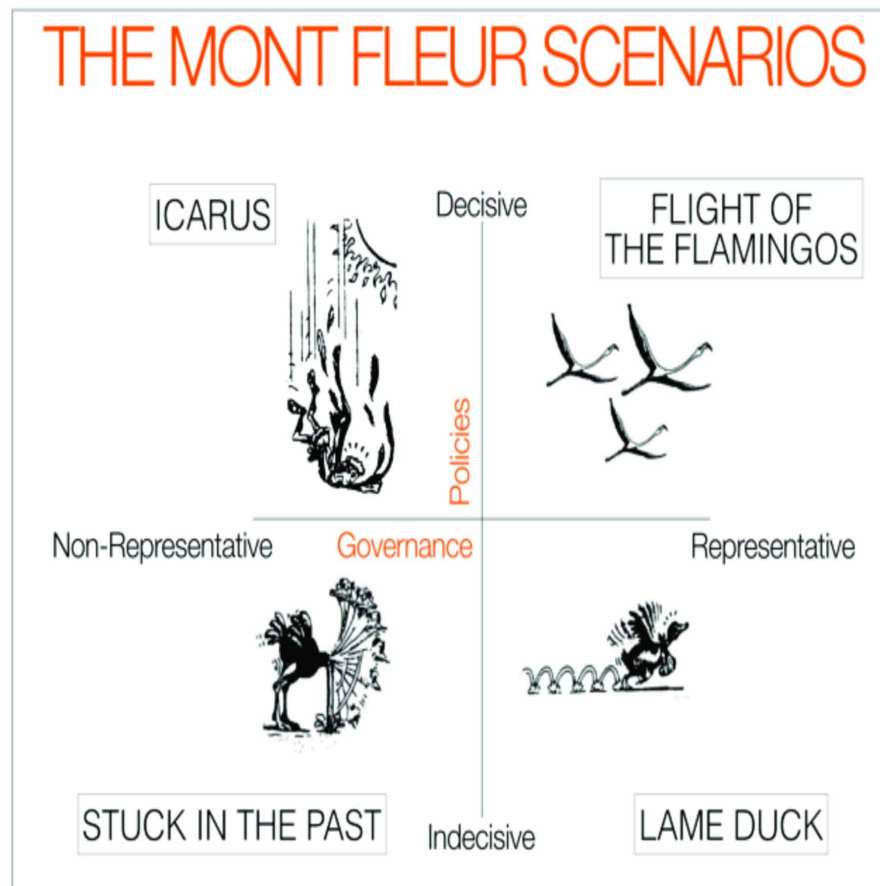
Step Four: Discover What Can and Must be Done

This is the time for shaping the future. Instead of simply adapting to circumstances, people can focus on how to transform the future. Alan describes this in the following way.

The scenario team met three times in a series of three-day workshops at the Mont Fleur conference center outside Cape Town. After considering many possible stories, the participants agreed on four scenarios that they believed to be plausible and relevant:

- **Ostrich**, in which a negotiated settlement to the crisis in South Africa is not achieved, and the country’s government continues to be non-representative
- **Lame Duck**, in which a settlement is achieved but the transition to a new dispensation is slow and indecisive
- **Icarus**, in which transition is rapid but the new government unwisely pursues unsustainable, populist economic policies
- **Flight of the Flamingos**, in which the government’s policies are sustainable and the country takes a path of inclusive growth and democracy.

Figure 9. Mont fleur Scenarios



The group developed each of these stories into a brief logical narrative. A fourteen-page report was distributed as an insert in a national newspaper, and a 30-minute video was produced which combined cartoons with presentations by team members. The team then presented and discussed the scenarios with more than fifty groups, including political parties, companies, academics, trade unions, and civic organizations. At the end of 1992, its goals achieved, the project was wrapped up and the team dissolved.

What the Project Was and Was Not

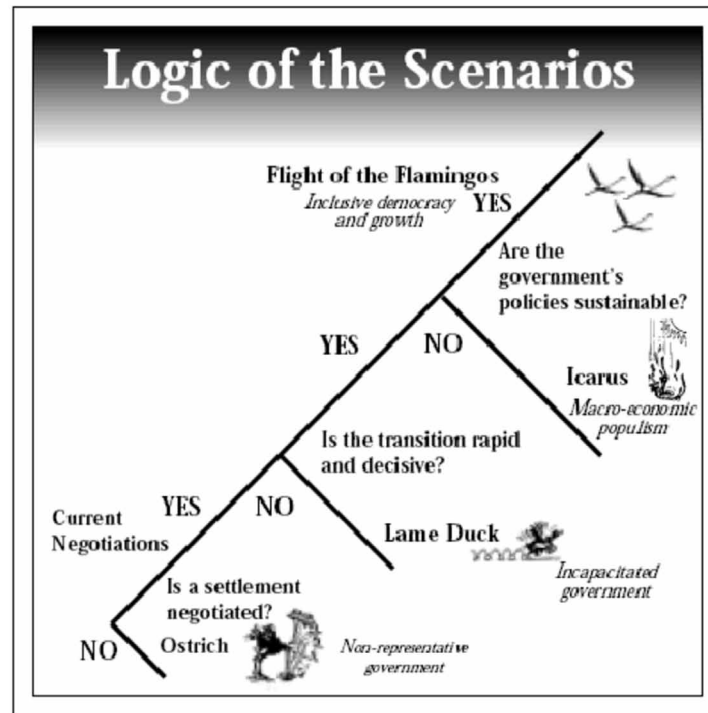
The ideas in the Mont Fleur team's four scenarios were not in themselves novel. What was remarkable, important figures delivering the messages, and how this group worked together to arrive at these messages. The approach was indirect and the results subtle:

Mont Fleur Did Not Resolve the Crisis in South Africa

The project, along with other, on-scenario forum processes, contributed to the establishment of a common vocabulary and mutual understanding. The shared language of Mont Fleur extended beyond the

negotiating elite and was thus able to include such dialogues as an exhortation to Flamingos in a Sunday church sermon and a concern raised about Lame Duck on a rural radio phone-in. This kind of common understanding, together with many other factors, promoted agreement upon a settlement to the crisis:

Figure 10. The Logic of Mont Fleur



- The participants did not agree upon a concrete solution to the country's problems. They reached a consensus on some aspects of how South Africa "worked," on the complex nature of the crisis, and on some of the possible outcomes of the current conditions. More specifically, they agreed that, given the prevailing circumstances, certain strongly advocated solutions could not work, including armed revolution, continued minority rule (Ostrich), tightly circumscribed majority rule (Lame Duck), and socialism (Icarus). As a result of this process of elimination, the broad outline of a feasible and desirable outcome emerged (Flamingos)
- The process was not a formal, mandated negotiation. Rather, it was an informal, open conversation. At the first workshop, some of the participants expected to encounter difficulties in agreeing on anything. Over the course of the meetings, they talked until they found areas of shared understanding and agreement, several of which were relevant to the formal negotiations which were occurring simultaneously
- It did not deal with the different parties and then finding a way to narrow or reconcile these differences. The Mont Fleur process, in contrast, only discussed the domain that all of the participants had in common: the future of South Africa. The team then summarized this shared understanding of the scenarios. The aim of such on-negotiating processes is, as Marvin Weisbord, an organizational consultant, has stated, to "find and enlarge the common ground."

Results From the Project

The Mont Fleur project produced several different types of results: substantive messages, informal networks, and understandings, and changed ways of thinking. The primary public output of the project was the group of scenarios, each of which had a message that was important to South Africans in 1992:

- The message of Ostrich was that a non-negotiated resolution of the crisis would not be sustainable. This was important because elements of the National Party (NP) government and the business community wished to believe that a deal with their allies, instead of negotiation with their opponents, could be sufficient. After hearing about the team's work, NP leader F.W. de Klerk was quoted as saying, "I am not an Ostrich."
- Lame Duck message was that a weak coalition government would not be able to deliver and therefore could not last. This was important because nature, composition, and rules governing the Government of National Unity (GNU) were a central issue in the pre-election negotiations. The NP wanted the GNU to operate subject to vetoes and other restrictions, and the ANC wanted unfettered "winner takes all" rules. Lame Duck explored the boundary in a GNU between compromise and incapacitation.
- Icarus warned of the dangers of a new government implementing populist economic DEEPER S2 policy. This message—coming from a team which included several of the left's most influential economists—was very challenging to the left, which had assumed that government money could be used to eradicate poverty quickly. The business community, which was worried about Icarus policies, found the team's articulation reassuring. The fiscal conservatism of the GNU was one of the important surprises of the post-election period.
- The simple message of Flight of the Flamingos was that the team believed in the potential for a positive outcome. In a country in the midst of turbulence and uncertainty, a credible and optimistic story makes a strong impact. One participant said recently that the main result of the project was that "We mapped out in very broad terms the outline of a successful outcome, which is now being filled in. We captured the way forward of those committed to finding a way forward."

The Mont Fleur Project was the creation of informal networks and understandings among the participants—an influential group from across the political spectrum—through the time they spent together. These connections were standard for this forum period, and cumulatively provided the basis for the subsequent critical, formal agreements.

Lastly—the least tangible yet most fundamental—was the change in the language and thought of the team members and those with whom they discussed their work. The Mont Fleur team gave vivid, concise names to important phenomena that were not widely known, and previously could be neither discussed nor addressed. At least one political party reconsidered its approach to the constitutional negotiations in light of the scenarios.

WHAT THE MONT FLEUR PROJECT ACCOMPLISHED

The Scenario Process Was Logical, Open and Informal

In the first Mont Fleur workshop, a story about the Chinese Red Army helping to liberate South Africa fell away on these grounds, rather than on the basis of preferences. Building Scenarios can be creative because the process is “only” about telling stories, not about making commitments. This allows people to discuss almost anything, even taboo subjects.

The Scenario Process was Inclusive and Holistic

A story about the future must be able to encompass all aspects of the world: social, political, economic, cultural, ecological, etc. Moreover, the process of telling several stories encourages people to surface and listen to multiple perspectives. In discussing a fundamentally unpredictable future, there is no one truth.

The Process Elicits Choices

One of the premises of scenario thinking is that the future is not predetermined and cannot be predicted.

Transformative Scenario Planning Helpful with the Following Three Characteristics

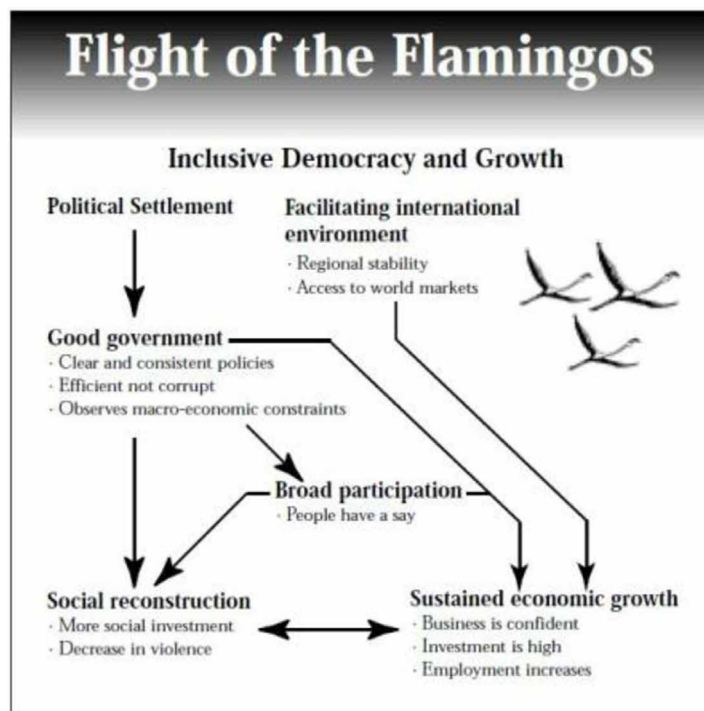
1. The participants in the Mont Fleur project, for example, viewed apartheid as unacceptable, unstable, and unsustainable, and saw the just-opened political negotiations as offering them an opportunity to contribute to changing it.
2. Participants cannot transform their situation on their own or by working only with their friends and colleagues. Even if they want to, they are unable to impose or force through a transformation. They must find some way to work together with actors from across the whole system. South Africans who wanted to transform the apartheid situation had been trying for decades to force this transformation, through mass protests, international sanctions, and armed resistance. But these efforts had not succeeded. Mont Fleur and the other multi-stakeholder processes of the early 1990s (which the previous forceful efforts had precipitated) provided South Africans with a new way to work with other actors from across the system.
3. The situation cannot be transformed directly. The actors who need to work together to make the transformation are too polarized to be able to approach this work head-on. They agree neither on what the solution is nor even on what the problem is. They did agree that they face a situation they all find problematic, although in different respects and for different reasons. Any attempt to implement a solution directly would therefore only increase resistance and rigidity. So the transformation must be approached indirectly, through first building shared understandings, relationships, and intentions.

The actors who came together in Mont Fleur all agreed that apartheid was irretrievably problematic and needed to be dismantled, but they came in with deep differences in their diagnoses of the ways in which it was problematic and their prescriptions for how it should be transformed. The scenario process enabled them to create common ground. In the community example, the administrators, teachers, parents,

and students might have a long history of unproductive disagreements that means they cannot simply sit down and start to work together.

Transformative Scenario Planning is, then, a way for people to work with complex problematic situations that they want to transform but cannot transform unilaterally or directly. The Mont Fleur participants constructed a new way of understanding the political, economic, and social challenges that South Africans were facing and then created four scenarios as to how South Africans could try to deal with these challenges. The participants constructed new relationships and alliances, especially between leaders of hitherto-separated parties, sectors, and races. And they constructed new intentions as to what they needed to do in their own spheres of influence to try to prevent the “Ostrich,” “Lame Duck,” and “Icarus” scenarios and to bring forth “Flight of the Flamingos.” Over the years that followed, these new understandings, relationships, and intentions enabled the participants and others with whom they engaged to undertake a series of aligned actions that did, in fact, contribute to their achieving these intentions.

Figure 11. *Flight of The Flamingos*



Transformative scenario planning can generate transformations such as those in these two examples only if three components are in place. Transformative scenario planning is a composite social technology that brings together three already-existing technologies into a new way of working that can generate new results. If any one of these components is missing, this new way of working will not work.

The first component is a *whole-system team* of insightful, influential, and interested actors. They choose to join this team because they think that if they can act together, then they can be more successful.

The second component is a *strong container* where actors can transform their understandings, relationships, and intentions. The political positioning of the exercise, so that the actors feel able to meet their counterparts from other parts of the system without being seen as having betrayed their own part;

the psychosocial conditions of the work, so that the actors feel able to become aware of and challenge (and have challenged) their own thoughts and actions; and the physical locations of the meetings, so that the actors can relax and pay attention to their work without interruption or distraction.

The third component is a *rigorous process*. In a transformative scenario planning process, the actors construct a set of relevant, challenging, plausible, and clear stories about what *could* happen—not about what *will* happen (a forecast) or about what *should* happen (a wish or proposal)—and then act on what they have learned from this construction. The uniqueness of the scenario process is that it is pragmatic and inspirational, rational and intuitive, connected to and challenging of dominant understanding, and immersed in and disconnected from the complexity and conflict of the situation. Furthermore, the future is a more neutral space about which all actors are more equally ignorant.

The transformative scenario planning process that was invented at Mont Fleur originated in the adaptive scenario planning process that had been invented at Shell two decades earlier— In an adaptive scenario planning process, the leaders of an organization construct and employ stories about what could happen in the world outside their organization in order to formulate strategies and plans to enable their organization to fit into and survive and thrive in a range of possible futures.

Adaptive Scenario Planning

Adaptive scenario planning is useful only up to a point. Sometimes people find themselves in situations that are too unacceptable or unstable or unsustainable for them to be willing or able to go along with and adapt to. In such situations, they need an approach not simply for anticipating and adapting to the future but also for influencing or transforming it. For example, an adaptive approach to living in a crime-ridden community could involve employing locks or alarms or guards, whereas a transformative approach could involve working with others to reduce the levels of criminality.

An adaptive response to climate change could involve building dikes to protect against higher sea levels, whereas a transformative approach could involve working with others to reduce emissions of greenhouse gases. Both approaches are rational, feasible, and legitimate, but they are different and require different kinds of actions and alliances.

Adaptive Scenario Planning vs. Transformative Scenario Planning

The key difference between adaptive and transformative scenario planning is, then, one of purpose. Adaptive scenario planning uses stories about possible futures to study what could happen, whereas transformative scenario planning assumes that studying the future is insufficient, and so it also uses stories about possible futures to influence what could happen. To achieve these two different purposes, adaptive scenario planning focuses on producing new systemic understandings, whereas transformative scenario planning assumes that new understandings alone are insufficient and so also focuses on producing new cross-system relationships and new system-transforming intentions. Adaptive scenario planning requires a rigorous process, whereas transformative scenario planning assumes that process alone is insufficient, and so it also requires a whole-system team and a strong container.

Transformative Scenario Planning and The U Process

Five steps can be framed as an application of the U-Process to the transformation of complex problematic situations. The U-Process is a model of transformation that includes five movements: initiating (in

transformative scenario planning, this is the convening step), cosensing (the observing and constructing steps), co-presenting (the discovering step), and co-creating and coevolving (the acting step). The U-Process is an indirect process—a detour—in that it is a way to get unstuck and move forward to transform a problematic situation through pausing and stepping back from the situation. It is a creative process in that what can and must be done on the right-hand side is not visible from the left-hand side but can be discovered only along the way.

Transformative scenario planning is simple, but it is not easy or straightforward or guaranteed. The process is emergent; it almost never unfolds according to plan, and context-specific design and redesign are always required. So the only way to learn this process is to practice it in a range of contexts.

Challenges and Limitations

Due to methodological constraints, foresight is often too theoretical and abstract for non-practitioners. The transmission of knowledge to policymakers operating with different cultures, vocabularies, processes and time scales is one of the biggest difficulties futurists face. As a result, “much foresight work, while very interesting and great fun to discuss over dinner, goes unused, unappreciated, and makes little observable difference” (Horton, 2012). Long-term futures also tend to seem dystopian or unrealistic to people and careful engagement is required in order to inform policymaking.

Foresight and Policy Making

Foresight and policymaking decision makers are often tasked to deal with short-term urgencies, as well as plan for long-term sustainable development. This is particularly challenging in developing countries where resources are limited and budgets and capabilities must be prioritized. What is the relationship of foresight to policy making? “In the best cases, foresight activities will initiate changes in the way decisions are made and policies are designed” (Da Costa, 2008). It offers a long-term view: “As a factor in governance, the purpose of foresight is to enhance the ability of decision-makers to engage and shape events at a longer range and, therefore, to the best advantage of the citizens they serve” (Fuerth, 2009). The biggest difficulty, however, is to get the message across to decision-makers, so that they most effectively use the foresight results.

Policymakers may sometimes be blindsided by ‘**black swans**’, ‘unknown unknowns’ and ‘**wild-cards**’ because traditional forecasting methods are based primarily on linear extrapolation. Foresight practitioners, however, are more comfortable with a non-linear world. Policymakers are dealing with increasingly complex, multidimensional issues that are frequently interconnected and interdependent. In today’s global environment, events and trends in various spheres interact with one another in complex and sometimes mystifying ways.

Complex Problems Simplified with Strategic Foresight and Scenario Planning

Short-term endeavors may rely on forecasting, whereas foresight is more suitable for mid to long-duration projects. Complexity refers to how easy or difficult it is to understand the relationships between an issue’s driving forces and uncertainties. Issues with clear, visible cause-and-effect relationships are designated simple or low complexity, while high complexity issues are those in which the cause-and-effect between driving forces and uncertainties are not fully visible or well understood or known. to how easy or difficult it is to understand the relationships between an issue’s driving forces and uncertainties. Issues

with clear, visible cause-and-effect relationships are designated simple or low complexity, while high complexity issues are those in which the cause-and-effect between driving forces and uncertainties are not fully visible or well understood or known.

Complex problems are interconnected and interdependent issues that might exist in different spheres, but interact with each other in unpredictable and sometimes mystifying ways. Complex systems are also the seedbed of ‘unknown unknowns’, ‘wildcards’ and ‘black swans’, which ultimately generate ‘wicked problems’. Wicked problems are large, intractable challenges with many dimensions and multiple stakeholders who may have divergent goals. They have no immediate or obvious solutions and their causes and influencing factors are not easily determined, so they have no simple solutions. Today’s wicked problems include climate change, energy security, global pandemics, terror networks, and extreme poverty.

Solutions and Recommendations

Foresight practitioners must overcome the gap between themselves and decision makers. This may be achieved if Foresight practitioners align their work with national political agendas and ongoing administrative processes, which allows them to more effectively feed their results into the appropriate political channels. Complex problems resulting from modern challenges like reforming the United Nations, Private Sector Engagement and Human Rights have renewed their appetite for Foresight practices that can describe the systemic change. Decision makers must also be aware of the crosscutting implications of policy effects in seemingly unrelated areas. In order to deal with such unintended consequences policies across the board must be adaptable and resilient to potential change, disruptions or shocks.

Future Research Directions

Foresight practitioners are beginning to adopt a new approach dubbed Human-Centered Foresight, using methods employed by designers to predict the future, starting with the ‘users’. based on a traditional design approach, human-centered foresight begins by thinking about the future from the center of the issues; identifying who the users are, what their interests are and how those might collide with changing external factors.

Properly facilitated, there is a potential for policymakers in low-capacity countries to develop long-term, sustainable development policies by collaborating with independent foresight academics, practitioners, and institutions producing current research.

CONCLUSION

Without Strategic Foresight, an organization may have a good understanding of the short-term trends in their industry, or even general long-term trends in society. But, in an interconnected world where change is occurring ever more rapidly, and where the boundaries between industries are blurring, more is needed.

What happens on one side of the world has an impact on the other side of the world. A small startup today may disrupt the largest company in the world tomorrow. Political instability can change the balance of power and have widespread consequences across the globe. Fortunately, with these topics dominating conference agendas and coffee table discussions, systematic foresight activity has gained momentum.

More and more organizations want to understand in greater detail how the world is changing and how they can make the most of these changes. On 22 January 2019 in Sarajevo, Bosnia-Herzegovina (BiH),

the EUISS (European Union Institute For security Studies) organized a strategic foresight workshop for representatives from the EU Special Representative in BiH (EUSR), the Delegation of the EU to BiH and EUFOR Operation Althea. The strategic foresight workshop is an example of the EUISS' continued efforts to strengthen the EU's analysis, foresight and networking capacities in external action. Strategic Foresight is to help them in that difficult task.

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KEY TERMS AND DEFINITIONS

Backcasting: A planning method that starts with defining a desirable future and then works backwards to identify policies and programs that will connect that specified future to the present. The fundamentals of the method were outlined by John B. Robinson from the University of Waterloo in 1990.

Black Swan: An event or occurrence that deviates beyond what is normally expected of a situation and that would be extremely difficult to predict.

Horizon Scanning: A systematic process that serves as an “early warning system” to inform decision-makers about possible future opportunities and threats. It identifies technologies, innovations, and trends with the potential to cause future disruptions, both positive and negative.

Lame Duck: An outgoing politician is an elected official whose successor has already been elected or will be soon. The official is often seen as having less influence with other politicians due to the limited time left in office.

Scenario Planning: Also called scenario thinking or scenario analysis, is a strategic planning method that some organizations use to make flexible long-term plans. It is in large part an adaptation and generalization of classic methods used by military intelligence.

Strategic Foresight: Also known as Futures Studies, is discipline organizations use to gather and process information about their future operating environment. This information can include, for example, trends and developments in their political, economic, social, technological, and legal environments

U Process: Developed by Otto Scharmer to provide a language for exploring different ways of being in the world. To transform your habitual ways of doing things you have to see them differently with an open mind and open heart. At a point of quiet, deep reflection where we become totally focused on being present and available to our intuition or inner voice.

Wild Cards: In futurology, future research, horizon scanning, and foresight, wild cards are low-probability, high-impact events. This concept may be introduced into anticipatory decision-making

activity in order to increase the ability of organizations and governments to adapt to surprises arising in turbulent (business) environments.

5

The Influence of Technology on the Strategic Planning Process

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INTRODUCTION

The concept of strategic planning came to prominence in the 1980s under the banner of New Public Management; since, several of the private sector components of strategic planning have been applied and interpreted within the public sector. While many of the concepts were not new, the application to the public sector was. The rise and general acceptance of public sector strategic planning also coincided with the digital revolution beginning in the late 1980s, offering enormous promise, but also an equal number of potential pitfalls. As the digital era became increasingly sophisticated, new possibilities emerged for governance and strategic planning.

The rise of the internet in the mid-1990s changed public sector planning from an almost exclusively hierarchical entity, into a series of interconnected networks. Hierarchical authority was still prevalent, but gradually the lines of authority, and in turn accountability, had been increasingly blurred amongst a growing number of actors. The further technological innovations have had major implications on government and governance structures, and the strategic planning process is critical in promoting innovation, growth, and effectiveness (Arend, Zhao, Song, & Im, 2017).

This entry explores the development of public-sector strategic planning, specifically the impact of technology and how strategic planning has grown throughout the digital era; along with potential opportunities and challenges moving forward as technology and organizational dynamics continue to evolve.

BACKGROUND

What is Strategic Planning?

Strategic planning is more than just another concept taken from the private sector to increase public sector efficiency (Hendrick, 2003). Strategic planning is a “deliberative approach and set of concepts, procedures, and tools that can help leaders to enhance the achievements of their organization” (Bryson, 2011, p. xiv). Strategic planning has become widespread throughout all levels of government in the United States over the last 25 years, and the growth of technology has only helped to stimulate it even further (Berry & Wechsler, 1995; Bryson, 2010; Bryson, Berry, & Yang, 2010; Bryson, Crosby, & Bryson, 2009; Hendrick, 2003; Poister, 2010; Poister, Pitts, & Edwards, 2010; Poister & Streib, 2005).

The importance of technology to organizations to inform both research and practice has long been realized; however, there has been little widespread agreement over how to best utilize and measure the

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impacts of technology on organizations (Orlikowski, 1992). Orlikowski and Barley (2001) suggest that to understand the ongoing innovations taking place in government it is imperative to understand both the technological advances and the institutional structures.

How to understand and best leverage the changing nature of technology is a question that will come up repeatedly throughout this review. In addition to the role of and questions over technology, debate exists over what makes up strategic planning and ultimately how encompassing it should be. Bryson (2011) explains it as the overarching, umbrella concept under which strategic thinking, acting, learning, and deliberation fall. These activities make up the most important components of strategic planning (Bryson, 2011) and collectively these activities provide an organized process for gathering information on a large scale and using it to determine a long-term direction (Poister & Streib, 2005). Strategic planning is a short-term planning strategy necessary to help ensure long-term success (Poister & Streib, 2005). It is a management tool that takes inventory of organizations' strengths and weaknesses, as well as opportunities and threats and how best to take advantage of the positives while mitigating the negatives (Denhardt, 1985; Kissler, Fore, Jacobson, Kittredge, & Stewart, 1998). Strategic planning is ultimately a way to meet the needs of the citizenry through improved performance and better service (Boyne & Walker, 2010). As government at all levels has moved away from traditional hierarchical structures toward more responsive networked agencies, strategic planning has become an increasingly used tool for governance (Berry, 1994) in an effort to enhance digital connectivity and socio-economic progress (Alam, Erdiaw-Kwasie, Shahiduzzaman, & Ryan, 2018).

Contrary to the widespread public sector support, there have been numerous criticisms attached to strategic planning. For one, strategic planning is not a panacea; strategic planning is not guaranteed to improve performance, and the point is not to create rigid channels and structures that trigger specific repeatable responses (Bryson, 2011). The inherent flexibility that characterizes strategic planning, and the efforts of strategic planning to produce real change often turns into one of critics most frequent complaints; strategic planning is hard to define, even harder to measure, and perhaps most difficult to determine who it is responsive to (Bryson, Crosby, & Bryson, 2009; Bryson & Roering, 1989; Kissler, Fore, Jacobson, Kittredge, & Stewart, 1998; Mansor & Tayib, 2012). The lack of a clear definition can be attributed to the changing nature of policy and the needs of the community; new issues emerge, outcomes are difficult to discern, significance is unclear, and goals fluctuate. Nonetheless, strategic planning is a tool that provides a certain level of assurance and preparedness to public sector officials (Kissler, Fore, Jacobson, Kittredge, & Stewart, 1998). Many critics highlight these concerns and continue to treat strategic planning as a fixed object instead of a system comprised of many interacting and changeable parts (Bryson, Crosby, & Bryson, 2009).

In taking this approach it is easy to overlook the progress and evolution of the strategic planning process. Strategic planning is generally accepted to include, "clarifying mission and values, developing a vision of the future, analyzing external challenges and opportunities, assessing internal strengths and weaknesses, developing strategic goals and objectives, identifying strategic issues, developing and evaluating alternative strategies, and developing action plans" (Poister & Streib, 2005, p. 46). What ends up mattering the most "is the degree to which it (strategic planning) focuses the organization on what is important, orients the organization to identification of strategic issues, and develops the internal process where strategies and priorities are established" (Abels, 1989, p. 294).

The Early History of Strategic Planning

Strategic planning as a management tool is a relatively recent phenomenon, proliferating in the private sector during the early part of the twentieth century and not appearing with regularity in the public sector until Luther Gulick contributed POSDCORB to the Brownlow Commission in the late 1930s. It was not until the late 1950s and early 1960s that strategic planning truly began to gain traction (Bryson, 2010). Many attribute the growth to the programs instituted during the Kennedy administration by Defense Secretary Robert McNamara (Young, 2003). The goal was to increase department efficiency through planning, while still addressing long-term agency needs (Young, 2003). Vietnam notwithstanding, McNamara's effort to implement strategic planning was generally successful and did not go unnoticed. Multiple states and municipalities began to pick up on and utilize the planning and efficiency principles adopted by McNamara in the Department of Defense (Borins, 2010; Young, 2003). These efforts have led some to refer to Defense Secretary McNamara as the "godfather" of public sector strategic planning (Borins, 2010).

Strategic Planning in the Public Sector

While strategic planning began to come to prominence in the 1960s within the federal government, its prevalence across the country was still quite small. It was not until the early 1980s through a series of economic, political, and societal events leading to significant governmental reform, that strategic planning began to be utilized frequently throughout multiple levels of government (Berry & Wechsler, 1995; Bryson & Roering, 1988; Denhardt, 1985; Hendrick, 2003). The Reagan-era market reforms that ushered in what came to be known as New Public Management turned out to be a major catalyst for the rise in public sector strategic planning due to their emphasis on greater efficiency through market-like reforms. Prior to this point, much of the planning taking place was done through capital budgeting and comprehensive city planning, which as Bryson (2010) points out was far from comprehensive. The Reagan-era reforms coupled with increasing attention brought by multiple authors in the early 1980s about how private sector planning could be applied within the public sector helped to spur a new era of truly comprehensive municipal government planning (Bryson, 2010). Strategic planning became "the" new innovative strategy in public management, "promising public agencies the benefits of a rational and highly structured, future-oriented management technique borrowed from the best run private sector companies" (Berry & Wechsler, 1995, p. 159). All the while this systematic, self-analyzing strategy was revolutionizing public sector planning, technology lagged behind. By the early to mid-1980s computers were available but hardly at the same price point or level of functionality that we enjoy today. For the most part the technology remained quite like that utilized by Defense Secretary McNamara nearly two decades prior. While greeted enthusiastically by the public sector, individuals were still voicing numerous complaints about time, measurement, accountability, and actual use and value of strategic plans (Berry & Wechsler, 1995).

The Beginning of the Digital Revolution

Strategic planning began to gain a foothold at a time of great upheaval in the public sector. As Denhardt (1985) notes, the social and technological changes overtaking the country and the world in the late 1970s and early 1980s led to increasing turbulence and complexity for government. The diversity of the challenges, ranging from the oil crises of the 1970s, changing demographics and values, inflation, and

a further outsourcing and devolution of traditional government responsibilities had a profound effect on government service delivery and both technological and organizational form and function (Bryson & Roering, 1988; Orlikowski, 2000). These changes, highlighted within the New Public Management reforms of the 1980s, further outlined the need for effective strategic planning (Bryson & Roering, 1988).

The problem seemed to become not whether strategic planning was a good idea, but how to carry it out effectively (Bryson, Crosby, & Bryson, 2009; Bryson & Roering, 1989; Kissler, Fore, Jacobson, Kittredge, & Stewart, 1998; Mansor & Tayib, 2012). The beginning of the digital revolution in the mid to late 1980s, characterized by the growth of the personal computer, began to answer this question by further altering traditional forms of government and offering multiple tools to make strategic planning more accessible and impactful within the public sector. This massive growth in technology revolutionized information systems, transporting it from a task primarily centered on “efficient data processing” to one viewed as increasingly “central and critical to an organization’s growth and survival” (Venkatraman, 1985-86, p. 66). This growth in computer and communication technology and the resulting possibilities unlocked through information systems and data collection and analysis further cemented the need for full-on public sector strategic planning. As Venkatraman (1985-86) states this significant investment and the “increase in resource commitment requires systematic planning approaches for ensuring that the resources are deployed both efficiently (in the short run) and effectively (in the long run)” (p. 67). The vast increase in information technology transformed strategic planning. With technological advances came a number of additional challenges, namely how to incorporate and evolve information technology from its traditional role as an “administrative support toward a more strategic role within an organization” (Henderson & Venkatraman, 1999, p. 472).

The rapidly changing nature of government and technology in the digital age led to many reforms crucial to the success and popularity of strategic planning, but perhaps none more so than the Government Performance and Results Act of 1993 (GPRA) (Poister, 2010). This act, under the Clinton Administration’s National Performance Review, required all federal agencies to engage in periodic strategic planning practices (Poister, 2010). As Berry (1994) notes there were more than 250 state agencies in nearly every state already engaging in strategic planning activities during the 1980s. With the passage of the GPRA this number increased exponentially not just in the required federal agencies, but in state agencies as well. Berry and Wechsler, (1995) in a national survey of state agencies found that nearly 60 percent of respondents were using some form of strategic planning and of those not, nearly nine percent had plans to do so in the future. Of those polled, 47 percent began using strategic planning from 1985-1989 and an additional 39 percent instituted programs from 1990 to the time of the polling (Berry & Wechsler, 1995). By 1997 as required by the GPRA, all federal agencies were conducting strategic planning; however, the nagging question of strategic alignment remained. Specifically, individuals were still questioning how to best incorporate and make use of information and communication technology that was critical to the effectiveness of strategic planning (Henderson & Venkatraman, 1999). At the federal level, it was very much an unbalanced effort, as some agencies dove in headfirst and others simply scraped by meeting the minimum requirements for compliance. This led to further mixed efforts and something of a carrot and stick approach in which the government attempted to update regulations to provide enough incentive to get as many agencies as possible to engage in strategic planning in a manner that would result in more than just compliance but effective and meaningful strategic planning.

The Growth of the Internet and Email

The growth of the internet and email has had a profound effect on how government works. Much like the Reagan-era reforms a decade prior, the information age ushered in by an increasingly connected society posed substantial challenges to the traditional ways of governance. The economy was reshaped by the advent of new technology, which also led to increasing global markets, and a much more interconnected world and marketplace (Kissler, et al., 1998). This period of innovation highlighted the role that technology can have in reshaping society and the challenges resulting from such innovation. Bryson, Berry, and Yang (2010) attribute these challenges to the growth of the internet, stating that it is “transforming the nature and patterns of public service; therefore, strategic management must reflect this reality” (p. 511).

As society has become increasingly globalized and networked, much of the challenge and potential for strategic planning and organizations lies in “information and communication technology advancement” (Bryson, Berry, & Yang, 2010, p. 511). Information technology strategic alignment has evolved from a task of managing resources to one that attempts to determine how to leverage internet based strategic technologies to “enhance efficiency, service quality, democratic participation, and seamless e-governance” (Yang & Melitski, 2007, p. 428). By increasing participation and communication amongst stakeholders, organizations are increasingly likely to ensure individuals are on the same page and there is some level of goal congruence (Ketokivi & Castaner, 2004). In order to achieve goal congruence, “organizations have to find appropriate relationships between the ‘entrepreneurial’ problem (which strategy to adopt), the ‘engineering’ problem (which technologies to use), and the ‘administrative’ problem (which processes and structures to select)” (Boyne & Walker, 2010, p. S188). Balancing these problems in a way that will effectively give credence to each has become increasingly difficult in an era of constant innovation and online technology. Borins (2010) expresses concern that using technology to make strategic planning broad based and accessible may also open it up to further manipulation and political manipulation. Whereas Holley, Dufner, and Reed (2004) raise the concern that by balancing out such problems raised by Boyne and Walker (2010) through technological innovation, it could potentially lead to what they term “islands of information” (p. 106). These “islands” are basically systems characterized by uncoordinated information technology and communication in which information systems fail to communicate with each other; either there are compatibility issues, or the information systems simply exist as redundancies (Holley, Dufner, & Reed, 2004, p. 106). This “computerization” of the planning process has been “highly controversial” and the balancing act of using information systems effectively and integrating them properly into the planning process has raised several additional issues for planners (Poister, 2010, p. 247).

Representational diversity is one such problem (Borins, 2010). Borins (2010) calls the representational issues one of “the main challenges for online strategic planning” (p. 221). At issue is how those engaging in the strategic planning process, ensure there is a diverse representation of the population (Borins, 2010). Maintaining diversity comes down to ensuring that equal voice is given to all involved and that regional demographics and population differences are accounted for (Borins, 2010).

While the challenges are many, the effective use of information and communication technology in the strategic planning process can be highly beneficial for a given organization. Information and communication technology “may be used to achieve greater government efficiency, better service quality, and more democratic participation” (Bryson, Berry, & Yang, 2010, p. 511). Environmental assessments (Denhardt, 1985), information retention and storage, as well as faster and easier feedback mechanisms are just some of the many benefits of utilizing information and communication technology in strategic planning.

Even with the vast potential of the internet for strategic planning, many organizations had yet to effectively figure out how to harness and take advantage of such technology when it was first becoming available. Many strategic plans were internal, and organization centric, prioritizing concerns of internal efficiency over transparency, engagement, and openness (Yang & Melitski, 2007). This lag between effective incorporation of technology and the planning process is one that severely hampered the potential of the technology for strategic planning. While the rise of the internet and email has led to greater attention given to the use of technology in the strategic planning process, the complexity and prevalence of multiple factors including politics, conflicting goals, and conflict have severely hindered the scale and effectiveness of public sector strategic planning (Bryson, Berry, & Yang, 2010).

While public sector strategic planning has increasingly turned to information and communication technologies, the debate early on was centered mainly on whether the internet would be a blessing or a curse for democracy (Barber, 2001). While great progress has been achieved, especially when compared with a decade prior, setting long-term strategic goals and effectively estimating the potential of new technologies has proven to be a difficult balance (Vishnevskiy, Karasev, & Meissner, 2016).

The Social Media Era

The social media revolution that has occurred over the last decade has seen the transition of the internet from a static mechanism to a large, thoroughly integrated platform. Strategic planners who were hesitant to embrace the internet and technology were left little choice after the success and restructuring of online networks in the wake of the dot-com bubble bursting. The resulting innovation further pushed technology forward by promoting greater involvement and connectedness through open-source collaboration (O'Reilly, 2005).

With the growth of social media, starting predominantly with Facebook and Twitter, and moving into several new and intriguing directions has afforded public administrators with multiple tools to utilize in order to impact and ease the strategic planning process through greater transparency, participation, and data storage and dissemination abilities (Bryson, 2011). While Facebook and Twitter were created as social networking services for individuals to connect and share, it was not long before private-sector entities began to leverage these networks for their business goals. As innovation in the public sector is often slower and more deliberate than in the private sector, it has only been recently that many public sector organizations have begun to follow private sector leads in utilizing social media technologies in the strategic planning process. Bryson (2011) highlights the many potential benefits, but Magro (2012) cautions that a careful and cautious approach is necessary in order to avoid the potential challenges brought on by a fast-moving online environment.

Many government agencies have begun to employ social media in the strategic planning process. The census bureau is just one example in which the agency employs and maintains several social media platforms to receive feedback and communicate with individuals to help inform the planning process on a continual basis (Desouza & Bhagwatwari, 2012). While there has been significant progress within the federal government in employing social media for planning and transparency initiatives, the results have been more uneven at the state and local levels (Magro, 2012).

Ultimately the marriage of strategic planning and social media through the evolution of technology is one that shows great promise but will take time and training to best utilize new and evolving technologies in a strategic manner (Fleck & Bryson, 2011; Magro, 2012). While significant research is needed to determine how to best align social media practices with effective strategic planning, if policy makers are able to keep up, the potential is undeniable (Magro, 2012).

Crowdsourcing

Another opportunity for public sector planners is the rise of crowdsourcing. First referenced in print in 2006 by Jeff Howe in an article for *Wired Magazine*, crowdsourcing is a form of open-source collaboration, where individuals bounded by support of an idea come together through several technological channels in support of the idea. Crowdsourcing began to gain traction in the private sector with the success of *Kickstarter* and *Indiegogo* right around the time of the Great Recession. As the community has continued to grow, public sector involvement has increased. Many of the platforms, often pitched as a faster and more efficient way for municipalities to deliver goods and services to constituents, change the existing budget/funding/planning dynamics of government and allow consumers to support and fund the programs they believe in.

SOLUTIONS AND RECOMMENDATIONS

Under the auspice of the public administration paradigm of New Public Management, the concept of strategic management sought to provide a solution to the established tactical and operational mindset firmly grounded within traditional bureaucratic organizations. Considered to be a product that assists in collaborative forecasting and the creation of short- and long-term goals within the private sector, strategic planning slowly assimilated into the public sector to promote both the establishment of organizational objectives and efficiency. Whereas the establishment of an agency mission and objectives through strategic planning has dramatically improved the planning and operational capabilities within the public sector, multiple challenges were faced throughout both the sectoral assimilation and acceptance process. Although widely embraced through multiple sectors, strategic planning was never dynamically conceptualized to integrate new methods of collaboration and facilitatory technology established after cultural and societal changes. The current shifts in knowledge and information management within the strategic planning process from a team-centric to a broader organizational perspective also challenges the methodology of how technology was utilized to obtain information for strategic management activities.

Although strategic planning has developed into a universal instrument for charting the course for public and private sector agencies over the past several decades, the dynamic organizational environment of tomorrow presents a challenge to the current broad definition attributed to strategically planning for an organization's future. Sampler (2014) argued that the current concept of strategic planning is obsolete due to the rapid rate of change, the complex networks and collaborations replacing traditional hierarchical organizations, and the adaptive work needs to press forward with less reliance on past practices and performances. Bryson, Edwards, and Van Slyke (2018) justified the position of obsolescence, as the current conceptualization of strategic planning involves a rigid framework based upon standard procedures and an analysis of past performance measurements for current operations.

Strategic planning is often perceived as an act of setting the course utilizing current knowledge, skills, and experiences. In an effort to align strategic planning with the complexities of the unknown future, Bryson et al. (2018) posited that strategic planning should be viewed as a function that focuses on a "temporal horizon" (p. 327) rather than concrete objectives that may have been developed utilizing limited and skewed foresight. The functional definition of strategic planning, when supplemented by open input and discourse, may help to compensate for the human mind's inability to engage in the rational forecasting of unknowns.

Bolisani and Bratinu (2017) advised that collective organizational knowledge may be used to supplement the gap between the limited rationality of decision-makers and the dynamic and uncertain needs of the future. Organizational collaboration through technology may facilitate the collection of knowledge from multiple layers and employees within an organization while promoting stakeholder buy-in within the strategic planning process (Bolisani & Bratinu, 2017). Bryson et al. (2018) advised that while current strategic planning efforts are limited to a specific group or team, collaborative efforts to engage organizational members are noted to improve the strategic planning process through the collection of varying ideas and forecasts. In conjunction with the functional definition of strategic planning, collaborative technology such as conferencing programs, social media, and crowdsourcing may enhance the volume of diverse ideas to help forecast both the needs and future objectives of an organization. Although the collaboration and communication of agency ideas may facilitate the planning process, the ideas may only represent a specific paradigm if the collaboration efforts do not include a diverse source of information (Pope, 2004). Collaborative technological platforms, such as social media and crowdsourcing networks, have the potential to bring a diverse range of stakeholders to the table, facilitating a more productive conversation, (Buehring & Liedtka, 2018), while promoting open strategic planning (OSP), grounded in transparency, collective inclusiveness, and information technology (Amrollahi & Rowlands, 2017).

Future Research Directions

The concept of strategic planning has transitioned from a rigid, procedural act to a function of collaborative engagements. With this transition, collaboration has changed from face-to-face discussions to the discourse between physically distant agents facilitated through technological advances in computers and digital communications. As with the case of forecasting the future based upon what is both known and unknown, modern advancements in technology present both welcomed solutions and theoretical questions. The novel concepts of social media and crowdsourcing provide both solutions to existing problems and a future capacity predicated only through additional research.

As the collaborative basis of strategic planning shifted from a limited team-centric involvement to vast social and organizational networks, existing social networking technologies, such as social media, were embraced to facilitate communication within distant and diverse populations (Hautz, 2017). The utilization of social media as an environment for the transfer of ideas has supplemented the legacy forms of personal communication such as telephones and text messaging (Wirtz, Daiser, & Mermann, 2018). Social media has been widely accepted across many sectors for the purposes of strategic planning, yet much work remains in identifying how the characteristics and efficiency of bilateral digital discourse differ dependent upon sector, industry, and technological platform (Hautz, 2017).

In addition to social media, crowdsourcing has emerged as a positive tool to increase collaboration amongst stakeholders working within a strategic planning function. Although research about crowdsourcing and open strategic planning has exponentially increased over the past decade, it remains very much in its infancy. Ghezzi, Gabelloni, Martini, and Natalicchio (2018) have begun exploring how to best leverage the crowd and similar attributes of open strategic planning based upon the Input-Process-Output (IPO) framework. Within this framework, Ghezzi et al. (2018) posited that future research should focus on the structure of problems and questions presented to the potential solvers. As problems and request for ideas may be innately complex, research is needed on how to dissect problems and requests to promote the most efficient work of the agents of whom information is being requested (Ghezzi et al., 2018). If the request for information or problem is not framed to reduce ambiguity, the utility of the returning information may not be compatible with the objectives of developing the strategic plan. In conjunction

with developing the proper framework of requests, additional research is needed on establishing the motivational and beneficial factors of both those seeking information and those providing information (Ghezzi et al., 2018). For crowdsourcing to yield the most productive information, it may be imperative for the facilitators of the strategic planning process to understand what would motivate the greatest number of agents to provide the maximum amount of information. Better understanding citizen engagement, motivation, and encouraging organization management to embrace the diverse ideas received from stakeholders will be critical to unlocking the wisdom of the crowd (Ghezzi et al., 2018; Jordan, Yusuf, Mayer, & Mahar 2016). The failure to include stakeholder ideas may promulgate a lack of buy-in and a sense of non-inclusiveness which may hamper stakeholder interest and public-sector utility.

As crowdsourcing may provide an organization with an overload of information irrelevant to the objective of strategic planning, cost-effective and resource-sensitive measures should be developed to adequately evaluate and sort through the information to determine the qualities of utility and validity. Understanding how people, organizations, information, and technology interrelate is imperative to the effective use of crowdsourcing in strategic planning (Zhao & Zhu, 2014). As the dynamics of a societal culture may be proportional to the level of technological innovation, further research into the integration of crowdsourcing instruments, such as wikis, social media, podcasts, and blogs, is needed to maximize the informational return of crowdsourcing. (Zhao & Zhu, 2014).

As the definition of strategic planning is ever evolving, the collaborative efforts to retrieve information for the planning process changes as well. Continuous research into social media and crowdsourcing platforms is needed to keep up with societal changes as well as to adapt to the changes in technological platforms that may be utilized to retrieve information from a vast and diverse population.

CONCLUSION

Strategic planning has grown from a military strategy to a private sector tool, and finally to a critical public sector innovation. Much of the reason for this public sector growth has been the parallel growth of technology and the changing nature of government over the last quarter century. At a time when public service delivery is increasingly complex and devolved, the need for efficient and effective public sector strategic planning is perhaps greater than it ever has been. Fortunately, the growth of strategic planning has been met, and in many cases exceeded by the vast technological developments of recent years. These advances provide innumerable possibilities for increasing efficiency, capacity, service quality, transparency, and participation if they are utilized correctly (Bryson, Berry, & Yang, 2010).

As Abels (1989) states, strategic planning can be invaluable to a public organization as a tool to gain consensus and determine goals; however, in order for this to happen the organization must “be meticulous in the design of the planning methodology with safeguards integrated into the process that will ensure planning continuation during organization crises or when planning enthusiasm wanes” (p. 295). Technology can do this. It can alter the nature of public service delivery as advances in the internet and the use of social media have begun to show. While the literature has yet to catch up to these advances, the potential is there for strategic planners, but in order to maximize this potential while limiting risks, strategic planners must proceed in a deliberative and cautious manner (Magro, 2012). Technology has and is still changing the nature of public service, and strategic planning must reflect and account for it (Bryson, Berry, & Yang, 2010).

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KEY TERMS AND DEFINITIONS

Collaboration: Being an active member of a group working toward a common goal.

Crowdsourcing: Using technology to engage and collect citizen input; leveraging the ‘wisdom of the crowd’.

Networks: Increasingly digital, networks allow the sharing of resources and collaboration of stakeholders.

New Public Management: The government paradigm that advocated running government like a business, with emphasis on efficiency.

Social Media: Websites and applications that allow users to create and share content within a social network.

Strategic Management: The overarching management process of determining how to achieve strategic planning goals.

Strategic Planning: A collaborative approach to organizational planning consisting of concepts and tools that align the present state of an organization with the future's goals and objectives.

5

Viability of the Sustainable Development Ecosystem

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1. INTRODUCTION

Sustainable Development (SD) concerns bearable and sufficient economic and social progress and growth—initiatives and strategies designed to enhance the quality of life of a community's citizens or, at the minimum, stabilizing or securing the current state whilst not overtaxing the environment. SD is founded on key principles of sustainability as well as assumptions about society, economics, and the environment—basically about our nature, existence, and “how things work”. As commonly understood, Sustainable Development is development that meets today's demands without compromising the survival of tomorrow (Kates et al., 2016). Thus, Sustainable Development should also be concerned about environmental protection and regeneration, reducing degradation and depletion, finding sustainable alternatives, and restoring what has been spoilt or overexploited. As lofty and “macro” as all this may sound, SD may also be applied at the “micro” level, at the organisational, departmental, or even team level.

At a global level, SD may attempt to address issues of equality, fair distribution, and access, such as championed by the United Nations Global Compact and its 17 sustainable development goals. A prime example is education: a community whose citizens have little chance of becoming educated has slight chance of long-term viability¹ beyond bare subsistence. Individuals lacking skills and knowledge cannot, generally, better their personal circumstances nor can they contribute productively to community welfare.² But whilst the ideals and aspirations of SD are laudable, if not presumed necessary, are they really possible?

This article pursues the question: *how viable is Sustainable Development?* The question might be framed alternatively as, “Is Sustainable Development sustainable?” To interrogate and explicate this question, the authors present an ecosystem model of Sustainable Development, with “ecosystem” defined for this purpose as the complex of interdependent animate and inanimate constituents of a given, or “bounded” community and their interaction, which, over time, reveals established patterns (Hays, 2010a; Hays, 2010b). By interdependence we mean continuing relationships of influence amongst elements that might be understood as cycles of cause and effect (or stimulus and response). This applies to the elements within the system (the bounded part) as well as with its external environment.

Organisations and institutions may be thought of as ecosystems as well, bounded entities inextricably tied to various stakeholders, vying for resources, and in malleable and evolving relationships with their environment.³ To understand an organization as ecosystem is to fathom its richness, complexity, and dynamism—the see it and its relationships as a complete and functioning system. Conceived thusly, an organization is both separate from its environment (bounded), yet inseparable from its larger system and web of relationships (interconnected).

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An ecosystem is inextricably tied to its environment, implying a dependency and continuous exchange. Under normal circumstances, all of these mutual influences promote a dynamic balance in the ecosystem. Things stay pretty much as they are unless disrupted by some unexpected, uncommon, or extreme event (Hays, 2013). In fact, and as we will show in portrayal of the SD ecosystem, knowing the elements in the system and the character of their relationships helps us make sense of the system's dynamic behaviour, and is what allows us to predict the system's behaviour under various circumstances. Such is the power of the map: an intervention at a particular point is going to have reasonably predictable outcomes.

We usually think of ecosystems as being impacted by external events, such as a community might be affected by a devastating forest fire. It is also the case, however, that ecosystems may have within them—perhaps unwitting or undetected—the seed, or *potential*, for spontaneous transformation triggered by some random stimulus. This emergent property might be destructive or may confer some attribute that will ensure the system's survival, an adaptive quality or resilience suited to shifts in the environment, for example, a threat or opportunity it presents (Walker et al., 2004).

Building on these ideas of Complex Adaptive Systems and the authors' respective and ongoing collaborative research spanning several years into various aspects of sustainability⁴, the authors have developed and present here for the first time a dynamic model of SD as an ecosystem, identifying the key features or variables in the system and their interrelationships. Whilst the approach is novel so far as we know with respect to SD, it is defensible in this case for at least two reasons: such models have been proven to be very instructive in other complex domains⁵, and SD generally focuses its attention at the community or regional level—ecosystems⁶. Positive results may be predicted from systemic interventions because understanding of the features and relationships within the ecosystem allows efforts to be applied to the points of greatest leverage, as has been pointed out in numerous studies⁷.

One hypothesis arising from this fact is that SD initiatives that address their interventions on the target community or region *as a complex adaptive ecosystem*⁸ will be more successful in the long run than initiatives that focus on a particular problem or issue, such as water security or vaccination programs. The same holds true for organisations and institutions, as has been researched with respect to organizational change and development.⁹ This is due, in part, to leverage and synergy amongst efforts made possible through *true-to-life* system mapping and deep understanding of behaviour causality, complemented by deliberately disregarding interventions, that well-intentioned providers might be misled to, based on a more superficial and reactive understanding of symptoms and assumed problem causes (Hays, under review).

The case of a sustainable communities project underway in rural Kenya is briefly described in the article as an example of an ecosystems approach to SD. The case qualifies as an ecosystems approach as it involves a multipronged set of interrelated sustainable initiatives addressing a given community as a Complex Adaptive System. Initiative streams cover: power (particularly directed toward lighting and refrigeration); water security; sanitation, hygiene, and medical care; education and skills-building; agriculture and livestock; industry and commerce; and includes a *train-the-trainer* concept that will enable the progress made and lessons learned from the program to extend to neighbouring communities.

The sustainable communities project is also an example of circular economy (Geissdoerfer et al., 2017; Sauvè, 2016) as resource acquisition, production, use, and reuse are contained and exploited, and profit reinvested into and benefitting the sustainable system and its citizens rather than being funneled into the amassing hands of a few or siphoned off to elements outside of the bounded system. Whilst it is too early to claim success, sustainable communities has the hallmarks of a SD program that might succeed—genuinely make a difference at the local and, quite possibly, regional level.

An important feature of the sustainable communities program is its conscious adoption of and adherence to proven principles of sustainability¹⁰ that can be designed into systemic SD solutions. These

principles and how they apply in the SD ecosystem model are outlined further on in this chapter. As just one example, albeit a prime one, the principle:

*Strive to become self-sustaining and self-sufficient (lessen dependence on external support and funding).
Build internal capacity through learning.*

serves as a reminder that external funding in terms of “charity” (giving a man a fish) is both reinforcing and self-defeating (and the dynamics can be mapped showing the predictable consequences). On the other hand, if the man can become productively educated and acquire useful skills, then he needs no charity and becomes self-sufficient (teaching a man to fish). Of course, it may be the case that an individual (or community) is not immediately or easily converted from a passive, dependent existence to a more proactive, independent, and self-reliant one, a complex phenomenon whose persistent behaviour can also be mapped. Comprising a blend of experience, confidence, knowledge, skill, opportunity, values, expectations, and motives, it is easy to see the scale of impediments to becoming self-sufficient. At the same time, these attributes all need to be addressed in order to achieve sustainable change, and this is an objective of the project in Kenya.

This kind of thinking—attempting to understand dynamic causality in complex behaviour—underpins Causal Loop Diagrams and, indeed, the authors submit, is essential to understanding why some Sustainable Development initiatives succeed and others fail. Our objectives are to increase the success rate.

2. PRINCIPLES OF AND CRITICAL SUCCESS FACTORS FOR SUSTAINABILITY

In this section we identify five Critical Success Factors (CSFs) over which we have some measure of control and 13 related operating principles (OPs). These CSFs and OPs derive from experience with attempts to implement sustainability programs,¹¹ and reference to extant literature, including published research on the closely-related phenomenon of organisational transformation.

Critical Success Factors¹²

Leadership

It is practically a given that leadership be included as a CSF for sustainability programs, as it is widely assumed that change cannot happen without strong leadership.¹³ But, here, we refer not merely to guidance, support, direction, and inspiration provided by traditional authority figures. We emphasise the leadership inherent or potential in the ecosystem that emerges and is developed through activity, experience, and opportunity. This is not positional leadership, but a distributed, shared, and shifting leadership (Sweeney et al., 2019) that steps up when, where, and how needed. If the system does not have its own inherent or developing leadership, it will fail to thrive.¹⁴ Thus, leadership succession and development are essential for sustainable operations.

Emergence

Emergence is a quality of Complex Adaptive Systems whereby a new feature of the system comes about as a result of interactions amongst the system’s elements (Jagustović et al., 2019).¹⁵ There would be

many interactions in the sustainability ecosystem, with various balancing, propelling, moderating, and reducing influences between and amongst elements. Emergence can be a good thing, and may even be essential to long-term survival. In a human social system, emergence can include most anything, from leadership, through ideas and methods, to relationships—all of which may lead to opportunities. Rules, rigid expectations, or restriction may stifle or repress emergence such as one might see in a resolute bureaucracy. On the other hand, flexibility allows emergence to happen and preparedness enables capitalising upon opportunities (Dahlberg, 2015).

Framework

Despite need for flexibility, a framework within which individuals can work and learn is important. For example, what is important to achieve should be clear, consistent, and consensual. How goals are to be pursued should also be understood and complementary strategies followed. While individuals and groups in an ecosystem may have different goals, approaches, and perspectives allowing for emergence, (if complementary) their unified efforts should be related to sustainability—both achieving and embodying sustainability. This is why we propose operating principles and guidelines rather than stipulations, aiming to instill a set of values and aspirations that provide unifying and beneficent purpose, direction, and ways of being and working.

Culture

By culture, we mean shared values, common interests, and complementary behaviours amongst the group.¹⁶ Common behaviours are the result of and further instill ways of doing, being, and working that come to be expected from members of the group and, presumably, productively serve the group.¹⁷ Here, rules, norms, customs, traditions, language, symbols, and communication patterns all apply (Chen, 2016). To achieve long-term sustainability, a culture of continuous learning and development must be cultivated (Beyerlein et al., 2017). As Hays et al. (revise and resubmit) have stated,

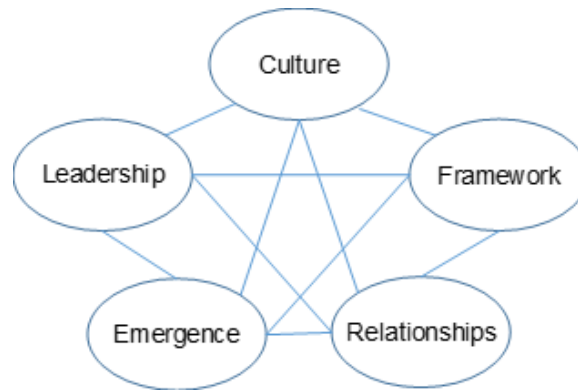
An organisational culture of sustainability engages most members continually and is rewarding to do so. It orients new members and embraces them into the doing and being of sustainability. Obvious facets of such culture-building include the codified vision, values, and priorities for sustainability and Corporate Social Responsibility, with every member ... having relevant and respective accountabilities (np).

Relationships

An operational ecological-ecosystem view of the world adheres (and is subject to) the interconnected “web of life” notion (Capra, 1996; Capra, 2007). It is probably the case that little that is complex, enduring, and important can be achieved alone (Solon et al., 2018). There are too many factors impeding progress to get much traction independently. But there is strength in numbers and diversity (Ingegnoli, 2013). Interaction and collaboration with different people and organizations may pose challenges, but confer capabilities and capacities that single-mindedness simply cannot (Hays, under review).

This section presented five Critical Success Factors for viable SD. These are shown in Figure 1 as an interlinked set. The five are not the entire ecosystem, but do collectively comprise a major part, as discussed below. Whilst each factor has its own distinct attributes, they all overlap and interact; they work together to “power” the SD ecosystem. This is the idea of synergy—interaction amongst elements

Figure 1. Five Critical Success Factors for viable Sustainable Development



in a system produces attributes and outcomes unaccounted by the simple sum of the individual parts (Lee and Green, 2015). Without all of these factors, we suggest, SD will fail in the long run. With them, a robust ecosystem may be possible.

The next section enumerates Operating Principles for viable SD. As space precludes elaboration, we do not explain each principle here; but will incorporate them into the discussion of the viable ecosystem model (Causal Loop Diagram) that follows.

Operating Principles

In addition to the Critical Success Factors identified above, the following operating principles added value in the sustainability projects in which we’ve been involved or needed in the ongoing work.

Table 1. List of operating principles

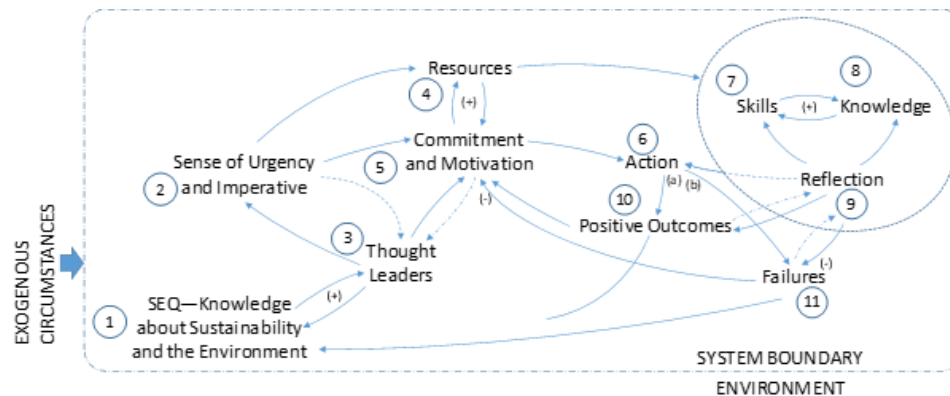
■ Find and build champions.	■ Plan for succession and evolution.
■ Find a meaningful job for everyone.	■ Plan and host multiple events and activities.
■ Have and keep to a learning and research agenda.	■ Empower, decentralise, encourage initiative.
■ Permit energies and resources to flow towards and with good ideas.	■ Interact, collaborate, and build partnerships. Promote diversity.
■ Envisage sustainability as a daily discipline and set of practices—develop mastery.	■ Befriend nature and the environment. Act as concerned citizens within the “web of life”.
■ Build sustainability into the system: codify, educate, embed, and reward sustainability measures (such as durability, adaptability, sufficiency, efficiency).	■ Operate with integrity and ethics. ■ Always think of the bigger picture and the part that each element plays in it. Act in accord with long-term benefit, rather than short-term ease or gain.

3. CAUSAL LOOP DIAGRAM

This section presents a basic Causal Loop Diagram (otherwise known as a relationship or influence diagram) of the Viable Sustainable Development Ecosystem. Belying its complexity, the diagram is portrayed to comprise 11 elements, or concepts, each of which is explained in the sequentially-numbered paragraphs below. Relationship diagrams add value to understanding complex system phenomena in

at least two ways. First is identification and explication of key variables or factors, here referred to as concepts. Second, and more importantly, relationship diagrams trace the direction (if not power) of influence between and amongst system variables.¹⁸ For example, in Figure 2, Commitment and Motivation, Item 5, is shown to be influenced by both Positive Outcomes, Item 10, and Failures, Item 11, albeit in diverging directions. In this case (and as explained below), these affects make sense to the reasoning mind and are clearly established in reinforcement theory.¹⁹ How and why they apply in our model of the viable sustainable development ecosystem is explained below. Beginning to reveal the true complexity of the ecosystem, each concept (items 1-11) is described with respect to the Critical Success Factors and Operating Principles discussed in the previous section.

Figure 2. Basic Causal Loop Diagram of the Viable Sustainable Development Ecosystem



In general, it does not matter where you start in a Causal Loop Diagram as the elements are all connected in some way, sometimes intricately or subtly, the “web of life” idea. But for practical purposes, you have to begin somewhere. In this case, we have labelled SEQ, Knowledge about Sustainability and the Environment, located in the lower left-hand of the diagram, item 1.

Finally, before beginning our “walk around the map”, please remember that this relationship diagram attempts to depict the *viability* of SD. Viability will depend on the virtuous dynamics displayed by the ecosystem, and will be undermined by vicious cycles allowed to enter or permitted to continue operating in it.

1. SEQ—Knowledge about Sustainability and the Environment

To read the relationship diagram, trace the lines of influence connecting elements. Here, you will note that SEQ is connected to Items 2, 3, 4, 10, and 11. The number of connections an element has to other elements indicates its relative importance or prominence in the system. Thus, SEQ is one of the moderately significant elements in our ecosystem, surpassed only by Commitment and Motivation (Item 5), to which we turn shortly.

Implied by SEQ is the collective volume of knowledge, awareness, and appreciation of the members of the ecosystem (community or organization in question) concerning sustainability and the environment—current conditions, understanding of causality, implications for the future, and knowledge with respect to effective strategies and initiatives. This capacity may be developed in a community or orga-

nization in a variety of ways, including committing to a learning and research agenda, allowing energy and resources to flow where they will have likely constructive impact, sponsoring multiple events and activities, and fostering collaborations, partnerships, and diversity. The main Critical Success Factor, here, is building a culture of sustainability.

For now, we see that the sense of urgency and imperative (to act) (Item 2) is fed by SEQ. As SEQ rises (or diminishes) urgency and imperative will rise or fall correspondingly. This is important as urgency and imperative bear on both Resources (Item 4) and Commitment and Motivation (Item 5), and, possibly, to Thought Leaders (Item 3), as well (suggested by the dotted line-arrow. The model would suggest, as is consistent with experience, that initiatives will not initiate or sustain without Resources and Commitment and Motivation.

Also shown as part of SEQ dynamics is that Thought Leaders (Item 3) positively affect Knowledge about Sustainability (Item 1) and vice versa. As one goes up, so does the other. This is a positively reinforcing loop, presumably a virtuous cycle, if we are interested in the viability of sustainable development. Of course, the opposite is also true, if one goes down, the other will reduce as well. Thought leaders include any individual or organisations that fill positions of influence. They could be scientists, business and government leaders, or influential members of society and media personalities. Obviously, the less ambiguous, debatable, or conflicting their messages, the greater the impact of Thought Leaders.

Continuing, we see that Resources (availability) (Item 4) impacts SEQ. Greater Resources would build increasing SEQ through education, training, and public service communications and information campaigns. Resources include funding, time, and people devoted to sustainability and the environment, including those directed toward Corporate Social Responsibility initiatives.

Finally, we see that Positive Outcomes (Item 10), that is “success stories” from sustainability and environmental initiatives, and “bad news”, Failures (Item 11) from efforts both affect SEQ by providing more information about what works and what doesn’t, as well as if effort is even worth the investment. This is reinforcement theory at its best. It would be reasonable to assume that the greater the number and kind of Positive Outcomes and the awareness about them would “fuel” the viable sustainable development ecosystem.

Sense of Urgency and Imperative

Sense of Urgency and Imperative has already been partly discussed in Item 1. Key points are that it is influenced mostly by SEQ (Item 1) and Thought Leaders (Item 3). A building Sense of Urgency and Imperative is driven by threat or fear—dire reports on current conditions or predictions about impending consequence of previous misuse or neglect. Whether or not founded on fact or grounded in reality, perceived threat can drive attention resulting in greater resource allocation (Item 4) and Commitment and Motivation (Item 5) to act, key drivers of mobilisation. Either or both of these effects can lead back to SEQ (Item 1), directly and indirectly, with Thought Leadership (Item 3) also being affected.

Referring to our Operating Principles, those most applicable here are having and keeping to a learning and research agenda, conducting diverse events and activities with a range of stakeholders, encouraging collaborations, partnerships, and diversity, and connecting individuals and units to relevant Thought Leaders. Whilst leadership is key, here, in stimulating a sense of urgency and imperative, a framework for channeling that energy is essential. Also critical is a uniting culture in which members feel shared purpose, commitment, and belief that together they may succeed.

It is important to note that Sense of Urgency and Imperative can diminish in either of two cases, which may or may not be desirable, depending on actual circumstances. In the first case, SEQ is weak, thus

there will be no sense of urgency and imperative. In the second case, SEQ is strong, but the state of the environment is presumed to be healthy or improving. Thus, there is no need for urgency and imperative. Practitioners should remain aware of the differential effects of SEQ.

Thought Leaders

As discussed above, Thought Leaders (in this instance) are individuals or organisations known as authorities regarding sustainability and the environment whose opinions are sought and influential. Since they can influence and, possibly, inspire others through word and deed, they impact Knowledge about Sustainability and the Environment (Item 1), Sense of Urgency and Imperative (Item 2), and Commitment and Motivation (Item 5). Thought Leaders emerge through the accumulation of relevant knowledge (SEQ (Item 1)) and, though not shown, becoming recognised or being promoted up the ranks in academic, business, and government organizations as with other specialists and experts. Given this, the most applicable Operating Principles include providing meaningful jobs, finding and building champions, instilling succession planning, and developing mastery. Allowing and encouraging relationships is a Critical Success Factor.

Thought Leaders may emerge or be urged into influential platforms given the sway of Urgency and Imperative (Item 2) and / or the stimulus of Commitment and Motivation (Item 5) inherent in the ecosystem, as indicated by the dotted line-arrows.

Resources

Resource availability and distribution in our ecosystem largely come about due to Sense of Urgency (Item 2) and Commitment and Motivation (Item 5), both elements serving as drivers pursuing resources and relinquishing them. This does not indicate where resources come from, but it is essential in a viable model of sustainability that the system, itself, has the capacity and capability of generating and managing its own resources. This assumption also explains the links toward SEQ (Item 1) and to the Skills, Knowledge, Reflection subsystem (Items 7, 8, and 9) in the upper-right hand side of the diagram. Whilst not immediately apparent, we have to assume that knowledge and skill acquired through education and experience will bear on the system's ability to generate resources and effectively mediate how they are used. Thus, meaningful jobs, empowering and decentralising, mastery, and integrity and ethics in conduct of business are all key Operating Principles. What is needed is to develop a culture of self-reliance.

Commitment and Motivation

Commitment and Motivation occupies a central position in our ecosystem, with no fewer than six connections (relationships with other elements). We have explained the influence of Sense of Urgency and Imperative (Item 2), Thought Leaders (Item 3), and Resources (Item 4) already. Another key factor with respect to Resources and its influence on Commitment and Motivation is that commitment and motivation are likely to diminish under conditions of sparse resources: effort may feel unrewarding to individuals, required for sustained endeavor, and chance of success perceived by members as slim, also a factor undermining optimism and determination.

This notwithstanding, when the element of Commitment and Motivation is high, Action (Item 6) is more likely, some of which results in Positive Outcomes (Item 10). As Positive Outcomes increase, Commitment and Motivation is also likely to go up, forming a positively reinforcing loop.

On the other hand, as Failures (Item 11) increase, Commitment and Motivation is bound to suffer—a negative effect, as indicated by the (-) at the tip of the line-arrow leading from Failures. To stem this affect, supportive leadership is required (not shown in the link), as is learning from failure, also not directly shown, but suggested by the link to the Skills, Knowledge, Reflection subsystem.

Given the nature of and dynamics surrounding Commitment and Motivation, leadership is a Critical Success Factor—keeping individuals inspired, directed toward constructive activity, and rewarded for effort and initiative. An empowering culture of productivity with encouragement to learn from failure is also essential. A framework for action is a third CSF, here, incorporating Operating Principles including ongoing learning and research, allowing energy and resources to flow where they may do the best good and to seed fledgling initiatives, and providing multiple and diverse events and activities that might spawn ideas and give birth to new initiatives.

Action

It could be argued that any action is better than doing nothing. Whilst there is no doubt some truth to that, some actions are better than others, and wisdom may be called for in dictating what course of action to follow or when the chosen course needs to be shifted or halted. Though wisdom does not appear in our model, it is suggested by the link from Reflection (Item 9) to Action, and may be considered an essential quality of our ecosystem leadership CSF, along with the Operating Principles Integrity and Ethics, Big Picture / Greater Good / and Long-Term Thinking, and Befriending Nature and the Environment.

Not just any action, but skillful and appropriate action is also required. In our relationship diagram, this is shown as the function of the Skills, Knowledge, and Reflection subsystem, and funneled largely through Reflection (Item 9). The greater and more effective the Action, the greater the production of Positive Outcomes (Item 10), and the fewer Failures (Item 11).

Not shown, but certainly worth consideration, is that *action reflected upon* will produce learning (Moon, 2013) and contribute to greater Positive Outcomes, so the function and value of Reflection as part of the learning dynamics of our Viable Sustainable Development Ecosystem should not be underestimated.

Skills

There is a wide range of skills required to build and sustain a viable ecosystem. Since, SEQ (Item 1) is concerned with knowledge about sustainability and the environment, we focus here on managerial, technical, and social skills required to solve problems, make decisions and operationalize plans and implement solutions. We also include the skills required for continuous learning, training, professional development, mentoring, and coaching, for these are needed if a system is going to successfully adapt to and evolve within a changing environment. These skills are important to bring into the ecosystem but also to develop amongst existing members, thus one CSF is a culture of learning, along with the particular Operating Principles Learning and Research Agenda, Meaningful Jobs, Succession and Evolution, Empower and Decentralise, and Mastery.

Skills is part of the Skills, Knowledge, Reflection Subsystem, and our maps shows these three elements operating in concert to drive ecosystem learning and performance. Whilst not shown, Reflection (Item 9), itself, is a skill and disposition that can and should be fostered. There may need to be an ecosystem (organizational) framework for reflection and learning and a culture that encourages them.

Knowledge

This is not so much SEQ (Item 1), but knowledge about the business and its environment—the kinds of things every organization needs to know to continue learning. This is knowledge needed to solve problems and to make informed decisions, and to keep the ecosystem evolving to meet changing conditions. Reflection (Item 9) is shown to feed knowledge in our model, so, again, plays a vital role.

Whilst thorough coverage of organizational knowledge is far beyond the scope of our current discussion, it should be clear that a culture of learning and knowledge is critical to the ecosystem's survival, supported by leadership and frameworks that allow emergence and exploitation of new ways of thinking, new ideas, new relationships, and new ways of working. More than anything, this suggests an organic, flexible, and responsive type of organisation unencumbered by bureaucracy and rigid controls.²⁰

Reflection

Reflection and its contribution to learning and effectiveness are extensively covered in the literature, and, as educators, we can hardly conceive of a learning or professional development process or activity that excludes it. In any circumstance, we believe reflection to play an integral role in the learning, adaptation, and evolution of the Viable Sustainable Development Ecosystem. In our map, Reflection is shown to have positive relationships with Skills (Item 7), Knowledge (Item 8), Action (Item 6), Positive Outcomes (Item 10), and, a negative relationship with Failures (Item 11).

Again, Leadership and a Culture that promotes reflection, especially with teammates, colleagues, and partners, will more often than not build learning and resilience and contribute to positive change (Hays and Reinders, 2018). Corresponding Operating Principles include: Building-in Sustainability (in this case, reflective practice), keeping to an evolving Learning and Research Agenda, holding Multiple Events and Activities, Empowering the workforce and Decentralising authority, Mastery, and fostering Collaborations, Partnerships, and Diversity.

Positive Outcomes

Desired, positive outcomes are rewarding in their attainment, but also important in that achievement provides fuel for continued effort. The gratification feeds Commitment and Motivation (Item 5), contributes to amassing knowledge (SEQ (Item 1)), and provides substance for Reflection (Item 9). Given the power and value of Positive Outcomes, an organization should celebrate wins as much as possible, focusing not solely on the specified outcomes, per se, but also efforts, techniques, and processes that lead to achievement.

Failures

Whilst doubtful that anyone really likes to fail, failure plays a significant role in the Viable Sustainable Development Ecosystem. We see that Action (Item 6) and Reflection (Item 9) flow into Failures, and Failures (Item 11) influence Commitment and Motivation (Item 5) and SEQ (Item 1). As Actions (Item 6) increase, that is, initiatives and responses to environmental threats and measures taken to improve sustainability rise, Failures are likely to increase, as would Positive Outcomes (Item 10), other things being equal. This is merely a matter of numbers. What would reduce Failures, other than chance, would be improving ecosystem knowledge and skill as funneled through Reflection (Item 9). Failures would

also diminish if Actions (Item 6) were to decrease, but this is probably not desirable. Both action and failures are likely to reduce in environments averse to risk and where failures are punished, though this dynamic is not shown on the map.

Failures can be productive when learning from failure is exploited. This is indicated on our map by the influence line pointing to SEQ—Knowledge about Sustainability and the Environment (Item 1), in a case of “what works and what doesn’t”. So, we want not to reduce failures, per se, but to reduce unnecessary ones and to optimize *productive failures*²¹.

This discussion on failures highlights the importance of allowing them to occur, perhaps even celebrating them, at least those that shed light on problems and their solutions, and reveal assumptions that may be impeding effective solutions. Likewise, it emphasizes the importance of learning in a viable ecosystem. Thus, again we see our Critical Success Factors at work, especially and obviously Leadership, Culture, and Framework. Some of the Operating Principles evident are Building-in Sustainability, Learning and Research, Mastery, Multiple Events and Activities, and Collaborations, Partnerships, and Diversity

In sum, the Causal Loop Diagram of the Viable Sustainable Development Ecosystem identifies elements and their interrelationships considered to be important for understanding the dynamics of SD. It portrays the ecosystem as comprised of various relationships that at least partly explain why a SD program might succeed or fail. To the degree that elements included and the lines and directions of influence amongst them are correct and complete, the CLD can be predictive—what will happen if we increase Thought Leadership (Item 3)? What are the likely consequences of driving Action (Item 6) in the absence of a learning subsystem (Items 7, 8, and 9)?

No map of a complex adaptive ecosystem can be completely accurate. This one is simple, with fewer than a dozen elements. No doubt readers might add or interchange elements or find competing or alternative dynamic relationships. But the CLD offered here provides a glimpse into the phenomenon of SD not previously depicted in this way. Considering the elements and their dynamic relationships as intricately and mutually linked may suggest new possibilities, initiatives, and strategies permitting practitioners and policymakers to better understand impediments, shift emphasis, and gain more value from available resources.

DIRECTIONS FOR FUTURE RESEARCH

This chapter outlines five Critical Success Factors and a baker’s dozen Operating Principles for viable Sustainable Development, and 11 elements comprising the Sustainable Development Ecosystem. Whilst each of these arise from the authors’ experience, observations, and insights, the factors, principles, and elements are individually and collectively open to challenge and deserve further investigation. They may be incomplete or insufficiently understood, and based on limited exposure to the breadth and depth of Sustainable Development initiatives worldwide. By nature, Complex Adaptive Systems are difficult to define and the dynamic interdependencies amongst elements may be speculated but hard to prove. This said, we have done the best we can to envisage Sustainable Development as a complex ecosystem and explain the logic of the many and variable relationships amongst its elements.

We trust researchers and practitioners can draw from and build upon our work. How our CSFs, OPs, and the CLD account for successes and failures in past and ongoing Sustainable Development projects would make for interesting and useful studies. Additionally, particular interventions and investigations might consider, for example:

- The merit of conceiving Sustainable Development as an ecosystem, and/or community-as-ecosystem.
- Alternate ecosystem views of Sustainable Development.
- If not ecosystem / Complex Adaptive System conceptualisation, what makes Sustainable Development viable?
- The veracity of the Causal Loop Diagram presented, and its elements and their relationships.
- Applicability of the five Critical Success Factors, and a more-thorough understanding of their character and implications.
- Utility of the Sustainability Operating Principles and their translation in specific contexts and initiatives.
- Our hypothesis that Sustainable Development initiatives will be more successful in the long term to the extent that they deal with problems as Complex Adaptive Systems.
- And, finally, what is the contribution of the Sustainable Development Ecosystem to addressing the UN's Sustainable Development Goals?

SUMMARY AND CONCLUDING REMARKS

This chapter introduces the idea of SD as an ecosystem and explains how and why it may be fruitful to conceive of SD in this way. The case is made through use of a detailed Causal Loop Diagram (the model or “map” at Figure 2) that provides key features of the SD ecosystem—the main elements and their interdependencies. Critical analysis, discussion of the model, and explanation of the dynamics involved suggest the circumstances under which SD will likely be sustainable and when it will predictably fail. Armed with such knowledge, policymakers and practitioners can make more informed decisions about where to intervene in a *community-as-ecosystem* (Murphy, 2018), that is, how best to invest the limited resources available.

Working with the Causal Loop Diagram and moving toward the idea of a Viable Sustainable Development Ecosystem, the authors came to what—in retrospect—might be an obvious observation. To be sustainable, Sustainable Development must be wise, for all that implies.

A wise system exhibits numerous virtues, but fundamentally is concerned with greater good and long-term flourishing, forsaking short-term ease or gains, knowing and honouring itself and its interdependence with nature and its environment, and consciously learning to be increasingly effective and resilient (Hays, 2010a; Hays, 2010b). This, it seems to us, is the challenge and solution for SD. What are the principles of sustainability that will guide us toward a healthy future, including both internal operations and interactions with our environment? How can we best build in sustainability to SD initiatives and programs? What essential conditions must we create to be sustainable? What are the attributes of mastery in sustainability, and how do we best develop them?

We cannot provide a complete answer, yet, and, possibly, never will be able to. But our explication of the Viable Sustainable Development Ecosystem does reveal Critical Success Factors and Operating Principles that give clues as to what we can do. The most conspicuous CSFs are leadership, culture, framework, and relationships, but emergence should not be overlooked. Emergence may provide the greatest possibilities for a viable SD ecosystem, given healthy and supportive leadership, culture, and framework for operating. One example would be what positive learning can come from failures.

We also identified and provided examples of sustainable Operating Principles. Those most often apparent are learning and research; building sustainability in to all operations and facets of the business; providing many and diverse opportunities for ideas to emerge, including promoting interactions,

collaborations, and partnerships of all kinds; and fostering flexible and organic structures and ways of working wherein individuals feel unimpeded by hierarchy or bureaucracy.

Our wise SD ecosystem is comprised of people who individually aspire to mastery—they demonstrate unwavering discipline in thought and deed, ever vigilant to what opportunities exist in themselves and in their communities to become more sustainable and focussed on making those improvements. They are courageous and driven to act, but always address the first question: is this the right and best thing to do for all stakeholders all things considered? As masters, they do not lord over anyone, but are always willing to step up to calls for leadership, taking a stand on issues that matter, speaking for those whose voices have been unheard, and reminding us all of the vital commitments we have made (or must make) to create a sustainable world for all inhabitants.

If the understandings arising from the Critical Success Factors and Operating Principles we have identified and the concepts and dynamic relationships we have elucidated here are incorporated into the planning, implementation, and evaluation of SD initiatives, they are surely to be at least more sustainable than would otherwise be the case.

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KEY TERMS AND DEFINITIONS

Complex Adaptive System: A system—such as a community or organization—having many elements that continually interact and influence one another in complex and, sometimes, unfathomable ways. Though striving for stability and security, the interactions produce behavior and structure not before seen (emergence and self-organisation).

Critical Success Factors: CSFs are factors or conditions that must be present in order for an initiative to succeed or a given process or desired condition to sustain. For example, sustainability implies that a system must have within it the capacity to generate its own resources (rather than be wholly dependent on external sources).

Ecosystem: A bounded system of living and interdependent entities in dynamic interaction with their environment, influencing and being influenced by their environment. Here, a socioecological system such as a community or organization.

Relationship Diagram: Otherwise known as Causal Loop or Influence Diagrams, these are “maps” or depictions of the salient elements in a Complex Adaptive System or ecosystem, and their relationships to one another shown as lines (directions) of influence.

Sustainability: Thriving into the future. Necessary for survival, sustainability implies cautious use of resources, including curtailing waste and other threats to the environment, production that does not exceed what can be replenished, and cultivation of products, services and lifestyles that enrich rather than exploit.

ENDNOTES

¹ Viability is a key concept in the real world and in this article, as indicated by the title. For us, viability has to do with capability to survive or, better, to thrive *independently*, that is, without undue and continuing external support—to succeed on its own. A viable proposal or intervention would be practical, realistic, achievable, and suited for purpose given existing circumstances, and robust and resilient in the face of challenging conditions. In many ways, viable means sustainable. To be viable, then, Sustainable Development must be able to be implemented or operationalised in such a way that its purpose is met—it achieves what it intends to—and continues to succeed into the future.

² As with viability, community is also an integral concept here. We are using community to designate a particular locality within which people live and interact, a social system comprising all of the things people need to survive, as well as resources they may share or compete for. It is likely that people living in a designated locality have common interests, values, culture, and so on, but increasingly the population will be diverse. No doubt, however, they would be united in desire to survive, if not flourish, though may have vastly different understandings of how that might be attained and sustained. For our purposes and with respect to Sustainable Development, inhabitants of a given community would need to establish mutually productive and beneficial behaviours for an ambitious SD intervention to succeed. This implies that a critical mass of a community’s members needs to embrace and live by the objectives of a given development or other change project for it to be achieved. For all this means, it is probably the case that a Sustainable Development project of any scope may have to concern itself with *community* development addressed through concerted communication, education, and culture change initiatives.

³ Chang and Tan (2013), Diment et al., (2011), and Stanczyk (2017).

⁴ These include Alshuaibi ...; Pereseina ...; Hays ... Reinders ...

⁵ See, for example, Nguyen et al., (2015); Rusoja et al., (2018); Sturmberg et al., (2012).

⁶ Tulane’s manual on change-making provides an informative and complementary perspective on communities as ecosystems (Murphy, 2018).

⁷ Including those cited previous herein, especially Hays (2010b).

- ⁸ The term “complex adaptive ecosystem” is seldom found in the literature, perhaps because ecosystem generally implies complex adaptive system. One source using the term as we do here is Perfetto et al. (2016).
- ⁹ Hazy and Silberstang (2009) and Matthews and Thomas (2007).
- ¹⁰ See Hays et al., (revision requested).
- ¹¹ Our CSFs and Operating Principles are adaptations and revisions of and additions to our previous and ongoing research, as found in Hays and Reinders (2020) and Hays, et al., (2020).
- ¹² Our notion of Critical Success Factors (CSFs) comes from the world of organisational change, though could be applied to any large task or project. CSFs are factors and conditions that must be in place to some palpable measure for a project to succeed. More on and examples of CSFs may be found in Akkermans and Helden (2002), Disterheft et al., (2015), and Rockart (1986). A typical example from the organisational change literature is King and Burgess (2006).
- ¹³ See, as examples, Ganz (2010) or Kotter (2012).
- ¹⁴ See Adner (2017), Dedehayir (2018), and Kramer and Pfitzer (2016) for various perspectives on ecosystem leadership. Hays (under review) explores the dynamics of leadership as an ecological system in his article on leadership in and for a changing world.
- ¹⁵ See Messier et al., (2015) or Roundy et al., (2018) for more on emergence.
- ¹⁶ See McLean’s (2017) dissertation on corporate DNA as very relevant background on our concept of culture as applied to sustainability.
- ¹⁷ behaviours and the beliefs, assumptions, biases, motives than underlie it may serve to perpetuate things as they are but may not necessarily be beneficial in the long run. This is important aspect of our model.
- ¹⁸ The “how” and “why” of the indicated influence—not easily depicted—is the most important aspect in creating (and reading) the map, with the particulars of “how” and “why” often based on assumptions, beliefs, speculations, biases, and limited observations, experiences, and evidence. Thus, while CLDs can be incredibly powerful, the grounds on which relationships are based need always objective analysis and critical reasoning.
- ¹⁹ See, for example, Bouton (2007) or Steers et al. 2004)
- ²⁰ See Alavi et al. (2014) and Karp (2006) for background on organic structures and processes.
- ²¹ See either Giloth, and Austin (2010) or Sastry and Penn (2014) for more on productive failures.

Corporate Social Responsibility, Irresponsibility, and Citizenship

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INTRODUCTION

This article explains three related conceptions: Corporate social responsibility (CSR), corporate social irresponsibility (CSIIR), and corporate citizenship (CC). The traditional word “corporate” is not restrictive to large and publicly traded corporations. “Corporate” can have the broader meaning of all “business,” including small and medium sized enterprises and B (i.e., benefit) corporations. The three conceptions involve significantly different approaches for answering the overarching question of the appropriate relationship between “business and society.” A prominent journal, *Business & Society*, founded in 1960 and sponsored in recent decades by the International Association for Business and Society, reflects this field title. The relationship sometimes has the labels “businesses and societies” (pluralizing the term) or “social issues in management.” The latter is the name of a division of the Academy of Management (founded in 1936). These three labels are essentially synonymous.

The emphasis in each conception is on defining legal and ethical responsibilities of business enterprises and business executives toward society and environment. The “responsibility” approach emphasizes a broad and multidimensional understanding of how businesses can contribute positively to societies. This approach can be contrasted with a narrowly economic conception of profit that disregards negative externalities of business decisions. The “irresponsibility” approach emphasizes strict compliance with legal and ethical standards for conducting business. It distinguishes between “harm” and “altruism” to emphasize that reducing harm caused by businesses is considerably more important empirically than inducing those businesses to practice altruism. The “citizenship” approach invokes “a political metaphor” emphasizing voluntary choices of businesses and executives as distinct from externally imposed responsibilities.

The article has four objectives. One objective is to lay out the basics of the three conceptions responsibility, irresponsibility, and citizenship, as developed to date in extant literature. A second aim is to contrast economic, ethical, and strategic perspectives bearing on these three conceptions. A third aim is to connect the three conceptions to corporate social performance (CSP), corporate governance, and the stakeholder theory of the firm. A final objective is to propose solutions, recommendations, and future research directions for addressing key problems in the field.

Research Methods

This article uses two research methods. The first and dominant method is a literature review. This review has three key dimensions. The review provides a summary of published work on the set of three related topics of responsibility, irresponsibility, and citizenship. The reviewer provides a logical structuring of that work. The review includes a critique of the strengths and weaknesses of the extant literature. The

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critique clears a path for proposed solutions, recommendations, future research directions. This review is not systematic in the sense of identifying and discussing every published work. The review seeks to provide the reader with a guide to the extant literature in a way that will facilitate further exploration into key issues. The reader can begin with the reference and additional reading items the author selected to reflect the range of those key issues. The secondary method is use of selected cases to illustrate instances and applications.

Limitations of the Study

There are three basic limitations. First, the works and cases reflect the views of the author. The literature review is explicitly selective. Second, the review includes some empirical studies. However the review of empirical work is selective rather than a systematic survey. The survey is not a meta-analytical study of findings. The literature review focuses on conceptual and theoretical work. Third, the linkage of responsibility, irresponsibility, and citizenship to other topics is quite limited. The focus in linkage is on performance, governance, and stakeholder concepts.

BACKGROUND

CSR is the traditional conception against which one can compare and contrast irresponsibility and citizenship conceptions (Windsor, 2006, 2013). The modern idea of CSR emerged in the 20th century as a response to the perceived negative effects of unregulated laissez-faire markets and Social Darwinism philosophy (London, 1904) in the 19th century. This response reflected both Marxist criticism of industrialization and, in the United States, the Progressive criticism (about 1890-1920) of the Gilded Age (about 1865 to 1900). Andrew Carnegie (1889) published an essay on wealth, which advocated responsibility of the wealthy for philanthropy. The piece later appeared as an essay on the gospel of wealth in *The Pall Mall Magazine* (London), and then in Carnegie's (1901) collection of essays. Carnegie's view reflected Christian principles and voluntary philanthropy. His "gospel" carries forward in today's *The Giving Pledge* the Gates and Warren Buffett started in 2010. The adherents pledge to donate at least half of their net worth.

Progressivism in the United States was a political movement drawing on both liberal and populist trends. Over time this movement targeted urban political machines and promoted women's suffrage, antitrust legislation, governmental efficiency, and prohibition. The movement established various new regulatory agencies, such as the Food and Drug Agency and the Federal Reserve System. Theodore Roosevelt (Republican) and Woodrow Wilson (Democrat) were prominent Progressive Era presidents. Progressivism moved beyond voluntary philanthropy to impose various new regulations on business (Wood, 1986). The 1920s were a resurgence of political conservatism. The 1930s Great Depression and World War II regenerated business interest in social contribution. This business interest continued until the end of the 1960s.

Friedman (1970), who won a Nobel Prize in economics, started an intellectual counter-revolution. He criticized CSR on two grounds. First, CSR is managerial theft masquerading as corporate altruism, but in reality reflecting managerial preferences adverse to shareowners' financial interests. Second, CSR is a drift toward socialism and an interference with government's proper sphere.

Businesses should obey laws and customary business ethics, while lobbying governments for benefits. The Friedman criticism was less a return to 19th century laissez-faire economics and more a reemphasis

on profit seeking (Jensen, 2002). Profit seeking received increased emphasis from the widespread embrace of agency theory in economics and finance. Agency theory dominated American business schools educating generations of MBA students. Agency emphasizes the fiduciary duty of executives to generate profits for shareowners of publicly traded corporations. It focuses corporate governance on the problem of monitoring and incentivizing executives to that purpose.

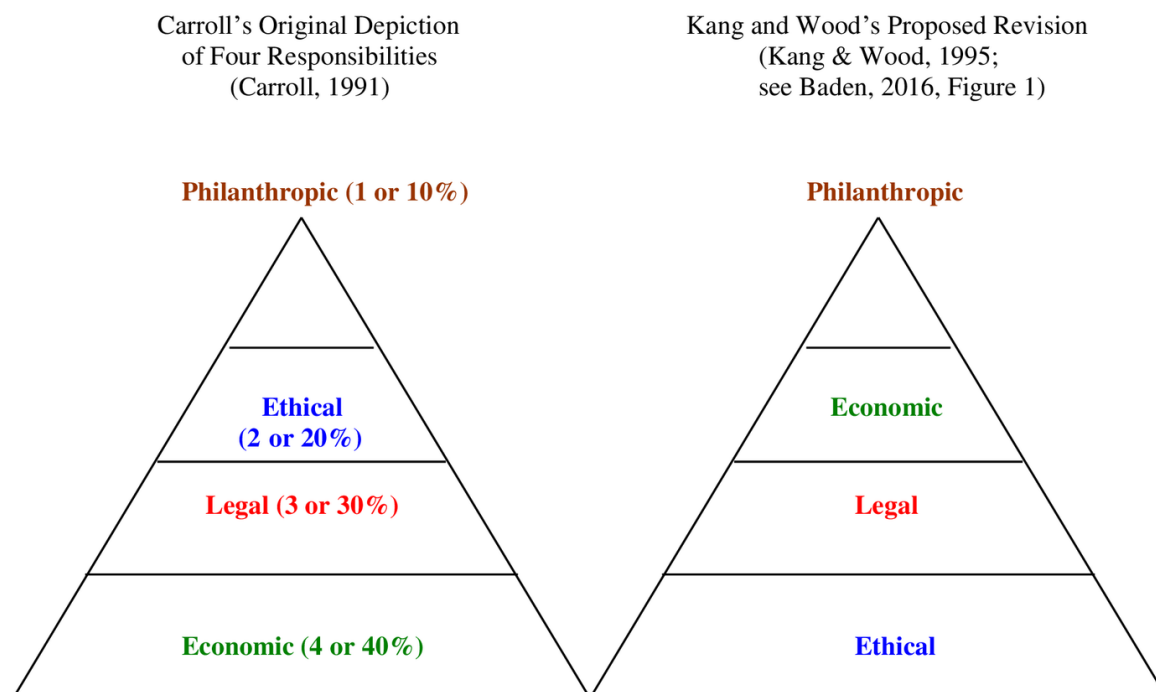
This economics-based movement against CSR resulted in efforts by proCSR academics and executives to define a persuasive intellectual basis. CSR promotes business ethics, corporate philanthropy, and environmental sustainability. This promotion includes specific policy goals, such as reducing poverty and child labor, ensuring widespread access to health care, or promoting increasing wealth in developing countries. This proCSR response over time gave rise to CSR, CSiR, and CC approaches (Carroll, 1999; Davis, 1973).

RESPONSIBILITY, IRRESPONSIBILITY, AND CITIZENSHIP

Ethical and Economic Views of Responsibility

The basic contest in CSR literature and practice has been between an ethical view and an economic view (Kitzmueller & Shimshack, 2012). The development of ethical CSR theory is strongly associated with Carroll (1991, 1999, 2000). This theory posits that moral managers behave differently than do amoral or immoral managers (Carroll, 2000). The economic view reduces business to a profit orientation. A more recent critique of CSR argues that psychological microfoundations are ill-explored (Aguinis & Glavas, 2012). A different viewpoint argues that governments, activists, and media should regulate businesses in place of voluntary self-regulation by businesses (Karnani, 2011).

Figure 1. Carroll's pyramid of four corporate social responsibilities



Carroll (1991) depicted a set of four responsibilities in the form of a pyramid, as Figure 1 shows. This pyramid can be isosceles (meaning at least two equal sides) or equilateral (meaning three equal sides), or a step pyramid. The essential feature is that each layer (or dimension) from the foundation to the apex becomes smaller in relative size. In Figures 1, 2, and 3, the dimensions are color-coded as green for economic, red for legal, blue for ethical, and brown for philanthropic. Economic performance and legal compliance are mandatory, ethical responsibility is expected, and philanthropy is desirable (Carroll, 1991).

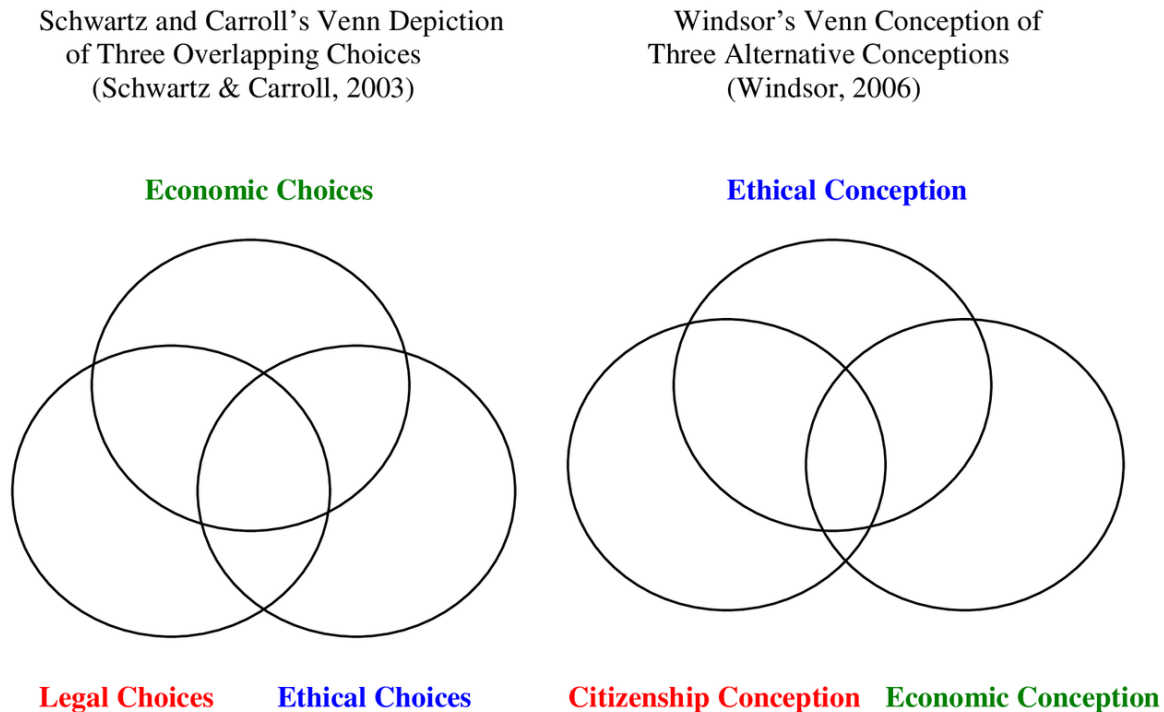
Surveys of business executives (Aupperle, Carroll, & Hatfield, 1985) suggest that they may tend to assign 10 (or 100%) in roughly the same order as the pyramid at 4: 3: 2: 1 (or 40%: 30%: 20%: 10%) for economic, legal, ethical, and philanthropic. As Figure 1 shows, Kang and Wood (1995) proposed a revision of Carroll's pyramid. This revision moved ethical responsibility to the foundation, succeeded by legal responsibility and then economic responsibility. Subsequently, Meynhardt and Gomez (2019) explained how to generate variations on the four-dimensioned model.

Later, Pedersen (2010) surveyed more than 1,000 international firm managers from various sectors and countries. The highest responsibility this author reported was environmental—reflecting a likely shift over time in understanding of the specific content of responsibility. The next responsibilities concerned product quality, then employees, and then community and society. Shareowner value or wealth received the lowest mention frequency. Baden (2016) argues that this recent information reinforces the idea of inverting the pyramid in accord with the revision Kang and Wood (1995) proposed, as Figure 1 depicts. According to Baden, the highest frequency mentions correspond to ethical responsibility.

In combination with empirical data on the views of business executives, Carroll's pyramid is implicitly also a causal model of how the four responsibility elements promote firm financial performance. Economic responsibility is broader than simply profit, which is a resultant reflecting success at providing goods and services to consumers and jobs and compensation to employees. Legal compliance and ethical conduct help to promote strategic competitive advantage and economic performance. The whole pyramid is infused with an assumption of moral management, such that the four dimensions are strictly separated, but interact for a moral manager. An amoral or immoral manager in contrast separates profit out of economic responsibility and pays no attention to the other three dimensions.

An economic (or theory of the firm) perspective defines CSR quite narrowly as “actions that appear to further some social good, beyond the interests of the firm and that which is required by law” (McWilliams & Siegel, 2001, p. 117). This perspective follows Friedman (1970). While McWilliams and Siegel's definition includes legal compliance, these authors ignore customary business ethics. They separate CSR actions into two kinds. One kind concerns CSR actions a stakeholder, who is prepared to pay the firm for those actions, demands. For example, customers may be willing to pay higher prices for environmentally friendly goods. This kind of CSR action is simply just another business decision. The other kind concerns CSR actions the management supports, for which no stakeholder is prepared to pay. This kind matches Friedman's criticism of CSR. A problem with the theory of the firm perspective is that it focuses on a one-period decision: The firm either makes money (or at least breaks even) or loses money; the former situation is simply a business decision, while the latter situation is the one Friedman criticizes. This one-period focus is nonstrategic. Strategically, “the interests of the firm” may involve multiple-period planning, stakeholder satisfaction, and building reputational capital. Strategically, a firm might need to lose some money in the present, in order to hold competitive position, or make more money in future time periods. A purely economic perspective can be criticized as being a straitjacket (Brooks, 2010).

Figure 2. Conceptions of corporate social responsibility choices



CSR theorists adapted to the controversy over the status of corporate philanthropy, and more broadly altruism, by excluding it from the formal framework. The adaptation restricted responsibilities to economic, legal, and ethical. Carroll had regarded philanthropy as effectively discretionary. Figure 2 shows the depiction of a proposed solution the author adapted from Schwartz and Carroll (2003). These authors use a three-dimensional Venn space model, in which space is a set of related elements—some of which can overlap. A business chooses the particular combination of the three dimensions by shrinking or increasing each Venn space. The business can change that combination over time. In Figure 2, the three spaces are equal in size. Thus the ordering of the three dimensions has no significance—the reader can simply spin the spaces. Once the sizes are varied, the largest space should presumably be at the top. To generate the “Creating Shared Value” Venn space depiction (Shared Value Initiative, n.d.), in Schwartz and Carroll’s framework it is necessary to substitute business opportunities for economic choices, social needs for legal choices, and corporate assets for ethical choices. The intersection of the three Venn spaces is “shared value.” A Venn space is simply the set of all logically related ideas, such as the set of economic choices or the set constituting the ethical perspective. Where Venn spaces overlap, the sets share elements. Figure 2 compares Schwartz and Carroll’s depiction to a different three-dimensional depiction the author adapted from Windsor (2006). Windsor suggested three alternative approaches or perspectives: Ethical, economic, and citizenship. Figure 2 explicitly places the ethical perspective at the top, on the argument that ethics dominates and informs both citizenship and economic perspectives.

Given the economic criticism of CSR, considerable literature has focused on formulating a “business case” for responsibility including environmental sustainability and on finding empirical evidence supporting that business case. A business case justifies a decision on the basis of improved profitability

or improved reputation or improved strategic positioning and competitive advantage (Carroll & Shabana, 2010; Tonello, 2011). A business case is instrumental in nature: A particular action will result in a desired improvement in financial performance. The business case is in effect a win-win solution: The business gains and social welfare either improves or at least remains constant. The requirement is that the business gain does not occur at the expense of social welfare.

Controlling Irresponsibility

Two problems with the conventional CSR approach are that it tends to merge with demands for corporate philanthropy and altruism and those demands tend to expand. There is in effect a virtually unlimited agenda for costly CSR initiatives. This problem ameliorates, if much of the agenda comprises profitable opportunities. Corporate altruism is subject to the criticism Friedman (1970) articulated. A business is profit-oriented, not social-benefit-oriented (Strine, 2012). Recently, attention has shifted to the causes and impacts of corporate irresponsibility, in order to identify effective controls on misconduct.

Figure 3. A broader definition of CSR (adapted from Windsor, 2013)

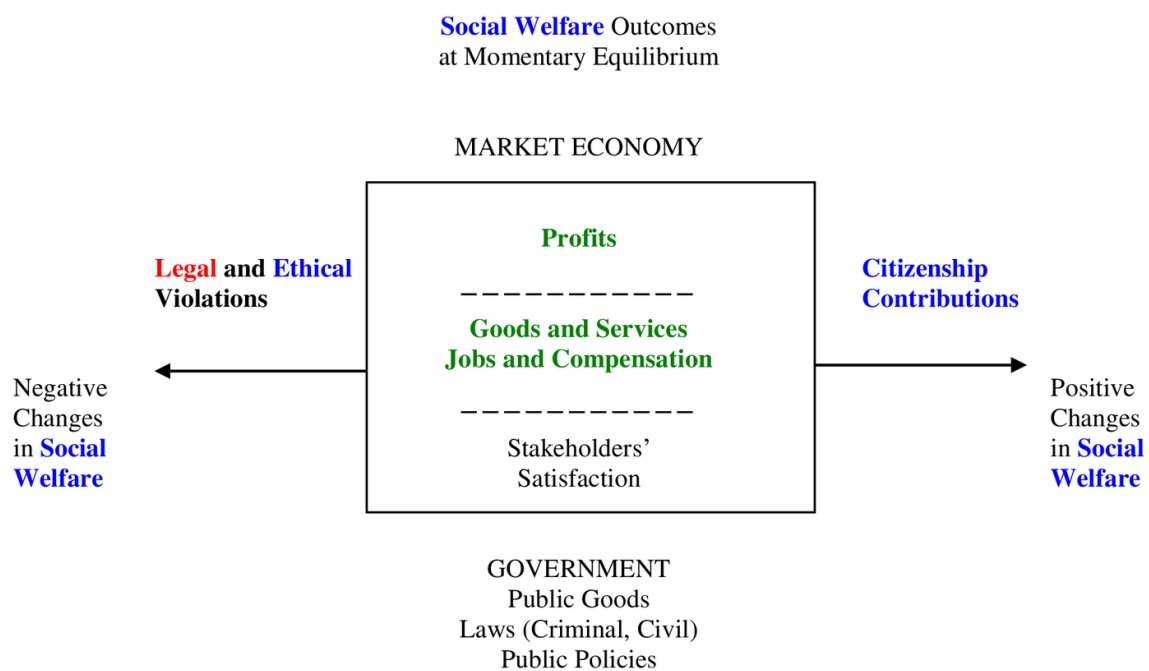


Figure 3 adapts an approach Windsor (2013) proposed. The vertical axis depicts the interaction between the market economy and the government. The market economy rewards a business for economic performance (goods and services, and jobs and compensation) and stakeholders' satisfaction with profits (rising with degree of monopoly power). The government provides public goods (defined as goods and services the market economy will not provide, but desired by taxpayers) and regulations in the forms of criminal laws, civil laws, and public policies. Capitalism is a mixed economy of private and governmental actors providing goods and services and regulations. The box at the center of Figure 3 is a Venn

space that in effect measures the size of the aggregate social welfare which is generated by the mixed economy. For purposes of the depiction, the aggregate social welfare is a momentary equilibrium which is measured at the immediate time period. This aggregate social welfare moves up and down dynamically with the mixed economy's functioning. The horizontal axis thus shows negative or positive changes from the momentary equilibrium due to nonmarket actions by a business. Legal or ethical violations impose harm on at least one person and thus reduce social welfare. The next subsection discusses citizenship contributions.

Citizenship and Political Corporate Social Responsibility

The CC interpretation (Hemphill, 2004) involves two “conflicting interpretations”: (1) An instrumental interpretation views corporate philanthropy as a strategy for building reputational capital, while (2) an ideal interpretation restates ethical responsibility and reflects expanding needs for corporate philanthropy (Windsor, 2006). This latter interpretation seeks to increase corporate accountability (Waddock, 2004).

Reducing CSR to corporate responsibility by removing the word “social” effectively leaves the definition of responsibility to the discretion of business managers. In this simplification, managers can choose among the economic approach, the stakeholder satisfaction approach, the strategic approach, or even traditional CSR.

CC should increase social welfare in some way. The market economy may dynamically adjust to offset the cost of citizenship or the firm may elect to absorb the cost directly in the form of reduced profits. Citizenship costs are likely to be reasonably limited (Strine, 2012).

In 2010 (*Citizens United v. Federal Election Commission*) the United States Supreme Court held (5 to 4) that the First Amendment's free speech clause prohibits restrictions on independent expenditures on public communications by business corporations, nonprofit organizations, labor unions, and associations. Examples of the latter are National Rifle Association and Sierra Club. Underpinning the majority opinion is a view of the business corporation as an artificial person, which thereby enjoys certain citizenship rights.

Related to the idea of CC is political CSR. Switzerland-based scholars Andreas Scherer and Guido Palazzo and colleagues in Europe (Scherer, Rasche, Palazzo, & Spicer, 2016; Scherer & Smid, 2000) pioneered this perspective. The essence of political CSR is that businesses have a duty to promote democracy internally to the organization and in society externally to the organization. This duty exists whether the host country for a multinational enterprise is developed or developing. Businesses also have a duty to provide public goods in instances in which the government lacks capability to do so. This duty is most pronounced in developing countries. The political CSR approach advocates a very strong form of CC which is designed to improve social conditions, including democracy.

Strategic Philanthropy and Shared Value Creation

Michael E. Porter and Mark R. Kramer developed new conceptions of strategic philanthropy (Porter & Kramer, 2002) and shared value creation (Porter & Kramer, 2011). Strategic philanthropy argues that charitable giving by businesses should serve some strategic purpose, rather than being in effect a random selection reflecting managerial preferences. In other words, the business should get some form of return on philanthropy, and that return can be focused: Higher return is preferable to lower return. Shared value creation argues that businesses can be profitable by solving social needs, and such profitability can be focused: Higher profit is preferable to lower return, not to mention to loss. These conceptions of strate-

gic philanthropy and shared value creation are the core of Porter and Kramer's view of CSR (Porter & Kramer, 2006). Shared value generates at the intersection of business opportunities, social needs, and corporate assets. Shared Value Initiative (n.d.) provides a depiction of three intersecting Venn spaces (see Figure 2). It may be feasible to measure shared value creation (Porter, Hills, Pfitzer, Patscheke, & Hawkins, 2012).

A study of corporate philanthropy in relationship to specific performance dimensions found that worse performers are likely to make larger charitable contributions than do better performers for environmental issues and product safety. They do not do so for employee relations (Chen, Patten, & Roberts, 2008). The study uses pooled data (1998-2000) for a sample of 384 United States companies. These authors interpret the findings as suggesting that corporate philanthropy occurs for legitimization, rather than as CSR. Worse performers attempt to offset bad reputation through charitable donations.

There has been criticism of the shared value creation approach (Crane, Palazzo, Spence, & Matten, 2014). In effect, the approach narrows CSR to a win-win condition only: Both the business and the society must gain. This condition corresponds to the McWilliams and Siegel (2001) model, in which either CSR is profitable or some stakeholder is prepared to compensate the business for a CSR initiative. Other conditions may occur for CSR. The reader should envision a simple two-by-two matrix with the business on one face and society on the other side. The options in addition to win-win are win-lose (business wins and society loses) and lose-win (business loses and society wins). The win-lose condition corresponds to CSiR: Business gains by imposing harms on society, such as uncompensated negative externalities. The lose-win condition may correspond to regulation of that CSiR: Society changes legal and ethical standards to control such negative externalities or other harms. Lose-lose (both business and society suffer) is undesirable for society. CSR and CSiR theorizing highlights a broader conception of how business and society interact. Win-win is definitely desirable, but this condition is not the exclusive context for CSR and CSiR.

SOLUTIONS AND RECOMMENDATIONS

Moral vs. Nonmoral Managers and Management Education

CSR rests on moral management: Moral executives do not engage in CSiR. Whether moral executives have a duty to engage in citizenship is more problematic. A situation at DuPont illustrates the problem of CSiR by nonmoral executives (Shapira & Zingales, 2017a, 2017b). As these authors report, DuPont used a toxic chemical in a West Virginia plant to manufacture Teflon®. DuPont settled litigation for \$670 million. Analyzing the documents which were made available through discovery in the lawsuit, these authors conclude that it was *ex ante* rational for DuPont to pollute in spite of the final costs to the firm and the harms imposed on society. The education of managers in business schools and the incentives for managerial decision making must emphasize CSR and citizenship over CSiR. The demand for responsible managers may exceed the supply of such managers, and the management education process may bear part of the responsibility (Windsor, 2018). It may be more important to move managers away from CSiR, than further toward citizenship behaviors. In Russia, working for Alcoa, William O'Rourke (Graham, 2012) set an explicit policy of not submitting to corruption, and reported various instances of attempted extortion by local officials. This exemplar is in direct contrast to the DuPont calculus.

If managers report significant support for CSR and against CSiR, as the author illustrated above in this article (Aupperle et al., 1985; Pedersen, 2010), a conceptual and empirical question remains as to

why those managers underinvest in CSR and citizenship (Hafenbraedl & Waeger, 2018). If managers exploit legal “loopholes” to minimize tax payments, such exploitation might be simply fiduciary duty or CSiR or absence of citizenship (Aharony & Geva, 2003). A theoretical standard is necessary for assessing which explanation is valid.

Defining and Measuring Corporate Social Performance

CSP focuses on the identification and measurement of the outcomes of business activities. The Triple Bottom Line (TBL or 3BL) performance framework is an instance. In TBL, the outcomes—portrayed as business performance dimensions—are economic (profits), environmental (planet), and society (people). Desirably, all outcomes should be positive (win-win-win). For any one or two positive outcomes, any other dimension or dimensions should be constant (meaning neither a positive nor negative change in outcome). Wood (1991a, 1991b, 2010) published the key work on CSP theory and measurement. Wood linked motives, actions, and outcomes into a coherent theoretical framework.

CSR, CSiR, and Citizenship in Developing Countries

There is a continuing debate concerning whether CSR, CSiR, and CC are universal (or global) conceptions applicable to all countries or should properly vary by country (Logsdon & Wood, 2002). A typical dividing line in this regard is between developed and developing countries (Windsor, 2017). This debate also encompasses cultural variations, which are not necessarily grouped by developed and developing countries. A study of Swiss Re, the large reinsurance company headquartered in Switzerland, explores multiculturalism in a developed country (Sachs, Rühli, & Mitnacht, 2005). A cross-country empirical comparison of France and the United States found significant differences concerning CC in two developed countries (Maignan & Ferrell, 2000). Variation in national institutions may be important in CSP (Ioannou & Serafeim, 2012).

Multinational Enterprises

A special topic concerns the responsibilities of multinational enterprises (MNEs) operating across national boundaries (Bondy, Moon, & Matten, 2012). Several variations occur in this special topic: Home country and host country are both developed; home country is developed and host country is developing; home country is developing and host country is developed; home country and host country are both developing. Further distinctions exist among emerging countries and transitional countries. An emerging country (e.g., Brazil, China, and India) is a developing country that has achieved industrialized economic growth and increasing international economic presence. A transitional country (e.g., Poland, Kazakhstan, and Russia) is a developing or emerging country that was previously under formal communist rule and has transitioned into formal noncommunist rule. China is an emerging country, but remains under formal communist rule.

Corporate Sustainability and Environmental Sustainability

Pedersen’s (2010) results suggest a shift in managerial concerns toward environmental sustainability. It seems reasonable to link the other managerial concerns Pedersen reported to the related notion of corporate sustainability. Political CSR arguably intersects with environmental sustainability, in the sense

that businesses must take responsibility for influencing government policy in the direction of protecting the natural environment (Lyon et al., 2018). An empirical study finds that liberal-oriented businesses are more likely to support environmental sustainability than are conservative-oriented businesses (Di Giuli & Kostovetsky, 2014). It is desirable that businesses see environmental investments as win-win opportunities (Eichholtz, Kok, & Quigley, 2010).

FUTURE RESEARCH DIRECTIONS

The futures of CSR, CSiR, and CC are difficult to predict (Lee, 2008; Windsor, 2001), given the theoretical disputes and the relatively weak empirical evidence. This evidence suggests that responsible behavior associates positively with financial performance, while irresponsible behavior associates negatively with financial performance. The DuPont litigation tends to undermine the latter. Four research directions are critically important: Integrated theory, empirical evidence, international standards, and cross-country conditions.

Integrated Theory of Business Responsibilities

The developmental history of the social responsibility literature involves a set of controversies. It seems understandable that a contest exists over such an important topic. One main cleavage is between economic and ethical perspectives. The economic viewpoint emphasizes dynamic markets and reasonable liberty for business action. This viewpoint tends to view CSR as voluntary altruism. The ethical viewpoint emphasizes responsibilities of moral managers. Research should address whether the relationship between these two viewpoints is necessarily competitive or may be complementary on some basis. Another cleavage is among economic, ethical, and strategic approaches. A strategic viewpoint emphasizes long term outcomes and the importance of reputation with stakeholders. A third cleavage is between responsibility and citizenship language. Responsibility tends to suggest duty or obligation; citizenship tends to suggest liberty and right to participate in lobbying.

There is some opportunity to integrate responsibility and citizenship theorizing with CSP, corporate governance, and the stakeholder theory of the firm. CSP is about outcomes, governance is about who controls decision rights in a business and why, and businesses are dependent to some degree on stakeholder support. Stakeholders include customers, employees, investors, and managers at the core of a business and additional interests, such as communities, governments, media, and suppliers. Positive and negative externalities of business actions generate stakeholders of a firm. There are increasing linkages to corporate political strategy for lobbying governments and international institutions.

Empirical Investigation of the CSR-CFP Relationship

A major emphasis in CSR literature has been on discovering empirically whether a positive relationship occurs between CSR and corporate financial performance (CFP). A meta-analysis of empirical studies concluded a small positive relationship existed (Orlitzky, Schmidt, & Rynes, 2003). An earlier survey of the problem had concluded that research was highly incomparable and did not yield definite findings, whether positive or negative (Griffin & Mahon, 1997). The purpose of such empirical research is to demonstrate to managers that CSR is at least modestly profitable. One empirical study suggests a curvilinear relationship in which both CSiR and CSR behaviors can be profitable, and that the profit advantage of

CSR over CSiR may be sufficiently small that managers can choose to be bad and profitable (Barnett & Salomon, 2012). However, unless the profit advantage of either CSR or CSiR over the alternative is marked, the choice of strategic approach is basically up to management discretion. The reader might consider a momentary equilibrium in which the profit advantage is constant for any two firms. If one firm selects a CSR strategy and the other firm selects a CSiR strategy, both firms might gain about the same profit advantage: Under this condition, the selection is up to the executives. The DuPont case may have been markedly more tilted toward CSiR being profitable and CSR being unprofitable. A moral manager will tolerate at least small loss in preference to doing wrong and imposing harm on others.

A meta-analysis of empirical findings involves the difficulties of assessing ex ante bias of researchers and the “file drawer problem.” In this problem some research may be rejected and thus suppressed during the journal review process. It is not possible to measure these two difficulties rigorously. In general, antiCSR scholars may expect nonprofitable findings, while proCSR scholars may expect profitable findings concerning the CSR-CFP relationship. Possibility a large number of studies reflecting both views may help. Scholars conducting meta-analysis studies can issue calls for unpublished research to address the file drawer problem (Rost & Ehrmann, 2017; Wang, Dou, & Jia, 2016).

Evolution of International Corporate Social Responsibility and Corporate Social Irresponsibility Standards

One approach to influencing managerial behavior is the development of internationally agreed standards for CSR, antiCSiR, and citizenship (Windsor, 2004). Such standards and corresponding international agreements have been evolving over the years. One example is the United States Foreign Corrupt Practices Act (FCPA) of 1977. In combination with a similar Swedish anticorruption statute (1978) and anticorruption activists, FCPA helped to result in near-universal adoption of the United Nations Convention against Corruption (2005). O’Rourke’s (Graham, 2012) experiences in Russia reflect this emerging anticorruption consensus. The United Nations Global Compact includes nine principles concerning human rights, labor rights, and environmental protection and a tenth anticorruption principle. The International Standards Organization has adopted ISO 26000 CSR guidance and ISO 37001 guidance on anticorruption systems. Various global and regional environmental protection agreements exist, including the 2015 Paris Agreement on limiting greenhouse-gas-emissions. The Global Reporting Initiative provides standards, evolving over time, concerning corporate reporting about topics, such as climate change, corruption control, and human rights. The United Nations is working on a human rights framework including the role of business.

Variation in Cross-Country Conditions

An emerging debate concerns whether CSR is universal and, if so, set by developed countries without much respect for the interests and views of developing countries. CSR emerged in developed countries, and reflects particularly views in North America and Western Europe. These views are not automatically consistent. There is increasing conversation in developing, emerging, and transitional countries concerning whether the extant understanding of CSR fits their conditions and needs. Countries in Africa, Latin America, and East Asia may have quite different institutions and traditions shaping views of MNEs and CSR standards. Continuing scholarship into cross-country variation is highly desirable.

CONCLUSION

The relationship between business and society is a topic of fundamental and continuing importance. This circumstance generates both interest and disagreement. This article examines CSR, CSiR, and CC. The examination places the three conceptions in relationship to one another; and to relevant topics such as CSP, corporate governance, and the stakeholder theory of the firm. Responsibility of businesses to societies remains a highly contested topic for scholars and practitioners with proCSR and antiCSR positions. The relationship among economic, ethical, and strategic perspectives lacks resolution. Empirical evidence on the relationship between CSR and CFP is perhaps weakly positive in favor of CSR and antiCSiR over the long term. However, any range between mildly negative and mildly positive leaves decisions to management judgment.

The article has explained the background to CSR and the developmental history of the conception. The article has provided detailed information on the economic, ethical, and strategic perspectives, and on the emergence of alternative conceptions of CSiR, CC and political CSR, and strategic philanthropy and shared value creation.

The key recommendations in this article concern management education, CSP definition and measurement, developing countries, MNEs, and the emerging shift in responsibility concerns toward business sustainability and environmental sustainability. The key research directions identified concern how to develop an integrated theory of business responsibility, continued empirical investigation of the relationship between CSR and CFP, and the evolution and effectiveness of international standards for CSR, antiCSiR, and citizenship. There should be continued investigation of variations in cross-country conditions, particularly between developed and developing countries.

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KEY TERMS AND DEFINITIONS

Corporate Citizenship (CC): A political metaphor in which the corporation has constitutionally an artificial citizenship which can be interpreted either as liberty to pursue strategic philanthropy and lobbying of governments in place of external requirements and expectations or as an equivalent to corporate social responsibility in different words.

Corporate Social Irresponsibility (CSiR): The theory that violation of legal or ethical standards by a business is irresponsible misconduct, typically resulting in illegitimate and avoidable harm to others for business profit.

Corporate Social Performance (CSP): Desirably positive economic, social, and environmental impacts or outcomes of corporate activities. Such impacts or outcomes can be negative or neutral.

Corporate Social Responsibility (CSR): The theory that businesses have broad responsibility to society for positive corporate social performance (CSP) and avoidance of corporate social irresponsibility (CSiR).

Economic Responsibility: The condition that businesses cannot practice extralegal responsibilities if they are losing money. Economic responsibility is also the expectation that business profits are a resultant of positive economic performance in the form of goods and services for consumers, and jobs and compensation for employees.

Environmental Responsibility: The duty or obligation of a business or a business executive to promote environmental sustainability.

Ethical Responsibility: The duty or obligation of a business or a business executive to comply with ethical standards and expectations.

Legal Responsibility: The duty or obligation of a business or a business executive to comply with criminal and civil laws and public policies.

Philanthropic Responsibility: An expectation that profitable businesses should make voluntary charitable contributions in support of home country communities in which they operate.

Triple Bottom Line Performance (TBL or 3BL): A framework within which organizations attempt to maximize jointly three bottom lines, which are typically characterized as people (social welfare), planet (environmental sustainability), and profits (business performance).

Corporate Social Responsibility and Management in a Glocal Context

5

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INTRODUCTION

Corporate Social Responsibility (CSR) – both as a concept and an adopted practice – is ubiquitous and in widespread use by international, national and local corporations, and supporters, skeptics, and critics alike. It is also a growing area of concern and practice for businesses, in particular in relation to challenges such as poverty, sustainable development goals, climate change, environmental issues, and a range of diverse ethical issues. More recently the issue of corporate social irresponsibility has emerged and will be tackled here briefly in the next section (Section 1) and in the section on solutions and recommendations (section 4).

This chapter reviews the literature and the main problems related to corporate social responsibility, to identify the most important current challenges and their relevance to management and business information systems. Sustainability and social responsibility tools - such as the Global Compact, Global Reporting Initiative (GRI), SA8000 standards and ISO 26000 standards - have drawn our attention.

In the first section, we review the literature on the CSR concept and its context. In the second section, the focus is on the discussion of CSR issues. In the third section, the discussion focuses on the problem of communication, internal management of knowledge, stakeholder participation and management of information and knowledge systems. Finally, the last section emphasizes the main challenge for the near future.

BACKGROUND

The Concept of CSR

It is important to talk about Corporate Social Responsibility (CSR), this is a fundamental concept for the most part of corporate decisions (Cochran, 2007), when we look at the relations between them and society. Its definition has been developing, with many proposals from academics, commentators, consultants, companies, civil society and governmental organizations.

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When investigating different ways of defining CSR, Banerjee (2008) concludes that, in relation to companies, in all we find three aspects: they must generate wealth, attending to environmental and social issues; should behave ethically, revealing high integrity and transparency, and they must engage with the community in which they carry out their activities, improve their well-being and support them through philanthropy or other means at their disposal.

“Firms are stepping up their environmental and social performance because investors are asking for it” (Dyck, Lins, Roth, Wagner, 2019). Studies such as that of Hou (2019) conclude that “socially responsible firms can achieve financial results superior to those of firms which do not pursue CSR initiatives”. Other authors consider firms are “being socially responsible”, they will have a tendency to experience minimized shareholder wealth and lower profits, which restricts the socially responsible investments (Lin, Law, Ho, Sambasivan, 2019).

For the outside observer, CSR is an opportunity for the company to self-regulate, to monitor its activities, and to respect the spirit of the law, ethical standards, and international norms, with positive impacts on the environment, consumers, and all other interested parties (Torrecchia, 2013).

Since the beginning of the first decade of the twenty-first century a growing number of companies have published SR reports or social responsibility reports. The writing and publication of CSR reports end up defining the company’s responsibility to the stakeholders, highlighting its values and building a relationship of trust.

Tanimoto (2015) reinforces accuracy, credibility and comparability of information as, if each company provides information according to its own criteria, it will not be possible to compare information between companies and justifies the role of the Global Reporting Initiative (GRI) to ensure the validation and certification of SR reports and adds yet another challenge: national governments should control the existence of such reports, believing that they can increase value for business and confidence levels to stakeholders.

Miguel, Jorge, and Candas (2017), in favor of social responsibility, consider that companies with better CSR performance have fewer funding constraints and suggest that for those corporations CSR may be considered as a lever for their reputation in the market and for their differentiation from competition, which is favorable not just for attracting institutional investors but also for fostering existing relationships with the main credit institutions.

Large companies, under pressure from representative entities of society, join the social responsibility (SR) in various ways, responding to various social demands (Torres, 2005). Because of this, some take ownership of social discourse and are an influence for other organizations by adopting or reproducing the same discourses and practices that are being disclosed as good and positive practices in social and environmental areas.

The existence of several stock indexes, whose listed companies have to meet a series of demanding conditions in areas such as environment and social governance prove that financial markets value these matters. In the United States, the Dow Jones Sustainability Index emerged in 1999 and the FTSE4GOOD in the United Kingdom emerged in 2001.

In 1999, the UN Secretary-General launched an initiative, which, in terms of SR, sought to make a commitment among the entities of all countries, challenging companies to adhere to and implement within their action the principles and values of human rights, working conditions, the environment and anti-corruption actions. It is the Global Compact which aims at companies to consider in their strategies and operations 10 principles (Global Compact Network Portugal, 2011).

Among the existing codes, principles, and norms in the SR domain, we summarize some initiatives:

- SA8000 Standard: First specific standard related to SR, produced and promoted by Social Accountability, 1997 (SAI, 2017).
- The AAA000 series of AccountAbility standards introduced in 1999 by the Institute of Social and Ethical Accountability (ISEA, 2017)
- ISO 26000: International Standards for Business, Government and Society standard finalized in 2010 (ISO, 2017).

We can attribute one contribution that the private sector has made with the founding in 1992 of the World Business Council for Sustainable Development (WBCSD, 2017), the world's leading organization in the business approach to sustainable development.

Being the main driver of CSR in Europe and aiming to strengthen the European strategy for corporate responsibility, the European Commission launched in 2001 the Green Paper "Promoting a European Framework for Corporate Social Responsibility", presenting CSR as a concept in which integrate social and environmental concerns into their operations and their interaction with stakeholders voluntarily.

One question remains in CSR, when the adoption of a widely construed conception of responsibility, how can be conceptualized corporate social irresponsibility? Without entering too much debate, in the present chapter and approach, social irresponsibility for corporations can be defined as the increase of environmental costs, external costs for society, communities and stakeholders. It can include even shareholder as a subcategory of group who bear costs when the management of the organization is responsible for negligence or fraud or any behavior that can be considered non-righteous. The irresponsibility goes beyond mistakes, simple ones. It includes big mistakes and any behavior that is considered clearly as irresponsible by the main standards of ethics and business ethics.

APPROACHES AND MANAGEMENT OF CSR

At this point, we will address how companies organize and manage CSR. In summary, we highlight the following three approaches to social responsibility:

Carroll's Pyramid, with Enormous Formative Influence on CSR

Carroll (1979) argues that the SR fully addresses all the obligations a company has towards society and must incorporate the economic, legal, ethical and discretionary categories of business performance. These categories are not mutually exclusive, but ultimately suggest their role in the evolution of their importance. Carroll also identifies the social issues to which companies may have to respond, underlining the importance of managing their non-commercial agendas, anticipating here somehow the management of stakeholders, by highlighting the possibilities of being able to give a business answer to the questions of those agendas, expecting a strategic approach to CSR. Later, Schwartz and Carroll (2003) considered only the economic, ethical and legal domains in CSR, using the Venn model, abdicating the pyramid model with 4 categories.

The Stakeholder Theory, Designed for The Business Strategy but Adopted in CSR

Popularized by Freeman (1984), at the heart of the issue lies because corporate management should not be limited to the interests of shareholders/owners - but also to the interests of other stakeholders. Although Freeman has already stated that stakeholder management is not unique to CSR, many companies have adopted this model as a way of thinking and managing their responsibilities, believing in involvement, collaboration and communication with the parties concerned.

The Triple Bottom Line (TBL) approach, which provides a way of integrating economic, social and environmental responsibility

The triple bottom line approach, also known by the three Ps - profit, people and planet -, is another way of approaching CSR. Developed by John Elkington (1997) from the UK consultancy firm SustainAbility, this model is perfect for understanding sustainability, since it contains the economic, environmental and social aspects that must holistically interact to be sustainable.

The shared value creation approach, which highlights the business case in CSR.

Porter and Kramer (2011) suggest the “shared value” in business, an approach some companies have adopted in relation to CSR. These authors recommend to companies the design of products and the choice of markets according to the needs of societies; the redefinition of productivity in the value chain, to reduce negative impacts and maximize positive ones.

In order to adopt CSR practices derived from sustainable development principles, it is necessary to take into account the different dimensions in which a company can act. Usually, we consider three dimensions: social, economic and environmental.

Following Santos et al. (2005, p. 31), the social dimension integrates the actions oriented to the management of the human element that composes its social matrix (internal component) and actions oriented to the surrounding community (external component). The economic dimension of companies relates to three types of partners: customers, suppliers and investors or shareholders. “Corporate environmental responsibility involves the integration of environmental issues into strategic management, giving them due importance, along with economic and social issues” (Santos et al., 2005).

We can broadly define CSR as responsible practices that are expected to create benefits for society as well as for its stakeholders (Lantos, 2001 and Porter and Kramer, 2006). Since short-term obligations prevent indiscriminate investments in this value creation, CSR is a long-term investment in the company’s future competitiveness (Porter and Kramer, 2006). Corporations can take advantage of their competitors (Orlitzky, Siegel and Waldman, 2011). If companies invest in CSR with the same structures that are at the basis of their most important choices, they will realize that SR can go beyond costs, obligations or charitable works - which may be opportunity, innovation and competitive advantage (Porter and Kramer, 2006). And while there is a growing appreciation of sustainable development, Porter and Kramer (2006: 154) argue that it is rare for companies to know how to do social action in an effective and sustainable way, noting that “by linking corporate philanthropy to their sector and its strategy, the company can, more than other donors, improve the performance of beneficiaries, further enhancing social value. “

In a complementary perspective, there are those who defend CSR, which is closely linked to risk management, which is already an integral part of the organizational strategies of modern companies. It should be noted that corporate scandals or environmental accidents can cause considerable damage to a company that may have worked hard to build a good reputation. In order to mitigate and anticipate these types of incidents, SR can be integrated into the organizational culture (Meulbroek, 2002).

The CSR strategy emerged as a concept to incorporate goals into future planning that enables enterprise performance management to integrate CSR approaches (Werther and Chandler, 2006). However, these corporate strategies have been the subject of several criticisms, including their lack of ambition, their tendency to be in a market-related department, public relations and human resources, that they are generalist, may vary from region to region and negative consequences may be obtained, albeit unintentional (Werther and Chandler, 2006).

In response to such criticisms, there are already companies that seek greater involvement with their stakeholders, ie NGOs, employee representatives and stakeholders, and incorporate their CSR activities more broadly into business strategy (Galbreath, 2006). This presupposes that the company has clearly defined the direction of its CSR approaches and its links to its strategic objectives, which implies that the needs of the stakeholders are analyzed in the short and long term, sought to be evaluated and incorporated them in business objectives. Thus, the CSR strategy is expected to deliver beneficial outcomes for all parties, including the community, through positive economic, environmental and social impacts (Katamba et al 2012).

“Companies give priority to CSR activities that are directly related to maintaining business and achieving economic results. CSR disclosure practices of SMEs and large companies do not differ significantly. However, larger companies disclose more information on Environment and Society. Companies who are closer to consumers disclose more information on Customers, Community and Society. The act of assuring a CSR report drives system improvements and extended CSR disclosure” (Dias, Rodrigues, Craig, Neves, 2019).

MANAGEMENT OF STAKEHOLDERS AND COMMUNICATION OF SR

In 2007, Freeman, Harrison, and Wicks came to give importance to the management of stakeholders in order to create value, aiming at the sustainability of organizations. Through positive long-term relationships, it is possible to identify win-win opportunities for all parties serving the company, stakeholders and society (Goodstein and Wicks, 2007; Svendsen, 1998).

Due to the proximity to the core of the company, we can distinguish two large groups of stakeholders (García, 2012: 89): internal (eg shareholders, partners, managers, employees - directly linked to the company and its organization) and external (e.g. (eg, customers, suppliers and subcontractors, authorities, pressure groups, local communities, regulators and employers' associations, trade unions, and professionals, NGOs, competitors, consumers - interest groups not directly linked to the organization). But this is just one of many classifications.

Lambin (2000: 336) defines competitive advantage as the set of characteristics or attributes of a company that put it in a position superior to its most immediate competitors. Today's companies seek competitive advantages and to build them can follow several paths: traditional vision, resource-based vision and vision based on superior stakeholder management (Rocha, 2010).

In the traditional view, five steps compose the strategic management process (Certo and Peter, 2005):

1. Analysis of the environment (internal and external);
2. Establishment of the guideline of the organization;
3. Strategy formulation;
4. Implementation of the strategy
5. Strategic control.

In the resource-based view, an organization is a set of resources that integrate themselves into categories (Goldschmidt, 2010):

1. Financial resources;
2. Physical resources (factory, equipment, facilities, and access to raw materials);
3. Human resources (encompass skills and training);
4. Knowledge and organizational learning;
5. Organizational resources (formal structure, systems, control, and coordination, culture and reputation).

In the vision based on superior stakeholder management, the road to building competitive advantage is built with an outward look, that is, for customers, competitors, partners, the press and society, looking for new ways of creating and delivering greater value than the competition (Rocha, 2010).

According to Goldschmidt (2010), the principles of sustainability in business, messages emitted by companies to their stakeholders can be related to any of the three items that make up the tripod of sustainability (environmental, economic and social performance). This implies ethical and transparent practices for all types of audiences with whom the company relates. Sustainability can thus present itself as a source of competitive advantage, contributing to this by how its different aspects are linked to the company's value generation model.

In order for the company to contribute to the promotion of sustainable development, it can invest in a stakeholder involvement process.

Calahorro (2008: 36) refers to the need to develop a Relationship Plan for supporting the CSR Strategic Plan, which summarizes six points:

1. Identify and catalog the different groups of stakeholders;
2. Analyze the expectations of each of them;
3. Establish priorities among the different actions that each group seeks;
4. Define programs;
5. Implement the timetable of the different programs;
6. Design a model of communication with different audiences.

After identifying the stakeholders and despite the complexity of the topic, each one should be analyzed individually, with their responsibilities and interests, taking into account the type of relationships they establish with the organization. Transparent corporate governance, transparency, and reporting to company partners and all stakeholders are increasingly important as a way to obtain social licenses for any company to operate, develop long-term activities with sustainability. This transparency implies a sincere, fast and spontaneous communication, close to the stakeholders. All of this is becoming increasingly important in an increasingly competitive world in which we have been overwhelmed by corporate scandals.

Described by McShane and Von Glinow (2003) as the process by which information is transmitted and understood between two or more parties, communication has gained increasing importance in companies, even considering itself strategic. Being essential for the durability of the company's relationship with stakeholders, communication enables the creation of positive associations and reinforcements (Kim and Rader, 2010).

If Corporate Social Responsibility reflects the company's attitude toward the environment and society, we affirm that corporate communication will ensure the company's dialogue with its stakeholders, effectively enabling that responsibility.

We can talk about sustainability communication, when the company uses different channels and languages, adapted to its most varied public, thus informing them of their practices of social responsibility. In this way, the company raises public awareness and stimulates the occurrence of this type of activity (Formentini, 2003: 4), making known what it has done, how and to whom it has done, thus expecting to add value. "When developed with ethics, transparency and a lot of competence, business communication is able to synthesize the company's commitment to society and all its stakeholders, allowing the aggregation of value to the business, which can contribute to a positive public image" (Araújo, 2009 and Bueno, 2003: 118-119), that is, a positive mental perception that the different publics have of an organization and that would have been constructed by the set of messages received by them in all their relations with it. We must not forget that a solid reputation of the company motivates employees, attracts investors, new customers, maintaining current ones, and can even reduce capital costs.

From another perspective, we can also talk about communication for sustainability, from a perspective where learning is shared, for example, promoting education for sustainability, thus broadening the interest and focus to new interests that go beyond the company.

When a company decides that SR incorporates the management of the company and is transversal to all of it, all its actions must be integrated in its policies, so the communication not only should not be left out and must be submitted to SR policies that are seen as authentic by society. And the success of a business communication strategy depends very much on the communication strategy to integrate into the company's overall strategy (Clutterbuck, 2001: 30).

The communication of corporate social responsibility can be defined as the "communication that is designed and distributed by the company itself, about its actions of social responsibility" (Morsing, 2006: 171). to provide true information about the company or brand, integrating business and social operations (Morsing and Schultz, 2006).

In CSR communication is very important, starting with its strategic design and implementation of programs and activities. Sustainability reports, codes of ethics, principles, standards, and content of messages in the most diverse marketing and publicity materials can be considered tools of communication of the social responsibility of an organization.

As can be seen, CSR is communicated through the traditional model of message transmission that implies: who says what, through which channel, with what effect? Communication processes and actions cannot be separated from CSR programs and activities. Being an interactive process, communication implies the existence of dialogue, based on bidirectional and unidirectional communication strategies. There are certain organizational contexts in which information about CSR is only transmitted, and others where the idea is to discuss and negotiate CSR with certain stakeholders. Only with a strategically defined, organized and implemented communication policy, is it possible that the company's SR principles are understood and internalized by its stakeholders.

With respect to the two-way communication Hodggers and Grayson (2002: 260) state that for a stakeholder to be effectively involved, a socially responsible company should have as its principle transparency and the promotion of dialogue with and between stakeholders. a communication channel open in both directions, where all of them feel committed and have the possibility to participate actively in the most diverse policies, assessing the needs of the community, defining and understanding the participation of the company to respond to such needs.

CSR communication faces a particular challenge, which is that more and more companies feel pressured to inform their stakeholders about how they are contributing to society, but on the other hand, different stakeholders can interpret the company's SR communication, unique only as an act of self-promotion (Coombs and Holladay, 2011). And it is also for this reason that companies should seek to ensure that stakeholders' perceptions of SR actions they carry out are in line with their strategic objectives, while maintaining consistency with their image and identity (Formentini, 2003: 4).

SOLUTIONS AND RECOMMENDATIONS

The issue of corporate social responsibility and irresponsibility is complex, as we have tried to highlight in the previous sections. Other authors share the same approach (Herzig and Moon 2013; Rriera and Iborra 2017)

The principles and objectives of CSR should be strategically aligned with other management objectives, being inseparable from it, under its relational culture. Thus, stakeholder management and SR communication will be more facilitated and more effective, and may have positive repercussions on business, the environment, and communities.

One way of further change - and research (see next section) – is to help tackle this issue of irresponsible behavior, misdeeds and opportunism is to deepen our understanding of: (1) what is corporate social irresponsibility; (2) what are its variegated features across cultures and societies; and (3) how social norms and legal rules can regulate or not those unwelcomed attitudes.

Beyond these partial solutions, it is relevant to integrate CSR in a reflection of corporate and management value, decisions and behaviors. This means that CSR has to be integrated in a broader debate and in broader policies that include the fight against corruption and irresponsible behavior.

Finally, it is time to move beyond self-control and to either (1) make it socially accountable or (2) turn it compulsory on some crucial dimensions. Self-regulation is not enough, other tools such as social, political and administrative regulation, including administrative authorities and agencies, have to be mobilized. This is clearly an issue of public debate and public policy.

FUTURE RESEARCH

Although CSR has been the subject of many studies since the 1970s and there is a great deal of literature on the subject, there are still few works that link the sustainable development of the territories. It is desirable to develop studies on social investment policies linked to local business development programs, to what extent companies support the research and development of social investment initiatives, by sharing their knowledge and know-how in actions that promote not only business priorities, but also that maximize benefits for the sustainable development of communities.

Another research that should be associated with that study has to do with the interest and capacity that organizations have to organize themselves in a network and of this benefit to the business and society.

It is necessary to investigate how companies are using the information and communication technologies to communicate SR, and in particular how they use the internet and social networks to interact with stakeholders.

As important as the previous study is the development of impact analysis methodologies for the development of SR actions in the business and in the communities, to better clarify the benefits, obstacles, and motivations to the adoption of this type of practices.

CONCLUSION

CSR has become a strategic necessity for companies, although its executives do not always understand its role in brand building and the importance of associating it with positive social actions, which may prove more complex than operating responsibly, since this requires the understanding of the multiple dimensions of CSR (Steenkamp, 2017). There are different positions regarding the benefits of CSR, and there are still skeptical voices that even deny its existence. Zero is that in the last decades, there are companies that have also paid attention to the broader social, economic and environmental conditions, in which the business also allows their momentum.

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KEY TERMS AND DEFINITIONS

Communication of Social Responsibility: Communication of practices of an organization that contributes to economic, social development and environmental protection.

Community: Local grouping of people living in the same geographical area, united by common interests.

Corporate Social Responsibility: Corporate Social Responsibility or CSR can be considered in two ways: either as a theoretical or philosophical concept based on ethics and theories of right and wrong

doing by corporations and corporation decision makers, incorporating more recently not just the production, but also the social and the environmental dimensions; or as a practice by corporations of integrating in their behaviors, decision processes, strategies and communication the responsibility towards all stakeholders and the environment.

Creation of Shared Value: Policies and organizational practices that, besides contributing to the improvement of one's own, promote better social and economic conditions in the communities where they operate and market their products and/or services.

Local Development: It is the process of developing a territory, by actors who belong to it or whose activity in it has an impact, which implies the formulation of strategies, decision-making, and implementation of actions that allow civic participation, society.

Social Irresponsibility: Social irresponsibility for corporations can be defined as the increase of environmental costs, external costs for society, communities and stakeholders. It can include even shareholder as a subcategory of group who bear costs when the management of the organization is responsible for negligence or fraud or any behavior that can be considered non-righteous.

Social Responsibility: Contribution of any organization to sustainable development.

Stakeholder: Interested party of any organization (examples: owners, shareholders, investors, employees, suppliers, customers, unions, business and other associations, community where the company operates, competitors, press, municipalities, government, consumers).

Stakeholders Management: A process that comprises the identification, planning, involvement management, commitments, and control of stakeholders in any organization.

Territory: Space that in a certain time has its own limits and where social relations are established.

Enriching Organisational Knowledge of Corporate Social Responsibility From the Traditional African–Nigerian and Islamic Religion Perspectives

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1.0 INTRODUCTION

Organisational knowledge of corporate social responsibility (CSR) has been dominated for decades by the American-European perspectives, although there are different perspectives to this debatable concept. This preference for CSR perspective from developed countries is obvious in the historical discourse of CSR. According to Carroll (1999), the long history of CSR could be linked to centuries of observed unethical behaviours and misconducts of corporations in the developed countries which later triggered agitations in the United States calling on the corporations to show more empathic concerns towards the society and the people. The agitation in favour of CSR became more pronounced in the 1950s through a widely celebrated treatise of the United States economist Howard Bowen titled “*Social Responsibilities of the Businessmen*” (Roy, 2010; Tounés, et al., 2011). Ismail (2009) opined that Bowen’s understanding of CSR is premised on the realisation that businesses could impact positively on the lives of the society through philanthropic initiatives and social-welfare projects.

Another perspective to the origin of CSR emanated from Tounés et al. (2011) who noted that the Protestant and Catholic groups were instrumental in the emergence of CSR through their philosophies of ‘public service’ and ‘stewardship’. The Catholic group preached to their members, particularly the property owners in industrial society, to imbibe the spirit of selfless service, empathy and contribution to support the society. It was the church’s philosophy as enunciated above that inspired ethical consciousness and led to the adoption of social responsibility.

For Mintzberg (1983), CSR had long existed as a consciousness to show concern for others in the society, a term widely known among Europeans as ‘noblesse oblige’, which literarily connotes ‘nobility obliges’. The root of ‘noblesse oblige’ indicates that it was a common French notion, used for describing ethical traits and worthy character displayed by a typical country gentleman, especially one who fulfils social obligations to the community. Obviously, CSR predated Bowen, it has been a noble English value practised by responsive individuals for ages. Bowen got credit for articulating CSR within the business context (Raimi, 2015).

Further exploration of CSR’s origin by Ismail (2009) indicates that CSR is an age-long practice traced to Oliver Sheldon, who wrote on the social performance of businesses in 1923 – a nuance that identified a strong link between social performances of business in the society and their market performances.

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Similarly, it has been explained that before the discovery of CSR in Europe and America; there had existed a well-developed philanthropic model called Zakat - a form of religious tax enjoined on the rich as part of their social responsibility for supporting the poor (Roy, 2010). Whereas, Tounés et al. (2011) wrote that opinions differ on the origin of CSR. There are write-ups that traced the earliest proponents of CSR to the Protestants in the United States of America. In other words, the two prominent religious group (Protestantism and Catholicism) were instrumental to the emergence of CSR through rigorous advocacy of church's philosophy of public service that inspired ethical consciousness and a personal sense of responsibility among the congregants.

The African-Nigerian and Islamic perspective of social responsibility has been fairly explored by scholars in their quest to unveil indigenous African and Islamic ethical practices (Amaeshi et al., 2006; Helg, 2007, Le Grange, 2012; Raimi, 2014), but there is still need for deeper exploration in this direction. A separate CSR discourse from non-Western lenses is important because Africa has a different CSR agenda and challenges, which are quite different from those of the developed climes (Visser 2008).

For instance, the African-Nigerian ideals such Ubuntu and Omoluwabi which provide support for CSR need to be fully comparatively discussed. Salarzehi, Armesh & Nikbin (2010) wrote that evidenced-based research affirmed that good actions are embedded in people's beliefs and social culture and both shape their personality and attitude to social actions. In particular, religious belief largely influenced participation charitable giving and voluntary social action. Research found traces of social responsibility visible in the ethno-religious beliefs and the culture of Africans (Amaeshi et al., 2006). Also, the communal solidarity in Africa is built on selfless services, personal sense of responsibility and zeal to serve parents, relations, friends and community at large (Fajana, 2000).

From the foregoing background, the objective of the paper is to examine Organisational Knowledge of Corporate Social Responsibility from the Traditional African-Nigerian and Islamic Religion Perspectives in order to enrich the conventional American-European perspectives of CSR. Apart from the introductory section, there are five sections in this paper. The next section critically reviewed the literature spanning discussion on CSR from American-European Perspectives, CSR from Traditional African-Nigerian Perspective and CSR from Islamic Perspective. The third section clearly describes the hermeneutics theory of interpretation. The fourth section discusses the methodology employed in the study. The fifth section presents the emerging findings and thematic issues. The sixth section presents the conclusions and research implications.

2.0 BACKGROUND

2.1 CSR from American-European Perspectives

Western literature classified CSR into two continental perspectives, namely: (a) American perspective of CSR and (b) European-UK perspective of CSR. The American perspective of CSR is the philanthropic model, which advocates voluntary participations by corporations in societal programmes that they are favourably disposed to. Their common line of thought is that corporations should show philanthropic gestures through donations to societal initiatives voluntarily without being coerced.

However, the European perspective of CSR is typified as a citizenship model, which is anchored on the assumption that corporations must have an inclusive policy that integrates socio-environmental concerns into their business model because they are part of the larger society. This perspective of CSR is built on the ideals that corporations apart from their primary goal of profit-maximisation have ethical

obligations which include contributing towards the realisation of social welfare and environmental issues (Carroll, 1999; Snider, Hill and Martin, 2003).

The American and European perspectives of CSR have been re-christened by Matten and Moon (2004), as “explicit and implicit” frameworks respectively. The explicit CSR framework presupposes that corporations in the United States of America and continents that share this ideological posturing on CSR willingly partake in philanthropic initiatives or volunteering programmes like health-care provision, employees’ rights, and environmental protection as part of their CSR policies. The legal requirement for compliance with CSR is less stringent in America relative to what applies in Europe/the UK.

The implicit CSR framework on the contrary is a CSR posture of Europe/the UK, where corporations see their volunteering involvement in socio-environmental programmes as part of their legal responsibilities as a corporate citizen. Researchers contend that in the Europe-UK axis, the legal system assigns to corporations: “an agreed share of responsibility for society’s interests and concerns” (Matten and Moon, 2004: 9). It has been reported that the issue of CSR is taken seriously in Europe where CSR compliance is made a front-burner issue when the European Union initiated landmark policies on CSR and passionately implemented them for the betterment of the society. Besides, the United Kingdom appointed a substantive Minister for CSR in the Department for Trade and Industry. France made CSR a binding legal obligation on companies to disclose officially the impact of their CSR programmes in their annual reports. The Danish Government established the Copenhagen Centre for CSR research. The Netherlands adopted the French model, requesting corporations to comply with the principles of environmental sustainability and ensure their annual reports reflect philanthropic initiatives in line with the Guidelines for Multinational Enterprises designed by the OECD, to which Netherlands is a signatory (Luetkenhorst, 2004; Raimi, 2015). Moreover, within Canada’s mining industry, when voluntary CSR compliance and self-regulation failed, the civil societies, NGOs and host communities forced the government to make compliance a binding and enforceable obligation like Europe through promulgation of Bill C-300. The Bill C-300 seeks more pragmatic accountability and “punitive measures” for offending corporations (Hart, 2012:6).

2.2 CSR from Traditional African Perspectives

The African perspective of CSR has been fairly explored by scholars in their quest to unveil indigenous African and Islamic ethical practices (Jackson, 2004; Amaeshi et al., 2006; Helg, 2007, Ajadi, 2012, Raimi, 2014), but there is still need for deeper exploration in this direction. African perspective of CSR is deeply rooted African moral theory, which as a philosophy prescribes actions that are right and desirables, and which promotes living harmoniously and peacefully with other members in the society. It extends also to imbuing in the people the practice of honouring communal relationships and maintaining solidarity (Metz & Gaie, 2010). Within the African moral theory, CSR should be understood as an attempt to develop a collective approach to problem-solving and the need to elicit social impact from diverse groups such as the extended-family system and the village community. It is evidently clear in African philosophy that being socially responsible to the people and the society is a way of life that had been embedded long before the formalised Western perspective of CSR (Phillips, 2006; Roy, 2010; Raimi, 2015).

Comparatively, African CSR philosophy is altruistic, as it seeks to provide social support for disadvantaged members of the society, whereas the Western CSR philosophy to large extent seeks to provide a mask for the limitless pursuit of profit and power by the corporations and their owners (The Economist, 2005). Helg (2007) discussed a number of African ideals such African Renaissance, Ubuntu and

Omoluwabi which functionally and structurally all align with principles of CSR. Another exploratory study found traces of social responsibility in the ethno-religious beliefs among Africans where the culture of charity giving is prevalent (Amaeshi et al., 2006). The communal solidarity in Africa is structurally built on selfless services, personal sense of responsibility (PSR) and empathetic zeal to serve parents, relations, friends and community at large (Raimi, 2015). For instance, in the traditional Igbo society, the communal solidarity is a noteworthy social responsibility. According to Fajana (2000:19) “the economy of the various states which make-up modern Nigeria was basically a subsistence economy and customs had established the practice that people serve their parents, village heads and the community without remuneration [doing good]. On a given day, people went and work for a particular individual. Through the day, the man they serve was responsible for their food and drink. On another day, the man returned the service and it went on until everybody in the group was served.” The above quote affirms that the spirit of social consciousness and solidarity had been firmly entrenched in Africa several decades before Bowen’s conceptualisation of CSR in the United States of America.

Another African ideal that explicates CSR, is the Ubuntu philosophy. Ubuntu is an empathic philosophy with root in the languages of Zulu and Xhosa of South African (Dartey-Baah and Amponsah-Tawiah, 2011). Ubuntu is a consciousness that inspires Africans to be concerned about the wellbeing of their fellow Africans (Mbigi and Maree, 1995; Helg, 2007). It also means “humanity towards others” and “the belief in a universal bond of sharing that connects all humanity” together (Helg, 2007:44). Ubuntu is founded on six core values, viz:

- a) Group solidarity (that is, all age groups/associations work in teams for mutual benefits),
- b) Conformity (that is, every individual must align with norms, mores, rules and regulation),
- c) Compassion (that is, every individual must have empathy for fellow mortals),
- d) Respect (individuals must give regards to fellow humans and traditions),
- e) Human dignity (freedom, liberty and self-esteem)
- f) Collective unity.

The focus of Ubuntu, like CSR, is the utmost concern for humanity, community, society, and people living therein as well as their traditional norms/values. Elkin and Strach (2002:11) describe Ubuntu succinctly as the: “African belief that a person becomes human through other people (umuntu ungumuntu ngabantu).” Another description of the meaning by Mbigi and Maree (1995:41) is “I am because We are.” It is therefore, a philosophical ideal that exalts collectivism above individualism. Le Grange (2012) explained and applauded the concept of Ubuntu because it embeds humanness, and potency to restore ecological stability to the damaged planet and battered society. The ideal of Ubuntu should be “invoked to contribute to the healing of the three ecologies—how healing of the social might transversally effect healing of nature and the self.” (p.56). Africans in South Africa specifically and others suffered erosion of their humanness (nature, society and self) as a result of centuries of colonialism and decades of oppressive and repressive apartheid regimes (Le Grange, 2012). Comparative analysis indicates clearly that Ubuntu accommodates the Triple-bottom-line wellness, that is, the three elements of Ubuntu (nature, society and self) explicate the Triple-bottom-line (economic, social and environmental considerations).

Related to the above is the African-Nigerian perspective on CSR called ‘Omoluwabi’ – a rich ethical nuance from South-West of Nigeria. Omoluwabi is purely a Yoruba philosophical term used for describing the worthy character possessed by an individual, group and nation (Helg, 2007; Dartey-Baah, and Amponsah-Tawiah, 2011). According to Omoluwabi Social Cultural Group (2010), the term Omoluwabi is an age-long Yoruba social concept that describes seven core traits of male and female such as Hard-

work; Honesty; Integrity; Fairness; Egalitarianism; Respect for Elders and Constituted Authority; and Fear of God. In all there are seven core attributes of Omoluwabi. These cherished traits are expected to guide the actions and inactions of people, groups and nations.

For the Yoruba people of South-West of Nigeria, the concept of Omoluwabi is valuable ethical concept. Dartey-Baah and Amponsah-Tawiah (2011) noted that there are seven attributes of the Omoluwabi construct. However, when critically viewed in line with the organisational knowledge discourse, the concept of Omoluwabi functionally resembles CSR. Like CSR, the Omoluwabi ideal shapes the society and strengthen people's morals "to contribute to the good, progress and development of the Yoruba nation [...] to influence the landscape through activities that will foster unity amongst the Yoruba nation and enhance economic growth of our people irrespective of location" where they may live (Omoluwabi Social Cultural Group, 2010). At global level, Ajadi (2012) noted that Omoluwabi is the reconstruction of organised indigenous principles, values and traditional codes as development paradigms considering the vantage position of Nigeria, its population and status in the world. Omoluwabi as a management construct emphasises renewal of trust, cooperation as a way of building an efficient and effective world-class management system hinged on indigenous foundational principles otherwise called Africanisation.

2.3 CSR from Islamic Religion Perspectives

Asian continent that housed the Islam has a rich history of strong sense of community and empathetic activities (Phillips, 2006). A number of scholars have written on the congruence between Islam/Ethics of Shari'ah Law and CSR (Al-Qardawi, 1973; Brammer, Williams and Zinkin, 2006; Dusuki, 2008; Gill, 2011; Mohammed, 2007; Mohammed, 2013). Undoubtedly, there are ethical provisions in Islamic jurisprudence serving as a regulatory framework for businesses, or what people otherwise call the dos and don'ts of business transactions (Dusuki, 2008). Moreover, Taman (2011) stated that the ideals and principles of CSR are consistent with Islam. CSR often finds acceptability from Muslim businesses and managers it is situated within the framework of worship and rewardable social action (Raimi, et al, 2014). In Islam, CSR assumes a broader spiritual significance because it is a philosophy that motivates man as an individual to interface with the larger society and fellowmen; its depth extends beyond the Western strategic or instrumental goals of flagging social actions to enhance goodwill or boost long-term financial performance of companies The Muslims as social beings therefore must have concerns for people, plants, animals and environment, and that social responsibility is a moral and religious obligation that cannot be ignored, nor disregarded regardless of financial positions of their businesses (Dusuki, 2008).

The growing number of scholarly articles on CSR and Islam, which established a strong link between Islam and ethical issues, is an acceptance of the fact that CSR theoretically and practically align with Islam (Taman, 2011). According to Gill (2011), Islam is a unique religion with a well-developed Code of Ethics that provide guidance for ethical and social behaviour of humans. The concept of CSR although relatively new in industrial society, it been firmly rooted in Islam as Zakat over 1400 years ago. To Dusuki (2008), CSR assumes a broader spiritual significance in Islam because it is a philosophy that motivates man to support the larger society and fellowmen through Zakat; its depth in Islam extends beyond the Western strategic or instrumental goals of flagging social actions to enhance goodwill or boost long-term financial performance of companies (Dusuki, 2008). Therefore, the practice of charitable giving (Zakat) is desirable behaviours that Muslims as individuals and corporate entities have been instructed by God fulfil their obligations the people, environment and the larger society. Allah says:

“And render to the kindred their due rights, as (also) to those in want, and to the wayfarer: But squander not your wealth in the manner of a spendthrift. Verily spendthrifts are brothers of the Evil Ones; and the Evil One is to his Lord (himself) ungrateful.” (Al-Hilali & Khan, 2018, Qur’an 17:24-25).

“Take Sadaqah (alms) from their wealth in order to purify them and sanctify them with it, and invoke Allah for them.” (Al-Hilali & Khan, 2018, Qur’an 9: 103).

“Corruption has appeared in the land and the sea on account of what the hands of men have wrought...” (Al-Hilali & Khan, 2018, Qur’an 30:41)

“And do no mischief on the earth, after it has been set in order...” (Al-Hilali & Khan, 2018, Qur’an 7:56)

“When he turns his back, his aim everywhere is to spread mischief through the earth and destroy crops and cattle...” (Al-Hilali & Khan, 2018, Qur’an 2:205)

Contextually, Zakat differs from Sadaqat. Zakat is a compulsory obligation payable annually by Muslims at the rate of 2.5% on net incomes that is benchmarked by Islamic law at 20 Dinar worth of gold or 200 Dirham worth of silver, while Sadaqah is a voluntary charity giving out anytime to support the less privilege in the society (Raimi, Bello and Mobolaji, 2010). Zakat has also been described a pillar of the Islamic religion instituted purpose for empowerment and creating social justice in the Muslim societies (Jawad, 2009). Zakat and Sadaqat perfectly fit CSR because they address social, economic and environmental concerns of the community (Raimi et al., 2013). Unlike CSR, the Zakat is built on a theological foundation of the Laws of God, hence non-compliance is viewed as “an affront to God’s will, with serious consequences on defaulters in this world and in the Hereafter.” (Dusuki, 2008: 22).

Another way of reflecting social responsibility in Islam is through Waqf. According to Raimi, Patel and Adelopo (2014), the term Waqf is often defined as “valuable property and tangible assets set aside by the legal owners as gifts to Allah and His cause and for the benefit of humanity. Waqf also connotes an endowment/foundation established by the affluent individuals purposely to provide free relief services and solace to the vulnerable members of the society.” (p.234). It could functionally be described as a surrendering and sacrificing one’s personal property for public affairs and wellness; it is the Islamic alms-houses and reflects social entrepreneurship in Muslim countries (Salarzehi, Armesh & Nikbin, 2010). Religious Waqf allocates property to mosques and religious schools as endowments. This allows for sustainability of the activities of the mosques and religious schools. However, the philanthropic Waqf is dedication of property to the society for humanitarian purposes for large scale benefits to the poor and marginalised public. This type of Waqf could be used to set up educational centres/school. Library, hospitals, animal care, care for the ecosystem, road and recreational facilities. Whereas, Family Waqf is dedication of property by parents for the upkeep of their children and dependants after death (Raimi et al, 2014; Salarzehi et al, 2010).

From the mainstream Islamic viewpoints as discussed above, CSR is a voluntary duty like the charity called Sadaqah; it is an act of empathy carried out by socially responsive individuals and groups as an act of worship with the mind-set of pleasing Allah and giving back to the society. From the foregoing, CSR and Islam connect because Islam gives preference to human wellness by instituting social security systems such as Zakat, Sadaqat and Waqf to bridge gaps and maintain socio-economic equilibrium between the rich and the power (Raimi et al, 2013; Dusuki, 2008). Therefore, considerations for social, economic and environmental wellness of humans, minerals, plants and animals (broadly summarized

as social, human and natural capital elements) are recognised personal and corporate responsibilities in Islam. In general, the laudable tenets of Islamic religion are consistent with modern business ethics including are the ‘Ten Principles’ of responsible business codified in the UN Global Compact (Zinkin, 2007; Williams & Zinkin, 2010). It is instructive to state that CSR is not at variance with Islam because apart from Zakat which is compulsory, there is opportunity for wealthy persons and organisations to pay extra levies on Muslims and corporations beyond the obligatory Zakat (Al-Qardawi, 1973).

3.0 HERMENEUTICS THEORY OF INTERPRETATION AND CSR

For this study, hermeneutics provides the needed theoretical underpinning. This theoretical underpinning finds support in the view of Crotty (1998) that, hermeneutics is not a research method, but a theoretical perspective that extends to a methodology, which underpins the methods employed in a particular study. Similarly, Bleicher (2017) opined that hermeneutics is loosely the theory or philosophy of the interpretation of meaning in the philosophy of social sciences, the philosophy of art and language and in literary criticism. In other words, it is the “art and science of interpretation” (Ezzy, 2002: 24). Therefore, hermeneutics theory is a critical textual interpretation about a concept for qualitative study, for the purpose of unveiling the philosophy or hidden understanding contained in texts.

As a theory, hermeneutics has undergone fortification over time as Ricoeur’s hermeneutic theory (Geanellos, 2000), hermeneutics and phenomenology (Tan, Wilson & Olver, 2009). But, Kinsella (2006) explained that, hermeneutics is a useful theoretical construct for qualitative exploration and critical investigation for interpretative research with a view to having indepth understanding of objects of inquiry. Hermeneutics is also desirable to help bridge the congruence between the philosophical foundations of a research and the methodological processes for validating research findings through textual analysis. The congruence between philosophy, methodology and method is actualized through a forward transition from naive understanding of the text by the researcher, to a deeper understanding of parts of the text in relation to the whole and finally an understanding of the whole of the text in relation to its parts a process termed the hermeneutic circle (Geanellos, 2000; Tan, Wilson & Olver, 2009).

With specific reference to CSR, hermeneutics theory of interpretation is applicable because theorists argued that, it helps in the interpretation and description of human experience in order to understand the central nature of such experience (Evans & Hallett, 2007; Tan, Wilson & Olver, 2009). Besides, a number of conceptual, theoretical and empirical studies had been conducted to provide insights into the philosophy of CSR essentially from Western perspective, but the contribution from the Traditional African-Nigerian and Islamic Religion Perspectives is few and peripheral. An enriched organisational knowledge of CSR from the latter is imperative leveraging hermeneutics theory of interpretation. At the end of the hermeneutics, richer insights on CSR philosophies from the Traditional African-Nigerian and Islamic Religion perspectives give comprehensive understanding and consequently opens new possibilities about organisational knowledge of CSR.

4.0 METHODOLOGY

Exploiting the Hermeneutics Theory of Interpretation as explained above, this research adopts a qualitative research method because the phenomenon of inquiry is veiled, hidden and unclear, it therefore need to be investigated, understood and interpreted. The authors sourced the required qualitative data from

journal articles, Islamic texts, other textual sources as well as relevant online resources on the subject. The extractions from sundry sources above were subjected to content analysis to gain new understanding, meanings, themes and insights from non-Western texts and scholarly works on CSR using content and thematic analyses (CTA). This methodological approach aligns with previous studies that used hermeneutics and phenomenology such as Tan, Wilson & Olver (2009) and Bleicher (2017).

4.1 Findings and Discussions of Thematic Issues

From the content and thematic analyses of scholarly texts (leveraging hermeneutics theory of interpretation), this study found that the concept of CSR had long existed in the philosophies of Traditional Africans and Islamic Religion as Ubuntu, Omoluwabi, Communal Solidarity, Zakat, Sadaqat and Waqf. The African-Islamic perspectives of social responsibilities correlate structurally and functionally with the American-European CSR perspectives that have dominated the academic landscape for decades. The findings therefore demystified the widely-held view that CSR is a new organisational knowledge in Africa and the Muslim World. Comparatively, the Western perspectives have consistently undergone refinement and reinvention in theory and applications by academics and practitioners in the society, whereas, the non-Western perspectives have largely remained under-researched and static. Although social actions had been entrenched in the cultural norms of Africans and Muslims with different names, and were deployed to tackle poverty and achieve social equilibrium in a number of ways ranging from training, micro-credit support for the poor, apprenticeships, infrastructural development in the communities, as well as providing welfare support services to the marginalised and other economically disadvantaged groups (see Table 1).

With regards to the meanings of CSR, the understanding across the three perspectives overlap. Western perspective views CSR as a voluntary obligations of companies to give back to the society. African perspective of CSR on the other hand is also a voluntary obligation carried out by individuals, groups and communities to provide social support for the disadvantaged members in the society. Islamic perspective of CSR reflects in Zakat, Sadaqat and Waqf. While the Zakat is a compulsory obligation, the Sadaqat and Waqf are voluntary acts of empathy carried out by socially responsive individuals and groups as an act of worship with the mind-set of pleasing Allah and giving back to the society (see Figure 1). The Muslims derived their CSR perspectives from the Eternal Law (Scripture-based).

On the issue Who takes on CSR? The three perspectives differ slightly. While it is strictly the corporate organisations in the Western perspectives, the African-Nigerian and Islamic perspectives of CSR accommodate individuals, groups and businesses to be involved in socially responsible behaviour.

For the African, social responsibility assumes different forms such as Omoluwabi, communal solidarity and Unbutu (Figure 2). Omoluwabi is an ideal that shapes the society and strengthen people's morals to contribute selflessly towards the society and the people for the overall objective of stimulating peace, progress and development in the Yoruba nation. In Igbo land, the concept of communal solidarity is particularly common, it is an ideal that is structurally built on selfless services, personal sense of responsibility (PSR) and empathetic zeal to serve parents, relations, friends and community at large. Among the South Africans, the concept of Unbutu is institutionalised, highly respected and practised. Unbutu reflects concern for humanity, community, society, and people living therein as well as their traditional norms/values – a perspective that exemplified corporate citizenship model in western literature. Ubuntu's humanness has three elements: nature, society and self, which fits perfectly as the Triple-bottom-line (economic, social and environmental considerations). The African perspectives of CSR is focused on people and desire for a distributive justice in the society.

Figure 1. Islamic Religion CSR Ideals

Source: Authors' Reflection

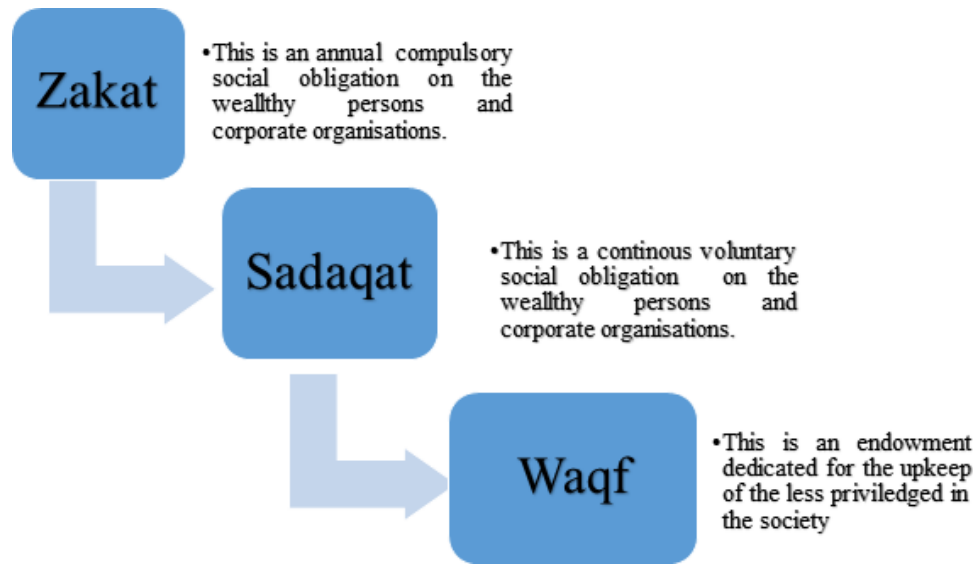
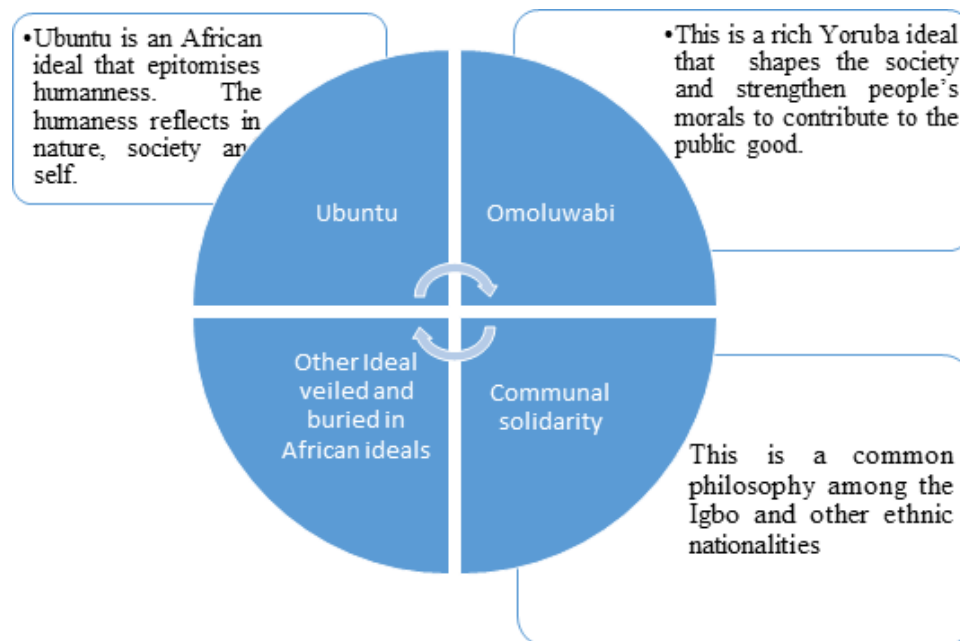


Figure 2. African CSR Ideals

Source: Authors' Reflection



5.0 CONCLUSIONS AND IMPLICATIONS

The paper sets out to examine organisational knowledge of CSR from the Traditional African-Nigerian and Islamic Religion Perspectives in order to enrich the conventional American-European perspectives of CSR that have dominated the academic landscape for decades. Using a qualitative research method,

Table 1. Thematic Comparison of Three Perspectives of CSR

Features of CSR	Western CSR	African CSR	Islamic CSR
Meaning	It is a voluntary obligation of companies to the society as corporate citizen.	It is a moral duty that individuals, businesses and communities owe fellowmen.	It is a religious obligation that Muslims as individuals, groups and businessmen are expected to fulfil for the pleasure of God.
Who takes on CSR?	Businesses	Individuals, Groups and Businesses	Individuals, Groups and Businesses
Drivers of CSR	Reputation-building Government wavers Greenwashing Strategic marketing	Social integration Empowerment	Fear of God personal sense of responsibility, support for the disadvantaged
CSR: Voluntary or Obligatory?	Voluntary (US) Obligatory (Europe)	Voluntary	Sadaqah (Voluntary) Zakat (Obligatory) Waqf (Voluntary)
Degree of compliance	Very high among big companies Low among SMEs	Very high among individuals, groups and communities	Very high for (Sadaqah) Low for Zakat Modest for Waqf
Domains CSR	Social, Economic and Environmental	Social, Economic and Environmental	Social, Economic and Environmental
CSR programs	Donations, Volunteering and Projects	Donations, Volunteering and Projects	Donations, Volunteering and Projects
Impact of CSR	Improved financial performance, Customer loyalty Competitiveness Enhanced reputation	Poverty reduction Wealth redistribution Social equilibrium Communal solidarity Bonding	Poverty reduction Wealth redistribution Social equilibrium Love of God Social Services
Theory of CSR	Relativism (Self-Interest Based), Utilitarianism (Cost-Benefit Approach)	Distributive Justice (Justice-Based Wealth and Benefits Approach)	Eternal Law (Scripture-based).

Source: Authors' Extractions from the reviewed literature

it was found that the concept of CSR had long existed in the philosophies of Traditional Africans and Islamic Religion as Ubuntu, Omoluwabi, Communal Solidarity, Zakat, Sadaqat and Waqf. These African-Islamic perspectives of CSR correlate perfectly with the conventional American-European perspectives. The findings therefore demystified the widely-held view that CSR is a new organisational knowledge in Africa and the Muslim World. In particular, the ideals of CSR had been entrenched in the cultural norms of Africans and Muslims, although with different names. CSR initiatives in these climes include poverty alleviation, training, micro-credits support, infrastructural development and other social services. Practically, this paper is a contribution to theory and practice of CSR in the field of organisational management and Islamic management. The paper has enriched organisational knowledge in the field of CSR both in theory and practice. It has also provided an integrated understanding of CSR across three perspectives, recognising different continental ethical values. The dominant Western perspectives of CSR, fuelled lack of a comprehensive global understanding within which a broader perspective of CSR ought to be positioned and projected.

6.0 FUTURE RESEARCH DIRECTIONS

Further research is encouraged to unveil more African CSR ideals that are buried in cultural practices and those that positively manifest in the day-to-day norms of Africans that are worthy of being investigated, strengthened and reinvented for adoption in the field of comparative management.

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KEY TERMS AND DEFINITIONS

Corporate Social Responsibility: This is the voluntary obligation that companies owe to the society as a commitment to giving back to the society.

Islam: This is the religion and the way of life of people that follow the principles and practices of Qur’an and Hadith at personal, organisational and societal levels. Islam is a unique religion with a well-developed Code of Ethics that provide guidance for ethical and social behaviour of humans.

Organizational Knowledge: This refers to specific knowledge emerging from the collective experience of organisation as an entity as well as from the individual experience of organisational members for the purpose of achieving set objectives.

Sadaqat: Sadaqah is a voluntary charity giving out anytime to support the less privilege in the society.

Zakat: This is a compulsory obligation payable annually by Muslims at the rate of 2.5% on net incomes that is benchmarked by Islamic law at 20 Dinar worth of gold or 200 Dirham worth of silver.

Understanding Corporate Social Responsibility of Commercial Banks in Nepal

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1. INTRODUCTION

This paper examines Corporate Social Responsibility (CSR)'s nature and practices of the commercial banks in Nepal, where the corporate sector has been expansionary in all sectors after Nepal initiated the economic reform 1992 to liberalize all sectors of the economy to the corporate investment, except few sensitive areas (communication and security)(MoF, 2017). Its good result occurs in the commercial banking sector in terms of number, services and investment. NRB (2017) and MoF (2017) report 28 Commercial Banks and 48 Development Banks. In 1990s, its numbers were only six. Until 2017, its growth rate is 400 times in the Commercial Banks and 800 times in Development Banks. Their net profit figures are very impressive in the top competitive financial market. At some extent, these banks have initiated social responsibility, although the industrial policy has made it voluntarily, unlike India and USA where corporate social responsibility is mandatory. In India, the corporate sector has to spend at least 2 percent of their annual profit in the society as corporate social responsibility. In USA, it is also 1 percent legal and ethical mandatory. Despite its voluntary nature, the well aware consumer expects their Commercial Bank's significant contribution to the society as their social responsibility in accordance with international norms and values of the corporate governance. There are few handful literatures in Nepal but almost have focused on MNC. In banking sector, there are none of literatures dealing such issue. In the context of growing CSR activities and practices of the Commercial Bank, its examination is relevant to understand in depth its nature, characters, size, trend and pattern for its promotion and development in these sectors.

This paper is organized into the following sections: Section 2: Objectives, Section 3: Literature Review, Section 4: Theoretical Framework and Section 5: Data sets and Methodology, Section 6: Results and Discussions, Section 7: Conclusions.

2. OBJECTIVES AND METHDOLOGY

The paper has main objective to examine CSR's nature and practices of the commercial banks in Nepal. In addition, the paper analyzes structure and trend of their CSR budget in Nepal. Further, the paper explores its size and CSR and Profit ratio and identifying their priority areas.

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3. CSR SCENARIO AND PRACTICE

3.1. Concept of CSR

CSR is inevitable ingredients of the successful, efficient and giant corporate governance in the world. In this context, debate on CSR is still going on at the different levels in the different forums, along with mandatory or voluntarily its practices. The concept emerged in 1917, when Henry Ford initiated social responsibility in terms of value of all stakeholders' interests as well as the social welfare of employees and shareholders (Lee, 2008 and Meredith, 1999). It was not emotional. It was a business perceptive and practice to be good corporate citizen. At some extent, the company had such practices in all over the world. Immediately after the World War II, the corporate business acknowledged the need to commit some of their profits to social causes. May be its cause would be social, economic and political turmoil(1930s-1950s) and the reactionary movement of the citizens to fight against the abuse of power, corruption, tax evasion, discriminatory pricing, and lack of protection for workers and consumers and other anti-social practices by industries(Afful, 2003). Its focus was only social cause. It did not focus on the issues of workers, customer and community. Its reflection is still even in 21st century, when they do not treat their workers, customers and their communities any better. Meanwhile, there is positive practices in which the company owners having human attitude to their workers and supported social causes, do so for religious or charitable purposes. However, distributing food and money to the poor during festivals cannot be called CSR (Afful, 2003). The Reputation Institute (2017) has listed higher CSR companies out of total companies (170,000) of the world such as Lego (1st Rank), Microsoft(2nd Rank), Google(3rd Rank), Walt Disney Company(4th Rank), BMW(5th Rank), Intel (6th Rank), Robert Bosch(7th Rank), Cisco System (8th Rank) and Rolls Royce(9th Rank). Such rating has improved their value induced sales, loyal consumer and employees more than lower rating CSR companies. Further, Sen et al.(2006) noted the growth of CSR activities and its influence on sales growth and the employment and investment. Carmeli (2005) mentioned it as a sustainable competitive advantage. Therefore, it has become ingredients of corporate governance for competitive advantage.

Academic perspective attempted on CSR in 1932, when Dodd (1932) and Berle (1932) published their article on "For Whom Are Corporate Managers Trustees?" in a Harvard Law Review. In 1953, Bowen published a book, Social Responsibilities of the Businessman focusing on the relationship of corporation with society and need of business ethics (Carroll, 1979). In 1970, Milton Friedman (1970) continued this debate through his article on "The Social Responsibility of Business Is to Increase Its Profits," in the *New York Times Magazine*. Thus, CSR has received public and academic attention for social interest. Such evolution of academic perspective has contributed its modern concept. The literatures (Carroll, 1999; Engardio et al. 2007; Hart, 1995; Holmes and Watts, 2000; McWilliams and Siegel, 2001; Nicolau, 2008; Tsoutsoura, 2004) mention CSR as the activities making companies good citizens who contribute to society's welfare beyond their own self-interests. In addition, Elhauge (2005) explains CSR as *sacrificing profits in the social interest*. In simple, it is social work of the corporate sector in the society. Similarly, Graff Ziven and Small (2005), Portney (2005) and Reinhardt (2005) in their papers have offered similar arguments consistently. If we examine it, we can find that it is normative nature and general statement in which the corporate sector binds to contribute in the society through using profit share but it must be in accordance with the social interest. It means not specifically whatever social goods desired by the society, which may be either environment or infrastructure or social sectors (health or education or sanitation).

3.2. CSR: Mandatory or Voluntarily

Some literatures (Griffin, 1998; Afful, 2003; Kootz and Weihrich, 1990 and Kreitner, 1999) have discussed whether CSR is mandatory and voluntarily. Griffin (1998) defines it as the set of obligations an organization has to protect and enhance the societal context in which it functions. Social responsibilities of business mean responsibilities of business towards customers, workers, shareholders and the community (Afful, 2003). The government of India (2017) mentioned it as mandatory in the Industrial Policy. Koontz and Weihrich (1990) and Kreitner (1999) argue in the similar way in their papers. EU (2001) focuses more on the integration of social and environmental interest. However, the government of Nepal (2017) explains it voluntarily by giving freedom to the corporate sector. Thus, CSR is in both mandatory and voluntarily in accordance with the country's perspective and policy on the corporate governance.

Figure 1. CSR Framework



3.3. CSR: Its components Pyramid

Sriram and Achick (2003) conceptualize categorically on CSR issue with the statement, "Conceptually, CSR is a bridge that links corporate and social interests in two ways. First, the firm is presumed to have other goal that it strives to achieve in addition to its shareholder wealth maximization goals. Second, groups other than stockholders (e.g. employees, customers, and community) are perceived to have a vested interest in the consequences of firm's actions." We can conclude CSR as investment on business and social interest as well as environmental interest. Schwartz and Carroll(2003) explained its three components: economic, legal and ethical in their conceptual framework.

CSR Practices in the Corporate Governance

CSR practices in the Corporate Governance are heterogeneous in the world. Its determinant factors are generally legal provision, ethical obligation and value creation as shown in the pyramid of CSR. European Countries and USA have clear and comprehensive corporate laws about CSR that is the corporate bodies sacrifice their profit for their public social welfare and business expansion.

For example, every US state recognizes the right of businesses to make charitable contributions. Seven states allow charitable donations regardless of corporate benefit, and nineteen other states allow donations that benefit the business or advance the public welfare (Choper, Coffee, and Gilson, 2004). Statutes in the remaining 24 states (including Delaware) include similar language, but without legal clarification about whether donations are permitted, when they do not benefit the firm (Donohue, 2005). Therefore, CSR is legally mandatory to the corporate body. Similar practices occur in European countries, where the stakeholder's participation is endorsed in CSR practices. Europeans have sought to incorporate CSR into their investment climate, both at the institutional and individual level (Sutton, 2004), and in strong social democracies, such as Germany and France, stakeholders (particularly employees) have much stronger legal positions than in the United States (Roe, 2000). Corporations in Europe and Asia are also more likely to have a few large shareholders, who may take social responsibilities seriously, particularly those towards employees (Roe, 2000). Further, European countries have focused more on the inclusion of stakeholders for CSR's transparency and effectiveness.

CSR is emerging issue in developing countries, where subsistence agriculture dominates to Industrial sector and traditional business patterns led to the corporate sector. It is new experience to the corporate sector. After the liberalization to FDI, MNC has brought such concept and practices at some extent in accordance with their mother countries norms, values and systems. Its practices seem to be contrast and dark more than developed countries. Literatures of CSR in developing countries (Human Development Index (HDI), Transparency International and Global Integrity) mentions poor CSR because of the absence of CSR provision in the corporate law. May be the government has not such way of thinking in the policy formulation. May be it is distracted by the lack of good governance, political stability, democratic issue, corruption and supremacy of law. Therefore, the lack of CSR provisions in the corporate law is a big issue. In this critical context, Multinational Company (MNC) has violated their mother country's CSR norms, values and system, except making a profit by ignoring all these issues. Therefore, CSR practices of MNC are unexpectedly poor and critical. Therefore, additional CSR of MNC is only a dream to the government and the people.

3.4. CSR Practices in Nepal

CSR is not new issue in Nepalese society, when we observe the evidence. In Medieval and Modern Period, CSR was a major ingredient of Nepalese society and its behavior. Its practice was individual level of Merchant and Businessman to get business as well as good will value. It was not profit based. In general, such social responsibility was philanthropy nature and pattern in which road, tap, schools, health post, public place, open place, the establishment of temples and other infrastructure having social and religious value and concern (Bista, 2016). It was religious obligation, except business obligation. Its impact was good but was limited. Since 1990, modern CSR has been appearing in the corporate sector, although the corporate law has not mandatory provision of CSR, like as India has. CSR relates to corporate sector as business ethics and responsibility. Nepal(2006) in CSR report of FNCCI (2006) perceives CSR as the commitment from business enterprise towards sustainable economic development, creating

good working environment for employee/ their families and local community / society welfare at large to improve the quality of life. Furthermore, the employees should be considered as business' best assets and ambassadors. Employee, shareholders, customers, government, civil society consider environment as important components of the CSR. The company acts either preventive or proactive is an act of CSR.

With the growing pressure from civil society organizations and other groups, the corporate sector in Nepal is taking social responsibility seriously (Afful, 2003). For example, FNCCI has in cooperation with the UN women's organization is supporting children education. Individual companies have also been involved in development activities such as Micro hydropower projects, biogas projects, environment, health and agricultural program. However, real picture is that most corporate sector organizations are aware of the socio-economic conditions of their surrounding communities. Unfortunately, they do not respond to it unless there is pressure. The relationship between the corporate sector and communities has still not been clearly defined (Afful, 2003). Bista (2005) mentioned some extent of CSR in MNC firms in Nepal.

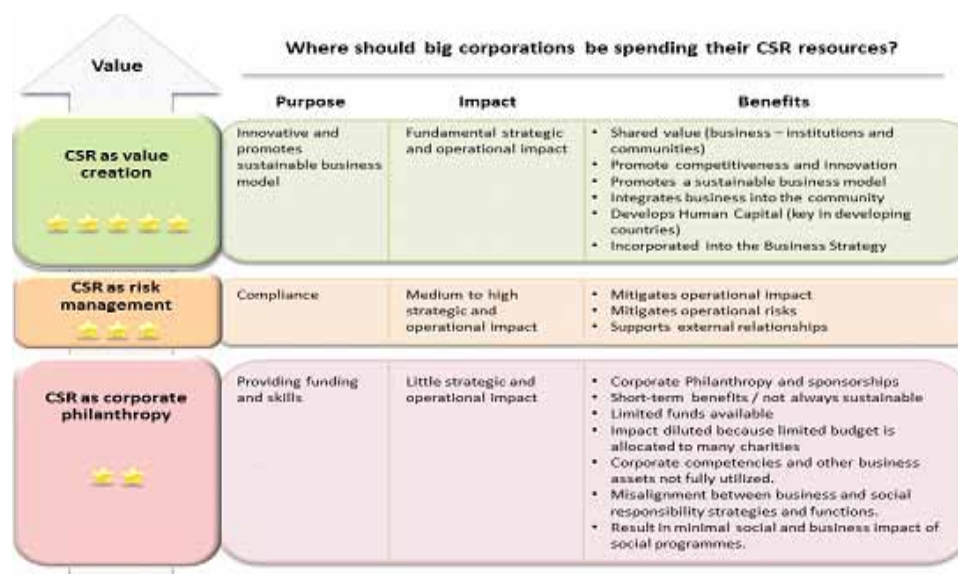
Observation on corporate law and policies of Nepal provides three tier legal and policy literatures such as Industrial Policy 1993, Foreign Direct Investment Act and One Window Policy 1992 and Interim Plan 2007-2010. All have mentioned CSR but not mandatory.

4. METHODOLOGY

4.1. Conceptual Framework

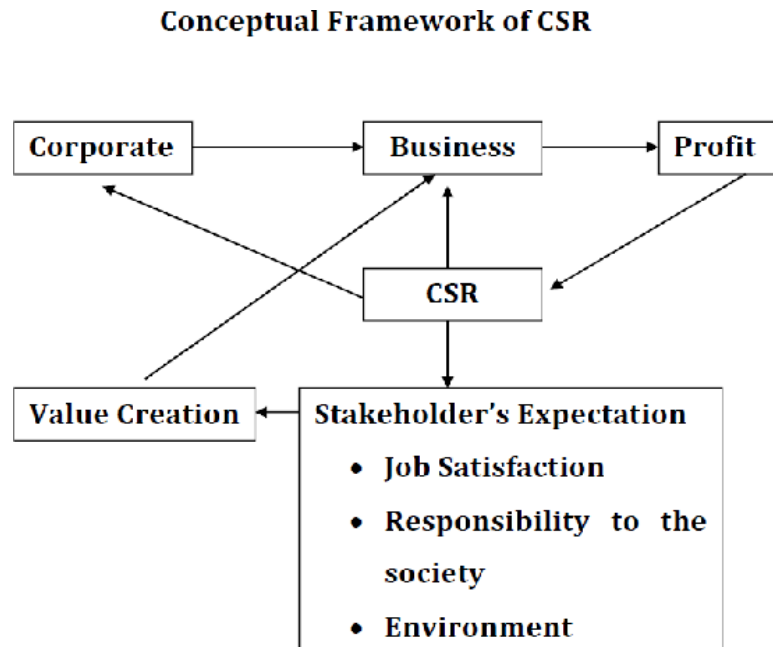
Corporate Social Responsibility (CSR) is inevitable ingredient of corporate governance of the corporate sector to create corporate branding value in the market and to make the consumer loyal on products. It is called corporate citizenship or responsible business. Carroll (1999) explains CSR having economic responsibility, legal compliance, ethical and philanthropy. It has three objectives: value creation, risk management and philanthropy.

Figure 2. CSR Framework



Multinational companies (MNCs) or Corporate are profit motive. Its profit function is to maximize net profit at large scale. In principle, such business should be responsible. It means the corporate should be responsible to the society. Then, the corporate business will be sustainable with value and good response. In order to make responsible business, the certain percentage of profit is spent to the society. Therefore, CSR depends on the corporate governance and profit. After creating value, CSR has positive impacts on sales growth and profit. Therefore, profit depends on CSR.

Figure 3. Conceptual Framework of CSR



Source: Bista (2018)

4.2. Data Sets and Data Collection Method

Responding above these objectives stated in this paper, we employed explorative and descriptive research method. Data sources of the paper was primarily secondary data and information collected from the published documents of the commercial banks, particularly their published audit report from 2008 to 2017. Out of total commercial banks (28), we selected six commercial banks by using purposive methods. The selected commercial banks included three different banks: joint venture banks (NABIL), private banks (Nepal Investment Bank, Mega Bank, Siddhartha Bank and Civil Bank) and public banks (Nepal Bank Limited). All public Banks provide their services to all 75 districts and almost villages. The joint venture and private Banks have covered only 70 percent districts, except Himalayan districts.

As supplementary, the primary data about CSR perception of stakeholders was collected at two levels: 60 staffs of the Banks at first stage and 100 stakeholders at second stage. The first level information was collected through telephone interview method. The second level information was collected through structure questionnaire survey in Kathmandu.

5. RESULTS AND DISCUSSION

5.1. CSR Characteristics

CSR of the Commercial Banks is inevitable to their corporate governance and corporate development. The Commercial Banks have conducted CSR at some extent in the country for a long time. For their value creation and social relationship, these activities are important events. At academic and business level, these activities are concern in the context of International norms, values and system of Multinational Company and Social Development Goal (SDG). In this context, there is a query about their CSR characteristics for understanding CSR activities, status, pattern, size and institution. In order to capture the CSR characteristics, the study has employed eight indicators: No of Years for CSR, Regularity in some years, CSR size, percentage of profit, CSR team, CSR events, CSR disclosure and the year of establishment.

Out of 28 Commercial Banks, the sample Banks are well established with commercial good will in the financial market. There are three banks before the Structural Adjustment Program (SAP) 1990: Nepal Bank (1937), NABIL (1984) and Nepal Investment Bank (1986). Nepal Bank was established in Rana Regime; meanwhile NABIL and Nepal Investment Bank were immediate after Structural Adjustment Program (SAP) 1980. The remaining three banks were established after the SAP II: Mega Bank (2010), Siddhartha Bank (2002) and Civil Bank (1993). When we talk about the age of the Commercial Banks, their age are 81 years age of Nepal Bank, 34 years age of NABIL, 32 years age of Nepal Investment Bank, 25 years age of Civil Bank, 18 years age of Mega Bank and 16 years age of Siddhartha Bank. Based on CSR disclosure, these banks have given least years for CSR activities. Out of 81 years age, Nepal Bank has given a year for CSR. It is 1.23 percent year. Similarly, when we observe CSR activities, there are 5 years of NABIL(14%), 4 years of Mega Bank(22%), 3 years of Nepal Investment Bank(9%), 2 years of Siddhartha Bank(12.5%) and 1 years of Civil Bank(4%). Thus, the Commercial Banks have allocated their time for CSR activities. It indicates CSR at least priority in the Commercial Banks.

When we observe Multinational Company like Microsoft, Google, MacDonald, Apple, etc., CSR activities are regular and consistently continuous, like as their operational activities so that the Corporate has positive impact not only at the society but also at business community and at the government. Its indirect effect will fall on the business promotion and then on the sales growth and customer's growth. Based on CSR disclosure of the Commercial Bank, CSR activities have irregular and discontinuous pattern since their establishment years. However, when they have initiated CSR activities, CSR is regular and continuous at some extents in four banks: NABIL, Nepal Investment Bank, Mega Bank and Siddhartha Bank. However, it is not in Civil Bank and Nepal Bank.

In general, the corporate sector forms CSR team as international practices for whole year CSR activities. In the sample Commercial Banks, there is not such team for CSR activities. It also indicates the least priority of the Commercial Bank on CSR activities and no mandatory of CSR. Its reflection can be found in CSR size and Percentage of Profit. In general, the Commercial Banks have at least double-digit billion Rupees profit per annum. However, their sacrifice for CSR to social cause and value creation negligible that is 0.05 percent. Thus, the Commercial Banks have negligible size and share of profit on CSR. In other words, it is ignorance of the Commercial Bank to their social responsibility.

Table 1. CSR characteristics of the Commercial Banks

Indicators	NABIL	Nepal Investment Bank	Mega Bank	Siddhartha Bank	Civil Bank	Nepal Bank
No of Years for CSR	5	3	4	2	1	1
Regularity in some years	yes	yes	yes	yes	no	no
CSR Size	41,43,094	38,04,000	0	610,000	60,000	53,00,000
% of Profit	0.04	0.14	0	0	0.013	0.18
CSR team	No	No	No	No	No	No
CSR events(Mean)	5	12	4	6	2	1
CSR disclosure	yes	yes	yes	yes	yes	yes
Establishment Year	1984	1986	2010	2002	1993	1937

Source: Audit Report of the commercial Banks, 2008-2017 and Official Websites of the Banks

5.2. CSR Trends of the Commercial Banks

CSR of the corporate is must. Literatures argue the corporate having social responsibility to the society because of ethical business as well as value creation of business. In USA and Europe countries, its trend is positively inclining. It has a good impact on the society and the sales of the corporate. How much the Commercial Banks have practiced CSR since their establishment is concerned to understand the Commercial Bank's level of ethical business. Based CSR disclosure of the Commercial Banks, CSR trend is irregular and discontinuous over nine year's data. NABIL bank has six years trend with the fluctuation. Nepal Investment Bank has also 3 years trend meanwhile other remaining Commercial Banks (Mega Bank, Siddhartha Bank, Civil Bank and Nepal Bank) has not trend. When we observe the awareness and understanding level about CSR nationally and internationally, its trend line is positively inclining. However, in the Commercial Banks, its trend line is erratic and unpredictable. Its impact is negative.

Table 2. CSR Trends of the Commercial Banks

Year	NABIL (Rs)	Nepal Investment Bank (Rs)	Mega Bank (Rs)	Siddhartha Bank (Rs)	Civil Bank (Rs)	Nepal Bank (Rs)
2008	0	28,35,000	0	0	0	0
2009	0	80,00,000	0	0	0	0
2010	0	577,000	0	0	0	0
2011	0	0	0	0	0	0
2012	115,000	0	0	0	0	00
2013	420,000	0	0	0	0	0
2014	24,25,000	0	0	0	0	0
2015	201,30,000	0	0	0	0	0
2016	250,000	0	0	0	0	53,00,000
2017	11,16,783	0	0	610,000	120,000	0

Source: Audit Report of the commercial Banks, 2008-2017 and Official Websites of the Banks

5.3. CSR Pyramids

CSR Pyramids has four major components: value creation, philanthropy, legal provision and ethical responsibility. In developed countries, they have practiced all components as social responsibility of their corporate business. In the least CSR size and its irregular practices, there is concern about CSR Pyramids to understand the structure and composition of CSR.

Whatever the Commercial Banks have conducted CSR activities, almost all the Commercial Banks have given first priority on philanthropy. NABIL and Nepal Investment Bank have given priority on value creation. Except philanthropy and value creation, the Commercial Banks have not given priority as ethical and legal compliances. Out of total CSR activities, the commercial Banks have given 25 percent priority on philanthropy and 12 percent on value creation. Thus, CSR activities have not followed international practices of CSR.

Table 3. CSR Pyramids of the Commercial Banks

CSR Pyramids	NABIL	Nepal Investment Bank	Mega Bank	Siddhartha Bank	Civil Bank	Nepal Bank
Ethical responsibility	0	0	0	0	0	0
Legal provision	0	0	0	0	0	0
Philanthropy	1	1	1	1	1	1
Value creation	1	1	0	0	0	0

Source: Audit Report of the commercial Banks, 2008-2017 and Official Websites of the Banks

5.4. CSR Size of the So Claimed CSR Bank, NABIL

This is case of NABIL. The selection of NABIL is due to the so claimed CSR first Bank and the CSR disclosure. Despite voluntarily nature of CSR, there is a query about CSR size in the percentage of NABIL's Profit. When we observe nine years' time series data of CSR and Profit of NABIL from 2008

Table 4. CSR size of the so claimed first CSR Bank, NABIL

Year	CSR (Rs)	Profit(Rs in Billion)	% CSR of Profit
2008	0	1.55	0.00
2009	0	1.63	0.00
2010	0	1.14	0.00
2011	0	1.34	0.00
2012	115,000	1.70	0.01
2013	420,000	2.22	0.02
2014	2425,000	2.33	0.10
2015	201,30,000	2.10	0.96
2016	250,000	3.62	0.01
2017	11,16,783	3.62	0.03

Source: Audit Report of the commercial Banks, 2008-2017 and Official Websites of the Banks

to 2017, NABIL has maintained 2.12 billion mean profit. However, its mean CSR is approximately 0.11 percentage sacrifice of the profit. It is very least. Because of its voluntarily and non-ethical practices, whatever size of CSR is impressive. When we observe other Commercial Banks, their situation is worse more than the CSR first bank, NABIL. It indicates no schooling and behavior of the corporate to CSR.

If we observe CSR and Profit of NABIL from 2012 to 2017, we can get positive correlation between CSR and Profit. However, if we observe negligible CSR portion of profit, its impact can be found to create value creation and business promotion of NABIL in terms of the growth of profit. Thus, CSR is valuable multiplier of profit of NABIL.

5.5. CSR Provision

CSR provision is must. In USA, European countries and India, it is mandatory to sacrifice at least 2 percentage of the corporate profit. In 2017, Microsoft company made 8 billion US\$ profit, out of which the company raised 1 billion US\$ CSR fund. It is nearly 12.5 percent of the company's profit. It is not mandatory but also ethical and value creation activities. Microsoft is motivated with the positive impact on sales and profit. In Nepal, it is voluntarily. Therefore, its impact and compliance are ineffective.

In the Commercial Banks, there is small telephone survey about CSR provision to 60 professionals. Almost all respondents have given voluntarily as reason behind small size of CSR. In addition, they hope that CSR will increase, if the provision is made mandatorily. Therefore, almost all focus on the need of CSR mandatory in the corporate law.

Table 5. CSR provision

CSR provision	NABIL	Nepal Investment Bank	Mega Bank	Siddhartha Bank	Civil Bank	Nepal Bank
Mandatory	0	0	0	0	0	0
Voluntarily	100	100	100	100	100	100
Need to Mandatory	100	100	100	100	100	100

Source: Field Survey, 2018

5.6. CSR Survey with Stakeholders

In the study, CSR survey with Stakeholders provides the stakeholder's perception about CSR situation, level, need and suggestion. The CSR survey with Stakeholders was conducted at small scale (100 respondents) in above sample banks to just understand the stakeholder's perception, understanding, satisfaction level and suggestion. The respondents were five categorical people: politician, professional, business, general customer and general people.

CSR knowledge is important to stakeholders to make effective CSR activities. If we assume all stakeholders have information and knowledge about CSR, it will be wrong. In the survey, except politicians, professionals and business people, general customer and general people have least knowledge about CSR (see its details in Table 6). May be it is due to the poor, small and irregular CSR of the Commercial Banks. Table 6 shows that except General Customer and General people, the politicians, professional and business people have some extent of knowledge about CSR activities of the Commercial Bank. However, most of all respondents have not information about CSR activities of the Commercial Bank,

although most respondents of politicians, professionals and business people have acknowledged that they are CSR stakeholders.

As stakeholders, they should have higher satisfaction level. Table 6 shows their poor satisfaction level. Almost all stakeholders have opined need of CSR and Banks should conduct CSR. Therefore, small CSR of the Commercial Banks is still insufficient to make good impression to the stakeholders.

Table 6. CSR survey with Stakeholders

Respondents	Knowledge about CSR		CSR activities of the commercial bank		if yes, its frequency	Are you stakeholder in CSR		your satisfaction level		should the Bank conduct CSR	
	Yes (%)	No (%)	Yes (%)	No (%)		Yes (%)	No (%)	Good (%)	Poor (%)	Yes (%)	No (%)
Politicians	70	30	30	70	1	60	40	30	70	100	
Professional	90	10	50	50	2	80	20	20	80	100	
Business people	60	40	30	70	3	70	30	25	75	100	
General Customer	20	80		100	0	40	60		100	100	
General People	5	95		100	0		100		100	100	

Source: Field Survey, 2018

6. CONCLUSION

Despite the strong commitment of FNCCI on effective CSR and business ethics in different public programs and voluntary obligation of CSR in Law and Policy, reality of almost the Commercial Banks is very gloomy and contradicted with the so-called practice of CSR because the practice of CSR is very irregular, voluntary, small and poor. Therefore, its outcomes cannot be accounted at significant level in social interest and business promotion. However, they have positive impact on the community for improving the relationship between the corporate sector and the community. Therefore, the government should make effective policy measures related to CSR, like as Europe and USA so that the corporate sector can sacrifice their profit regularly and uniformly in accordance with the CSR provision of Law and Policy. Then, the country will get significant benefit in the side of skill transformation, social security, community development and environment protection. Otherwise, the Commercial Banks will be a hot issue in future for the community and the civil society conducting movement for CSR.

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What Can Organizations Do to Combat Human Trafficking?

5

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INTRODUCTION

Human trafficking has become a relatively common term used by the media, policy makers, and scholars. In particular, criminologists and sociologists have been interested in this social issue for decades, but numerous other disciplines such as psychology (especially in the area of dealing with the complex trauma that victims undergo), economics, political science and others have been tackling the issue. However, it appears as a still relatively new topic for industrial-organizational psychologists.

The objectives of this chapter consist of discussing the most influential definitions of human trafficking and presenting the latest statistics that articulate diverse forms of this crime, in order to delineate specific ways in which the organization managers can actively participate in efforts to combat it.

This chapter discusses human trafficking in the context of organization management and corporate social responsibility. On the one hand, workplaces may directly or indirectly benefit from slave labor; on the other hand, there is a potential for some less obvious links with sex trafficking, especially when it comes to individual workers and some unspoken rules of organizational culture. This creates a number of possibilities for a workplace to actively engage in fighting human trafficking, especially in the areas of prevention and partnership. Annually updated Trafficking in Persons Report consistently pays more attention to the role of organizations. The latest edition draws the readers' attention to using financial transactions to uncover human trafficking and features a number of tools developed by inter-governmental organizations.

Efforts to combat human trafficking should start with corporate leadership taking a stand. Sensitive leaders encourage employee training programs that empower workers to report suspicious activities to management and law enforcement. Once there is a level of basic knowledge in the company, some entities can be open to hosting corporate volunteer days or launching an initiative that personally engages employees in the fight against human trafficking, in cooperation with local anti-trafficking organizations in the community to cater to the greatest local needs. Simple acts such as delivering meals, hosting a clothing drive, or creating amenity kits for survivors can make a difference, while at the same time integrating employees. In some cases, employee volunteers may be able to provide a skillset that helps further the work of a local anti-trafficking organization. Such efforts should be promoted and recognized by the leaders. Aside from educating employees, many organizations can further spread awareness on the issue of human trafficking by educating their customers. For example, the travel and tourism industry can distribute resources for customers to spot and report trafficking incidents on travel itineraries. Regardless of the type of organization, each and every one should be committed to slavery-free supply chains. A good start is to have a requirement for every supplier and vendor to sign a contract saying that they will not knowingly engage in labor and/or sex trafficking. Moreover, multiple organizations have financial resources that permit them to engage in anti-trafficking philanthropy. Companies can create

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employee campaign funds specifically dedicated to this cause; service organizations, corporate and family foundations also provide much-needed funding for anti-trafficking organizations.

While the above actions resonate with many corporate managers, this chapter intends to provide a systemic, theoretical lenses to present and assess the ways in which organizations can wisely engage in the global and local fight against human trafficking.

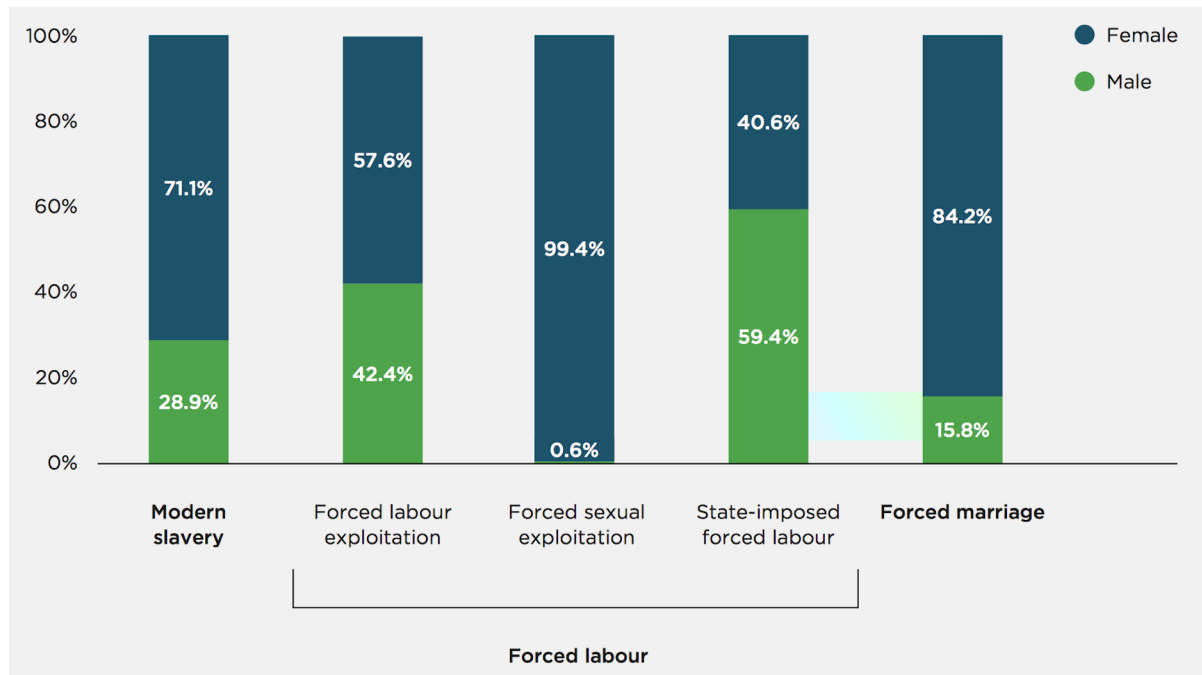
BACKGROUND

The year 2000 appears as a pivotal moment for defining human trafficking – it is in this year when the U.S. Congress and a few months later the United Nations have issued official descriptions of this crime. The specific U.S. law is the Trafficking Victims Protection Act (2000), which singles out two “severe forms of trafficking in persons”: (1) sex trafficking in which a commercial sex act is induced by force, fraud, or coercion, or in which the person induced to perform such act has not attained 18 years of age; and (2) the recruitment, harboring, transportation, provision, or obtaining of a person for labor or services, through the use of force, fraud, or coercion for the purpose of subjection to involuntary servitude, peonage, debt bondage, or slavery (Section 103, 8). The United Nations’ definitions are known as the Palermo Protocol and specifically state that “(a) “Trafficking in persons” shall mean the recruitment, transportation, transfer, harboring or receipt of persons, by means of the threat or use of force or other forms of coercion, of abduction, of fraud, of deception, of the abuse of power or of a position of vulnerability or of the giving or receiving of payments or benefits to achieve the consent of a person having control over another person, for the purpose of exploitation. Exploitation shall include, at a minimum, the exploitation of the prostitution of others or other forms of sexual exploitation, forced labor or services, slavery or practices similar to slavery, servitude or the removal of organs; (b) The consent of a victim of trafficking in persons to the intended exploitation set forth in subparagraph (a) of this article shall be irrelevant where any of the means set forth in subparagraph (a) have been used; (c) The recruitment, transportation, transfer, harboring or receipt of a child for the purpose of exploitation shall be considered “trafficking in persons” even if this does not involve any of the means set forth in subparagraph (a) of this article; (d) “Child” shall mean any person under eighteen years of age.

The Palermo Protocol definitions, although commonly quoted, have been criticized by scholars for the tautological use of the term “exploitation” (Weitzer, 2014) and the difficulty to apply it in empirical studies (Skilbrei & Tveit, 2008). In a similar fashion to the U.S. Congress, it defines human trafficking as “the recruitment, transportation, transfer, harboring or receipt of persons, by means of the threat or use of force or other forms of coercion, of abduction, of fraud, of deception, of the abuse of power or of a position of vulnerability or of the giving or receiving of payments or benefits to achieve the consent of a person having control over another person, for the purpose of exploitation” (U.N. General Assembly, 2000: 2). Nevertheless, the Palermo Protocol may appear useful as it singles out some specific purposes of exploitation, namely: prostitution of others or other forms of sexual exploitation, forced labor or services, slavery or practices similar to slavery, servitude or the removal of organs. The type of exploitation not explicitly enlisted in Palermo Protocol is for example child marriage, considered by many researchers as a practice similar to slavery (Raj, Jackson, & Dunham, 2018). In fact, the International Labor Organization has decided to include victims of this phenomenon in the latest statistics concerning the worldwide number of victims of human trafficking.

This brings up the burning question: how many people in the world are victims of this crime? There is no easy and precise reply, as already evident from the blurriness and plurality of definitions. The most

Figure 1. Percentage distribution of victims of modern slavery, by sex and category. Source: International Labor Organization, Walk Free Foundation, & International Organization for Migration (2017).



recent estimates (International Labor Organization, Walk Free Foundation, & International Organization for Migration, 2017) state that on any given day in 2016 there were 40,293,000 persons in servitude, of whom approximately 16 million in forced nonsexual labor exploitation, 5 million in forced sexual exploitation, 4 million in state-imposed forced labor, and 15 million in forced marriages. Figure 1 shows the percentage distribution of victims of modern slavery, by sex and category.

Trafficking and forced labor play a major role in the economies of many countries (Peksen, Blanton, & Blanton, 2017). From the point of view of organization management, the form of modern slavery that has the highest potential to be somehow related to or influence corporate activities is labor trafficking. Although it includes labor exploitation (when employers deny workers their rights under federal and state labor law, such as the right to fair compensation, working conditions, and working hours), the two phenomena are not synonymous. According to Farrell et al. (2018), the exploitation has to occur through the use of force, fraud or coercion to be considered labor trafficking. Experiences of physical violence, document fraud or withholding documents, and isolation, restrictive movement, and communications can result in pervasive health concerns. This has led some researchers (De Vries & Farrell, 2017) to consider labor trafficking victimization as a form of polyvictimization. Individuals are much more vulnerable if they are immigrants, which often means that they do not speak the language of the destination country and do not understand the culture, especially their rights and obligations of their employers. Thus, one cannot ignore the fact that labor trafficking is often related to migrant worker abuse. There is a fine line between diverse forms of abuse of vulnerability of migrant workers and its escalation into trafficking situations. Chuang (2017) identifies foreign labor recruitment as one of the areas related to labor trafficking. She believes that the recruitment market often “turns migrants into debtors, leaving them vulnerable to a wide range of exploitative practices by unscrupulous recruiters” (Chuang, 2017: 149). Such practices include exorbitant recruitment fees, contract switching, and prolonged abusive

treatment by the employers. Outsourcing of labor migration management to recruiters usually helps fuel market-oriented governance that prioritizes private profit interests over migrant welfare. According to Bhavnani and Schneider (2015), most trafficking occurs within a person's own country or region, and often for non-sexual forms of labor. Domestic trafficking usually affects men in the developing countries, who may be forced into debt-slavery or hard labor by dictatorial regimes. Additionally, children are trafficked to become soldiers (e.g. Uganda), domestic servants (Philippines; Pakistan), beggars, or laborers on plantations and in factories.

HOW TO FIGHT HUMAN TRAFFICKING?

How do organizations combat human trafficking?

When the official definitions were introduced in 2000, the U.S. government has also established norms around three Ps: Prosecution of traffickers, Protection of victims, and Prevention of the offense. Then, in 2009, a fourth P was added, emphasizing Partnerships between governments, multilateral organizations, non-governmental organizations (NGOs), and the private sector. Prosecution of traffickers should be certain, swift, and proportionate to the gravity of the offence to be an effective deterrent. Unfortunately, in relation to the reported number of persons trafficked, the number of successful prosecutions is an abysmal few (Winterdyk, 2018). An organization may be in a position to provide proofs in anti-trafficking cases (documentation or witnesses' testimonies), especially in cases of labor trafficking. Although this implies time and thus resources, the corporate social responsibility requires maximum collaboration with the authorities in the efforts to prosecute traffickers.

Strategies to protect victims include 3 R's (Rescue, Rehabilitation, and Reintegration) and organizations can play a vital role in an initial stage by developing the ability to identify potential human trafficking victims both among its employees and the people that they encounter, using proactive identification methods. Since virtually anyone can come across a potential human trafficking victim, it is crucial to know the signs of this hidden crime, and to raise awareness among workers concerning for example the anti-trafficking hotlines that one should contact in case of a suspicion. If an organization is in a position to temporarily offer protection to a human trafficking victim without jeopardizing anyone's safety, it should consider this possibility, in close collaboration with authorities. While most organizations will not be involved in the rescue and rehabilitation of survivors (this delicate and possibly dangerous process should be left to professional agencies), they can play a role in their reintegration, for example by offering employment to formerly trafficked individuals who have undergone the rehabilitation process.

According to Steiner et al. (2018), most prevention efforts can be categorized into three different types of models: a law enforcement or criminal justice model, a migrants' rights model (main focus on labor trafficking), and a human rights-focused model (main focus on sex trafficking). The first model concentrates on criminalizing human trafficking seen primarily as an issue of national and international security, with the main focus on efforts to prosecute traffickers. The second model emphasizes the perspective of an individual immigrant worker who should be protected from exploitation, ensuring the enforcement of proper rules and regulations at workplaces, as well as offering individuals information concerning their rights. In a similar vein, the third model also considers the victims' rights (specifically, human rights), but tends to amplify the highly emotional public outcry regarding trafficking of women and girls, echoing the outrage of the historical response to white slavery. On its own, none of these models can be effective to counteract such complex crime as human trafficking; the key is a combination of efforts on various levels, targeting all types of trafficking.

For all of the prevention models discussed above, information about trafficking aimed at law enforcement officers, potential and current labor trafficking victims, and women and girls trapped in prostitution is essential. Thus, raising awareness also constitutes a crucial part of prevention. Various materials are being printed and disseminated online by public and private organizations, informing potential victims of their rights and offering possible ways out to current victims. For example, since 2015, the Orange County Transportation Authority (OCTA) in California has trained hundreds of coach operators to identify and help victims and has used its buses as traveling billboards with Be the One campaign (see Figure 2).

Figure 2. Local transportation organization helps increase awareness about human trafficking in Orange County, California. The photograph features an Italian Rotarian volunteer, Roberto Giua who attends the meeting of the Orange County Human Trafficking Task Force on January 25, 2018. Source: photo by author.



Moreover, websites of many organizations now feature information about human trafficking; in fact, according to Martin et al. (2017), almost a third of Fortune 500 companies mention human trafficking on their websites. Workers who travel may be exposed or even lured into sex tourism; they should be informed about its links with modern slavery, especially in case of commercial sexual exploitation of children.

Finally, partnership to combat human trafficking refers to collaboration among anti-domestic violence organizations, attorneys, victim assistance providers, health services providers, and local law enforcement to provide combined services to achieve goals and objectives beyond any individual organization's capacity, in line with the coalition model (Kim et al., 2018). An example of partnership is the group of large international corporations (including, among others, Coca-Cola Company, ExxonMobil, Ford, Microsoft, and LexisNexis) forming the Global Business Coalition Against Human Trafficking. These companies are working to combat human trafficking by teaching employees to notice indicators of possible trafficking victims.

More recent scholarship emphasizes the need for transformative partnerships, with four common denominators (Lagon, 2015): market – accounting for the supply of trafficking victims (e.g., children detached from family and regular and irregular migrants) and demand (for cheap products, cheap labor, and purchased sex); metrics – empirical bias for choosing interventions and measuring progress; matching missions based on aligned goals; and motives or sound intent that goes beyond window-dressing corporate social responsibility or discrete philanthropy without addressing human trafficking in its business operations or supply chains. According to Martin et al. (2017), by setting up a company policy against human trafficking, top management makes it clear to consumers, employees, investors and business partners that this crime is not tolerated. It is essential to keep an up-to-date anti-trafficking policy, along with monitoring, risk assessment and stringent remediation practice. Effective management of a supply chain requires full understanding of its activities, including awareness of where key suppliers are located and the work environment in those places. Organization executives need an action plan to pay special attention to industries and places where there is substantial risk for trafficking. A supply chain audit can be an integral component in monitoring and enforcing anti-trafficking policies (Gold et al., 2015). A supply chain audit can help detect worker exploitation and other violations of anti-trafficking policies; the auditors should pay attention to the red flags identified by the U.S. Department of State (2015) including: living with employer, poor living conditions, multiple people in cramped space, inability to speak to an individual alone, answers that appear to be scripted and rehearsed, employer holding identity documents, signs of physical abuse, submissive or fearful demeanor of a worker, employees who are unpaid or paid very little, and presence of workers under 18 and in prostitution. Some strategic choices that organizations can make in terms of their corporate social responsibility concern taking transparency more literally by providing greater levels of detail about the exact provenance of their products and making specific data available as a public good (New, 2015). In their study of corporate disclosures in the apparel industry, Ma et al. (2015) concluded that suppliers, especially in China, are using increasingly advanced techniques to cheat code of conduct inspectors and further changes need to be implemented to help resolve this issue.

Specific corporate efforts to combat human trafficking are not optional anymore in many countries. The 2015 amendments to the Federal Acquisition Regulation, require United States government contractors to actively root out human trafficking throughout their supply chains. In addition, various state and international disclosure laws require companies to disclose to consumers what efforts (if any) they make in that regard. The U.K. Modern Slavery Act of 2015 requires that every organization with annual income in excess of £36m carrying on a business in the U.K. must produce a slavery and human trafficking statement for each financial year. The French Supply Chain Vigilance Law requires French parent companies with at least five thousand employees to identify and avoid adverse human rights and environmental impacts of their own activities and the activities of enterprises they control or with whom they have an established commercial relationship. Phillips et al. (2016) found that 55 new pieces of national legislation imposing mandatory requirements onto companies to disclose information about

labor issues in their supply chains have been passed since 2009. This implies regulation of efforts to combat human trafficking on a corporate level. However, LeBaron and Rühmkorf (2017: 29) conclude that “after nearly two decades of activist pressure on governments to strengthen systems and initiatives to detect and address forced labor and slavery, the business of forced labor continues to be insufficiently regulated.” Their research on domestic politics of corporate accountability legislation has elucidated the role of industry actors in creating and maintaining the governance gaps that allow labor abuse to thrive, as they have identified private, industry-led mechanisms and sought to deflect alternative regulatory tools with greater stringency. McGrath and Mieres (2017) believe that labor regulation, the international trade regime, worker organizing models, migration policy, and a host of other political-economic and social factors structure the conditions within which the human trafficking supply chain nexus is situated.

In relation to socially responsible organization management aimed at combating human trafficking, Chuang (2017) proposes a term *philanthrocapitalists*. Philanthrocapitalists use their business skills to tackle social problems such as human trafficking. Corporations are positioned as crucial agents of change by engaging in more ethical recruitment practices and better supply chain management. “Anti-trafficking-focused philanthropies have even combined forces to create an impact investment fund (with aspirations of reaching US\$ one hundred million by 2020)—that aims “to bring much-needed strategic focus and financial resources to the fight against modern slavery” (Chuang, 2017: 150). Certainly, not every organization can aspire to become philanthrocapitalists. However, many workplaces can engage in some of the similar efforts, especially if they use recruitment agencies to hire migrant workers and choose an agency that abides by ethical standards and safeguards against labor trafficking.

As shown by Azad (2018) on the specific case of migrant workers from Bangladesh, fair and transparent recruitment has the potential to ensure better working and living conditions for them. In this particular situation, the legal and ideal scenario is that of a recruitment actor collecting vacancy information in the destination and then recruiting workers from a database of workers in Bangladesh who have already registered to migrate overseas, or an employer in the destination hiring services of an agency to recruit required workers. Each step of this process should be in line with the existing regulatory bodies. Unfortunately, in practice, according to Azad (2018), the recruitment on both sides is a mix of both legal and illegal practices. It is quite common that an unlicensed and unauthorized broker buys a work visa from the employer and sells it to the worker in Bangladesh, often making a high profit. As proposed by the International Recruitment Integrity System (Wickramasekara & Baruah, 2017), the recruitment should be fair to all parties involved, including: a) the employers – by hiring the right person with the right competencies for the job without fear of being duped by unscrupulous intermediaries; b) the migrant workers – by finding suitable and legal employment without paying for the right to work, having their passport confiscated, or becoming a victim of labor trafficking or forced labor; c) the recruiters – by fair competition for professional recruiters and employment agents who practice honest, transparent, and fair recruitment. The focus on recruitment is a preventive measure to reduce the future exploitative experiences of the migrant workers. Special attention should be placed on ensuring that an organization does not benefit from child slavery, in particular in the context of labor taking place in developing countries.

Nevertheless, there is a lot of skepticism concerning the organization’s willingness and actual capacity to combat human trafficking. According to Limoncelli (2017: 122), “relying on companies’ voluntary initiatives usually produces only modest and uneven improvements of working conditions and labor rights along global supply chains.” She believes that in reference to this point, Brazil’s model of placement of companies on the “dirty list” coupled with governmental inspections and sanctions (such as bank-lending penalties, the freezing of assets, and the denial of government subsidies) has proven quite efficient.

SOLUTIONS AND RECOMMENDATIONS

According to Patterson and Zhuo (2018), the United States has taken the lead among the advanced nations in promoting awareness of the problem and encouraging countries to take action against it, with its State Department's annual Trafficking in Persons Report and its Labor Department's Worst Cases of Child Labor Report. Moreover, the European Union and the major global institutions, most notably the United Nations (U.N.), have been active in documenting and promoting similar programs against the problem. In particular, the U.N. has formally adopted the eradication of trafficking and forced labor as one of the major goals of the 2030 agenda for sustainable development.

In their study with advocates from the field of human trafficking across the globe (Steiner et al., 2018), the interviewees highlighted the importance of anti-human trafficking organizations engaging in work utilizing individual, collaborative and societal/public policy approaches while understanding the way in which the culture/country context impacts socioecological approaches.

Therefore, besides international and national efforts, there is a lot that can be done to combat human trafficking on an institutional and individual levels. This is where organizational management and corporate social responsibility sensitive to this issue comes into play.

While virtually any organization can identify and implement a specific action to combat human trafficking (for example by raising awareness among its employees), there is a growing number of entities whose mission and vision are centered on this issue. Bain (2017) enlists a number of entrepreneurs focused on addressing human trafficking, whom she considers as the new wave of changemakers.

Numerous organizations concentrate on primarily assisting human trafficking survivors. Formerly known as Made By Survivors, now rebranded as Her Future Coalition is a social enterprise based in the U.S. It developed a business model to ensure that trafficking survivors were economically empowered as entrepreneurs themselves, minimizing the risk of them being trafficked again. The organization works with other suppliers and partners to sell products made by the survivor-entrepreneurs in Nepal and India in the U.S. and beyond, while expanding shelter services, education opportunities, and employment for the victims. Numerous other organizations engage in similar activities on a local, national, and global level. A business unrelated to human trafficking can identify a partner organization like Her Future Coalition, supporting its efforts by purchasing products made by survivors, for instance to use them as gifts for its employees or clients.

Another way to combat human trafficking as an entrepreneur is to tackle global supply chains and a specific business sector, for example fashion. A California-based social enterprise called Remake has created and runs a "storytelling platform" to foster humanity within fashion markets. It is a way to foster a social and consumer movement around stopping labor trafficking within fashion supply chains. At times, the scope of similar efforts by a single organization may be broader, including various business sectors in a certain region. For example, the Mekong Club is an organization in Hong Kong that supports and assists the private sector in the fight against human trafficking in Asia by establishing specific networking groups that offer business expertise in supply chains and operations.

Companies that specialize in technology step into the fight against human trafficking in the area of mapping, applying cutting-edge aspects of geospatial analysis and using investigative modeling in big data analytics. An example of an organization that pioneered this type of efforts is Deloitte. Combating human trafficking is interwoven with a number of services that the company performs, including consulting the Deloitte's Global Security and Justice practice. The company helps clients make globally informed and locally relevant choices about border management, law enforcement, aviation, and immigration, with the overarching goal of helping clients solve security-related challenges, including human trafficking.

Deloitte has also been successful in partnering with academia and activists, by not only co-sponsoring a networking event (Freedom from Slavery Forum organized by Free the Slaves), but also having its own employees share the acquired technological know-how with 38 leaders from 36 organizations across the globe, and thus becoming an integral part of the forum (see Figure 3).

Figure 3. The third Freedom from Slavery Forum at Stanford University. The photograph features the participants on October 6, 2017. Source: photo by author.



Some noteworthy anti-trafficking efforts have been launched by well-established service organizations, such as Rotary, with a specific dedicated international group of volunteers, Rotarian Action Group Against Slavery. In this case, the existing structure of such large organizations with well-established funding mechanisms and presence across the globe, facilitates raising awareness both among members and the general public, as well as financing specific projects aimed at eradication of human trafficking.

FUTURE RESEARCH DIRECTIONS

When it comes to human trafficking, obtaining ever more reliable empirical data is necessary for shaping meaningful policy discourse and the development of effective countermeasures (Zhang et al., 2014). A

considerable further research is required to understand precisely how far and in what ways the strategic mobilization of private governance might be impacting the stringency of reflexive regulation to bolster labor standards, and to discuss the displacement effects that may be occurring as private actors seek to undercut efforts to strengthen public governance of labor in global supply chains (LeBaron & Rühmkorf, 2017). McGrath and Mieres (2017) identify as an important future research direction the task of mapping the emerging and rapidly growing field of activity around the human trafficking supply chain nexus in order to set the context for detailed qualitative analysis.

CONCLUSION

As stated by Philips (2017), creating organizations to fight for social and environmental justice should receive at least as much attention in management research as creating more effective and profitable organizations. Human trafficking is a diversified and multi-faceted criminal industry that generates considerable revenue. It may be related to a number of areas of activity of an organization, in particular in terms of the supply chain management and migrant workers. Active efforts to combat human trafficking should be reflected in the enactment of corporate social responsibility of organizations. Even on the level of a company's board of directors (responsible for determining the material issues that the company should be reporting on), increasing attention is being paid to anti-trafficking actions. According to Eccles (2017), in certain industries such as agriculture, food products, and manufacturing, failure to eliminate human trafficking in their supply chain can damage the long-term viability of the company. Consumer reaction to modern slavery abuses can damage the company's brand (and stock price), have negative effects on the morale of its employees, and make it difficult to attract new ones.

As shown in this chapter, the private sector has launched numerous inventive approaches to fight human trafficking, including some pioneering models in a wide range of sectors. Technology and data analysis tools can be helpful to follow transactions and identify potential traffickers, which is especially significant in the financial sector. Supporting research and collaborative efforts between multiple external stakeholders, including public-private partnerships, leads to a better understanding of how technology is used to facilitate human trafficking. In the transportation sector, both individual users and employees can make a difference through raising awareness, enhancing prevention, and reporting possible cases of trafficking. This applies also to the hospitality sector, where in addition entrepreneurial thinking and innovation can provide support for survivors of trafficking by offering temporary refuge. Examples are numerous, but certainly more can and should be done by organizations to combat human trafficking as a way to enact the corporate social responsibility.

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KEY TERMS AND DEFINITIONS

Corporate Social Responsibility: Taking into account the organization’s social, economic and environmental impact, and consideration of human rights; conducting business in an ethical way.

Human Trafficking: Modern-day slavery that involves the use of force, fraud, or coercion to obtain some type of labor or commercial sex act; also referred to as trafficking in persons (TIP) or modern slavery.

Palermo Protocol: Protocol to Prevent, Suppress and Punish Trafficking in Persons, especially Women and Children adopted by the General Assembly of the United Nations in 2000.

Philanthrocapitalists: New generation of philanthropists who (unlike earlier generations of philanthropists, who focused on funding third party initiatives) are creating and actively managing their own ventures, using their access to the global elite to assume a direct role in global governance; crucial agents in anti-trafficking efforts.

Supply Chain Management: All activities related to the management of the organization’s supply chain (including product development, sourcing, production, and logistics, as well as the information systems needed to coordinate them), aimed at maximizing customer value and achieving a sustainable competitive advantage.

Trafficking Victims Protection Act: Introduced in 2000 by the Congress of the United States, the first comprehensive federal law to address trafficking in persons. The act provided a three-pronged approach that included prevention, protection, and prosecution, with the subsequent addition of partnership.

Transformative Anti-Trafficking Partnership: Partnership of various organizations aimed at helping human trafficking survivors reclaim dignity and actually reducing or abolishing the ongoing threat to potential victims. Such partnership is attentive to market forces, takes metrics seriously, has matching missions, and exhibits sound motives.

A Guide to Cracking Down Cyber–Ethical Dilemmas

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INTRODUCTION

Brutal cyberattacks continues, the exorbitant cost of damages keeps on soaring, *cyberwar* proliferates fast despite the *big spending* (in billion US dollars) on cybersecurity. This is skin to a vicious circle culminating in a chronic disease aptly called a “chronic problem of data protection” (Lee, 2019). The problem is arguably rooted in our indifference to ethics or insufficient understanding of the ethical principles and the practice of these principles, so that the ethical dimension of the problem is missed out when formulating information security policies and implementing information protection systems.

Fallacious beliefs and *relativistic arguments* exacerbate the problem; the tripartite relationship, called the “*Ethics-Law-Security Connection*”, complicates the situation. The *techno-ethical threats* prove the urgency of the problem. The *ethical ramification and challenges* reinforce that urgency.

Given that it is unrealistic to keep all threats out as threats inflicted by insiders, clients, contractors, etc. are ever-existing, eradicating the problem is desirable but doomed to be futile. Hence, mitigating by lessening the incidence of hacking or making hacking exasperate so as to minimize damages is a sensible and feasible alternative. An *ethics-based guide* underpinned by Ethical Computing was conceived. The aim of this guide is to identify ethical issues, to discover significant ethical and security ramifications, to connect the issues to the relevant theories and technologies, and to resolve the ethical dilemmas, with a 3-point precondition: Know your ethics, Shift view and understanding of risk and ethics, and Take ethics seriously. This chapter is about that guide and concludes the exposition with an illustration of some common dilemmas.

BACKGROUND

Ethical Computing

Ethical Computing is the practice of *Computer Ethics*. It aims to deal with identifying/discovering ethical issues arising from developing and using computer-based application systems and analyzing these issues to come up with balanced solutions. Its current major issues of interest include privacy, intellectual property, digital-divide, professionalism, trust, anonymity, and cyberbullying. Its methods and tools for ethical analysis include the *Ethical Matrix* and *Hexa-dimension Metric*. (Lee, 2015b and Lee, 2018a)

Computer Ethics

Ethics is the same in peace times as during the *cyberwar era*. Computer Ethics, Data Ethics, Cyberethics are terms that denote more or less the same phenomenon. While *Data Ethics* is about the ethical issues

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involved in collecting, sharing, interpreting, synthesizing, and using data (Floridi & Taddeo, 2016), *Computer Ethics* or cyberethics is a subfield in Applied Ethics akin to Business Ethics, Technology Ethics, Medical Ethics, etc., and focuses on the *ethical issues* surrounding the computer. Following the classic definition by Moor (1985), different views of Computer Ethics appear in the literature (Johnson, 2009, for example). Computer Ethics has a wider scope and should be viewed as a dual mission (a discipline cum practice grounded in ethical principles) and a dual function (a risk as well as an anti-risk mechanism) (2014-15).

Ethical Principles

Only the common theories/principles are briefly reiterated in this chapter for illustration purposes.

Duty-based principles

- *Deontology* asserts that an action is morally right if it is done out of a sense of duty.
- *Kantian Categorical Imperative* tells us never to treat human beings merely as means to an end; always treat them as ends in themselves. A human being hence has a right not to be exploited and has a duty not to exploit another human being.

Results-based principles

- *Consequentialism* holds that an action is morally right if its consequences are beneficial or morally wrong if its consequences are harmful.
- *Utilitarianism* means that an action is morally wrong if its results are more harmful than beneficial.

Other common principles

- *Golden Rule* states that “Do unto others as you would have them do unto you” or “We should do to others what we would want others to do to us”.
- *Social Contract Theory* says that an action is morally wrong if someone’s rights are being violated or an action is good if it is carried out in accordance with moral rules that rational people would collectively accept as binding because of the resulting benefits to the community.
- *Virtue Ethics* advises us to live according to the values we cherish and care.

Note: Sometimes these principles may be in conflict; self-reflection/self-discipline helps to make a balanced decision.

The Double-Edged Sword Effect

Ethics has a dual function which is akin to a double-edged sword; it can be on the one hand an attacker – it can expose unethical consequences of an action that violates ethical principles or it may cause the wrongdoings to backfire at the ethical abusers. On the other hand, it can be a shield or protector or an anti-risk measure to defend actions which are consistent with the ethical principles. (Lee, 2014-15) For illustration, in the case of US President Nixon’s downfall, it is ethics that defeated him, not the law, and in the case of South African President Mandela’s survival, ethics plays a role in strengthening him against politico-legal suppression during his ordeal. The following episodes further enlighten this effect:

Audrie Pott, a 15-year-old school girl, was sexually assaulted by three boys aged 16 and 17 on 12 Sept 2012 after she passed out at a house party. Her attackers took photos of her half-naked body and shared these photos with classmates. Audrie became so distraught after seeing the photos that she killed herself. The three boys were arrested for sexual assault and admitted to a juvenile court for the heinous crime they committed. They were sentenced to serve between 30 and 45 days in a juvenile detention center. (The Mercury News, 2012)

Charlotte Dawson, a New Zealand-born Sydney-based TV performer and an ambassador for the Australian anti-bullying program Community Brave, was found dead after being subjected to a continuous tirade of abusive tweets. She dug her own grave, as a critic put it: she “has made a career of slagging off all and sundry and using her broadcasting power to bully others, calling critics bogans (low-class persons) and scraggs (a lean, meagre person, an animal)”. Here is an example of those abusive tweets: Tanya Heti, a Melbourne woman, tweeted “on behalf of NZ we would like you (Dawson) to please go hang yourself”. (The Sydney Morning Herald, 2014).

Foolish Mum: Mrs Clenston, a senior manager of a multinational bank and extremely cautious about privacy. So she used her daughter’s email address to send hate letters complaining about Mr Yuile (a neighbour) to Mr King (Yuile’s boss). King forwarded the email to Yuile.

- Yuile googled in and found “Sze-Man Clenston” on the website of one of Hong Kong’s famed schools. Yuile suspected that the complaint could have been raised by Clenston. But Clenston refused to admit it and claimed that Sze-Man was not her daughter.
- Yuile sent a copy of the hate letter to the school principal, and Sze-Man was reprimanded. The news soon spread around the whole school. But Clenston was still adamant despite Sze-Man’s innocent punishment.
- One day, another neighbour, Mrs Llewyn accidentally bumped into Sze-Man’s Facebook account and discovered a family photo showing clearly Mr & Mrs Clenston, Sze-Man, and brother holidaying on a beach somewhere. So, Mrs Clenston got no room to escape.
- Upon Yuile’s counter-complaint, Mrs Clenston lost her job, and Sze-Man left her school as a result of complaints from other students and their parents. (Lee, 2014-15)

Stupid Dad: Mr Que, a local politician, failed in the last district election and now planned for a comeback. Thinking that it would project a younger image, he uploaded his son’s photo instead of his own, in a Facebook account he set up to recruit followers and to solicit support. The hit rate was as well as expected but the younger Que was recognized as the son of a failed politician, and consequently suffered all sorts of ridicule among his friends and schoolmates! (Lee, 2014-15)

The Knowledge Effect

An exploratory study was conducted in a classroom setting and the subjects were senior Computer Science undergraduate students. The aim was to test the hypothesis that the knowledge of ethics has an effect of guiding the students to the ethical use of the computer. The result of the survey indicated that 8% of the students claimed at the start of the course that they were aware of Computer Ethics but not certain if they used the computer ethically, compared with 72% who claimed at the end of the course that they understood ethics and would use the computer ethically, and the remaining 28% (post-course population) claimed no change for various reasons. Overall, knowledge of ethics has a remarkable impact. It is noteworthy, however, that ethics has no impact on 21% (post-course population) who claimed

that understanding ethics did not change how they would use the computer (ethical or unethical). The empirical data is consistent over the seven consecutive years ($p > .05$). The conclusion testifies to this effect. (Lee & Chan, 2008)

Methods and Tools of Ethical Analysis

There are a number of methods and tools developed and applied over the years. The classic informal guidelines or tests and menu-driven linear checklists can be found in Kallman & Grillo (1996). These classical methods are either common-sense based or have embedded some basic ethical theories, and are found generally to be clumsy to use or lacking vigor. Introduced and described in this chapter are the relatively new Ethical Matrix and Hexa-Dimension Metric.

Ethical Matrix

This is a tool recently adapted from food and agriculture for ethical analysis in the IT context. The columns of the matrix correspond to “values” held by stakeholders with respect to ethical principles, and the rows correspond to the stakeholders or interest groups. The number of columns and rows may vary as required. The cells contain the concerns (the main criterion that should be met) of the stakeholders with respect to the value held (by the stakeholders) or a particular ethical principle.

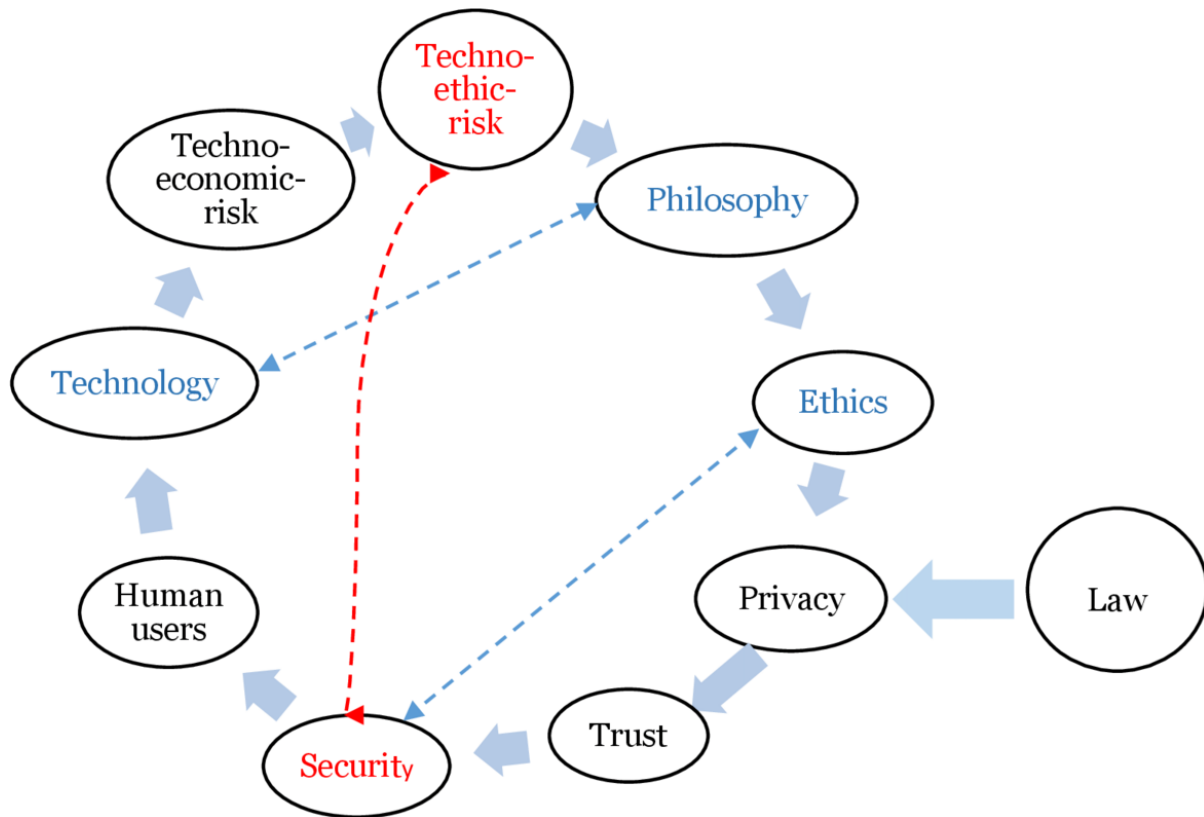
Hexa-dimension Metric

This is a measurement instrument initially conceived as a checklist for decision making in technology-driven and information-intensive organizations. Its aim is to measure the values held by the stakeholders and to arrive at a balanced solution. The metric comprises six attributes that measure the efficiency (requirements): financial viability (a justifiable return on that the investment), technical effectiveness (an optimal utilization of the technologies acquired), legal validity (consistency with corporate rules and regulations and the law in force), ethical acceptability (consistency with corporate code of practice and/or the generally acceptable ethical principles) and social desirability (safety of the huge amount of data consumed and generated by the technology, and ecological sustainability (environmental protection since running the technologies consumes a lot of natural resources (electricity, water, paper, etc.), and generates air, noise pollution) (Lee, 2018b).

Techno-Ethical Threats

Arguably, abusing or not abusing the technology depends on the users’ sense of morality. Such a sense is influenced by many factors, the major amongst which is the users’ understanding of the ethical principles. Using the technology in contradiction to ethical principles constitutes a different type of risk, a techno-ethical risk or simply *ethical risk*. To illustrate, a common episode (the *Splitting Loyalty Dilemma*) is used, which is about taking home from work a USB containing corporate data for personal convenience. Doing so runs the risk of breaching privacy or undermining confidentiality. In this case, the person who takes home an un-encrypted USB in which confidential data are stored is a threat, taking home a USB is a vulnerability, and the action is a violation of data privacy, thus a risk. This risk is related partly to technology (the USB) and partly to people (both the perpetrator and the victims), and is, therefore, a techno-ethical risk. Figure 1 below depicts this phenomenon.

Figure 1.



To amplify the notion, newer threats are found to accompany new convenience and enjoyment that the modern disruptive technologies provide. It is no imagination that after our bank account number was exposed to a stranger by accident or as a result of carelessness, trusting the online bank account we log into to be true may turn out to be a forgery! This is an incidence of threats related to the Internet of Bank Accounts (IoBA). This clearly shows not only the proliferation and ubiquity of techno-threats but also insidious techno-ethical threats to personal privacy and security. IoBA inherits all the IoT related threats, and also those of Cloud Computing because IoT devices are often connected via the cloud.

It is of interest to note why IoT is attractive to hackers. IoT connects not only a huge number of devices but also numerous data points; IoT requires users to submit personal information, including name, age, address, phone numbers, and even social media accounts; the labour of stealing data or corrupting the connected devices is not overly toiling and the harvest could be a bonanza. The scavengers can net invaluable information in a single hit. Since bank accounts are closely connected, hacking into bank systems is not only easy and convenient but also lucrative.

Threats directly related to IoT include personal data leaking, denial of service, device- and application-related, for example, the hidden cameras in billboards that track the demographics of passersby who stopped to read the advertisement (*Wikipedia*), to name a few.

There are also IoT related threats arising out of the Cloud, and in connection with AI and Bog Data. IoT users more than often deposit their data on the cloud to be used instantly or in the future and may be vulnerable to threats, for example, cloud vendors could sell the users' confidential data with the ramification of personal privacy invasion and data ownership dispute. AI-driven home automation hubs,

smart locks, smartwatches, gadgets that we either keep at home, carry or even wear around, automobile navigation and infotainment systems, advanced medical devices, and automated teller machines lead to numerous threats, the common ones being Hijacked Devices Sending Spam Emails, Hijacked Devices Conscripted Into Botnets, Home Intrusions, and Remote Vehicle Hijacking” (*IoT For All*).

Ethical Ramifications and Challenges – a Few Examples

Self-Driving Cars (The Globe and Mail, 2018)

The situation here is akin to the choice being ‘delegated’ to the robot driver to decide who is going to be harmed and who’s not. This choice poses legal and ethical issues in the event of an accident:

- Where and with whom should the responsibility lie?
- What right do the pedestrians, passengers, owners of the damaged properties, etc have?
- Who should be prosecuted for the damages?
 - The driver? But the driver is not a human. Is there a law to sue a machine that is programmed to drive? Law always moves much more slowly than the event. So, there is no law yet.
 - The human programmer? The programmer who merely carries out the job according to the specs may be covered by the employer and shielded under the principle of deontology.
 - The manufacturers of the autonomous car including the robot driver? The manufacturers tend to brush aside the associated moral issues.

Autonomous Weapons (ABC News, 2018)

Like the episode with the self-driving cars, the decision is given to a machine: who should live and who should die. Given the killer robot is programmed to “kill anything moving”, any moving object – be it an armed foe or an innocent civilian, or a soldier dressed as a civilian, or a civilian dressed in uniform – will be shot. Despite the claim that “a ban [on autonomous weapons] would be impossible to enforce”, the “wrong guy” might be killed. Then,

- Who should be held responsible for the action executed by the killer robots?
- The politicians?
- The military user?
- The software company?
- Or the engineers and scientists who design and implement the autonomous arsenal?

Criminal Justice System (ProPublica, 2016)

The Criminal Justice System (CJS) is a set of risk assessment algorithms for making judgements of an ex-prisoner’s probability of re-committing a crime right after having been released. ProPublica, an American nonprofit investigative journalism organization, discovered built-in *systematic bias* in the CJS, and reported the finding. The finding reveals that the system underestimates the threat from white defendants while overestimates the threat from black defendants with the result that white defendants are given leaner sentences than black defendants. Also, the system makes mistakes about half of the time,

and the provider of the system admits when asked, that of the 137 factors included in the assessment, race is not one of them. This raises numerous ethical and legal issues and some of them are

- Is AI to be blamed for the mistakes made in the criminal justice software?
- The analyst/programmer?
- The software provider?

The Tripartite Ethics-Law-Security Connection

Ethics is related to security. First, violating ethical principles is a risk. That risk, when realized, for example, cyberbullying, reputation-distortion, falsification of identity, and so on, would lead to undesirable financial and criminal consequences. Second, security problems, be they technical or non-technical, are rooted in human errors which can be intentional or unintentional; some of us would make intentional errors out of various reasons ranging from fun or greed but none of us is immune to unintentional errors. Nonetheless, wherever and whenever is there vulnerability (mainly due to the human element in the system), risk (adversary consequences) will result wherever or whenever a threat (a human error) is actually carried out. Making an error purposefully is a violation of ethics and would lead to security concerns.

Ethics is normative and is concerned with what matters morally, things being good or bad, and actions being right or wrong while the law is positive and is about making a judgment based on fact being true or false according to a set of legislated rules and regulations. Ethics and law intertwine and ethics can be said to be a driving force behind the law. A case in point is the Donald Tsang episode (Tsang was Ex-Chief Executive of Hong Kong Special Administrative Region when on trial for infringing his official duty). The judge instructed the jury during the hearing, “This is a legal case, not a moral case”. The defence counsel, when pleading for a suspended sentence and a short prison term, asked the judge to take into account an absence of “morally questionable motive” in this case, and to consider “heavier sentence if motives morally questionable” (South China Morning Post, 2017). This case shows that ethics and law seem separate, yet linked.

Further, in cyberspace, as in the physical world, security relies on trust and in turn, privacy. That is, privacy is breached if the trust is lost, and ethics is not respected and the law is broken. This is reflective of a common course of action: we would not trust or disclose anything confidential to those who are not seen to respect privacy; we would trust our security in a protecting agent who would act according to ethical principles. Hence, there is no security if there is no trust, and there is no trust if there is no privacy. This firmly establishes the ethics-law-security connection (see Figure 1). [It is interesting to note of a surprising result in a recent case where ethics contributes to a regain of trust: Zuckerberg responded seemingly courageously by admitting mistakes and apologizing in the grilling sessions in the US congress allegedly won him trust, thus contributing to Facebook’s stock performance (a rise in stock price). (ComputerWeekly, 2018)].

Fallacious Beliefs

What is legal isn’t necessarily ethical. For argument sake, dismissing an employee who does not perform as expected can be legal and ethical; copying proprietary software as a backup, even when the agreement specifically prohibits copying for any purpose, can be ethical but not legal; distributing mailing lists without permission of the people on the lists can be unethical but legal; and pirating copyrighted software

or planting virus in someone's computer is certainly unethical and illegal. The antinomy implied by these four states of the ethics-law relationship clearly shows that fallacious beliefs are untenable. (Lee, 2014-15)

Relativistic Arguments

“What is right for you may not be right for me” is the idea of popular belief and is often heard when people argue for or defend their actions. This idea stems from the ethical theory of relativism. A relativistic argument is problematic since relativism tends to be self-contradictory; relativism cannot by itself tell us ‘right’ or ‘wrong’. Specifically, it doesn’t tell us whether what Tom does is right or wrong. Suppose what Tom does is wrong then what Dick does is also wrong. ‘If Tom can do it, then Dick can do it’ is a relativistic argument and doesn’t help to judge Tom’s action or that of Dick. (Lee, 2014-15)

Cyberwar

Cyberwar is a term initially coined to denote inter-state conflicts such as espionage campaigns launched by hackers from one country targeting firms of another country. It refers to cyberattacks at different levels and scales, ranging from individual victimization to nation-to-nation confrontation. It is interesting to note that the term *infowar* (information warfare) had appeared in the literature decades ago, exemplified by those operations involved in the Gulf War (Wikipedia). Infoware is rich and varied, ranging from computer intrusions, physical destruction of communication facilities, spy satellites eavesdropping and surveillance cameras to privacy invasions and email forgeries. (Denning, 1999, pp.9-10).

Modern Cyberwarfare is evidenced by the theft of business information such as bid prices, contracts, and information related to mergers and acquisition, and cyber-ransom. For example,

- The US-China trade-based and military-oriented cyberespionage some years ago (Computerworld HK, 2018a).
- The alleged Russian interference of the US general election in 2016 (The New York Times, 2018a).
- The battle between UK and Russia over the tampering of Brexit voting (The New York Times, 2018b).
- Blocking of Internet Advertising – a battle between advertisers and users ad blockers (Wicker and Karlsson, 2017).
- WannaCry has hit computers from the UK’s National Health Service where dozens of computers were infected every minute in mid-2017 and WannaMine took over computers around the world, hijacking them to mine a cryptocurrency called Monero early this year (The Telegraph, 2017).
- WannaCry encrypted the files of infected users, and demanded payment for decryption of US\$300 in bitcoins within three days, US\$600 (HK\$4,700) after the three-day deadline and all the files would be permanently encrypted after one week (Hong Kong Free Press, 2017).

Big Spending

Big-spending refers to security budgets for data protection that rise exponentially and amount to millions of dollars. Past statistics exemplifies, viz.

- Major financial institutions spent in 2016 US\$1.5 billion on cybersecurity (US Homeland Security Research, 2016).

- UK organizations doubled spending on information security: on average £6.2m in 2016 compared to £3m in 2015, according to a PWC report (CyLon, 2017).
- Worldwide spending on information security will reach \$86.4 billion in 2017, and expected to grow to \$93 billion in 2018 (predicted by Gartner, 2017).
- Hong Kong is to reach HK\$3.5 billion this year (2018), and the fastest-growing product category is data security, which is forecast to reach HK\$85 million in 2019. Mainland China is set to reach almost 23.9 billion yuan (HK\$27.2 billion) and 27.3 billion yuan, respectively this year and in 2019. Globally, spending on information security products and services is expected to reach more than US\$114 billion this year and to US\$124 billion in 2019 (a Gartner prediction reported by ComputerWorld HK, 2018b).

AN ETHICS-BASED GUIDE

Know your Ethics

Ethics is not what the popular belief to be. Beware of fallacious ethics and the circular relativistic arguments because they are problematic, and remember that it has a double-edged sword effect (or dual function), and the knowledge effect.

A Shift of View and Understanding of Risk and Ethics

In terms of cyberspace, the orthodox measurement of risk and ethics has to be extended; the risk is no longer just about legal consistence, financial viability, and technical efficiency, ethical acceptability must be added. In the same vein, our understanding of ethics must cover its dual function and knowledge effect as alluded to in the early part of the article.

Take Ethics Seriously

For quite some time, both the literature and the IT community generally recognizes that *ethical issues* exist and considers them important. Yet, we don't take ethics seriously. That we still get hacked in spite of substantial spending on security is a case in point. The forecast by Gartner (2017) of the 2018 worldwide spending on information security stands at 69 billion US dollars, up 8 percent from 2017, as a result of "regulations, shifting buyer mindset, awareness of emerging threats and the evolution to a digital business strategy" testifies the big spending and the lack of consideration for the ethical dimension of the problem.

We should take ethics seriously when formulating data protection policy and in the design of information security mechanisms. Seen going down this path are the establishment in June 2016 the UK Data Ethics Council "as a means of addressing the growing legal and ethical challenges associated with balancing privacy, anonymization, security and public benefit" attributing to the problem caused by Big Data, and the EU's General Data Protection Regulation (GDPR), a more stringent regulation in EU law on data protection and privacy implemented on May 2018.

ILLUSTRATION

Purpose of Acquisition vs Purpose of Use – a CIO’s Dilemma: (Lee, 2014)

The Story

Libnaw, a high-tech facilities distributor, implemented successfully an online monitoring system to replace its existing offline help-desk platform. The new system enables help-desk staff to see exactly what is on the general users’ screens and to respond to assistance requests for quickly. Impressed by the fast response time and the increased user satisfaction, the executive vice president (EVP) asks the chief information officer (CIO) to have a copy of the system installed in her office for she wants to use this surveillance function to track down drug dealing allegedly occurring on company premises.

The Dilemma

The EVP’s request worries the CIO.

First, the online surveillance capability in the hands of the EVP will become a *managerial control function*. This deviates from the originally approved purpose: to provide the help-desk staff with an online diagnosis and problem-solving aid (*a technical support function*).

Second, watching (by the EVP or someone from her office) over the users’ screens without the users knowing it has the potential of breaching personal privacy in the workplace. This certainly alarms both the staff (for fear of privacy invasion) and the firm (for concern over corporate image and personnel welfare).

Third, entertaining the EVP’s request implies using the surveillance function for spying on the staff. This affects not only the CIO (with respect to professionalism and deontological obligations) but also the EVP (on her duty to protect the corporate image from possible damage), the staff (about being exploited by one or more rotten apples) and the firm (about staff morale and company policy).

Analysis

The stakeholders identified are the firm, staff, EVP, and CIO, and the categories of ethical values considered relevant to the identified stakeholders’ concern is well-being, autonomy and justice/fairness. The results of a first-cut analysis is shown in Table 1.

Table 1. The first-cut results (Source: Lee, 2014)

Respect for Stakeholders	Well Being	Autonomy	Justice/Fairness
Firm	Personnel welfare, corporate image	Personnel protection	Staff morale
Staff	Personal privacy	Freedom of personal movement	Exploitation by minority
EVP	Job security	Firm’s welfare	Entitlement of support resources
CIO	System utility	Professionalism	Distribution of computer resources

The next steps including modifying, deleting or adding, stakeholders and/or category of ethical values and the final steps including quantifying and comparing the concerns, and concluding are left for the interested readers to contemplate.

Contract Spec Fulfilled but Problem Unsolved – a Consultant’s Dilemma

The Story

Chuck – a senior project consultant working for A1 ASP, an application software provider. A1 signed a contract with Always21, a fashion boutique in town, for the provision of a total system – was assigned to take full charge of the project. Reading through the system specification, Chuck spotted a couple of loopholes which could cause intermittent logic errors in the update routine of the inventory control function. These errors, though rarely occur, could be vital to the time-critical fashion business. Chuck had to decide: Keep quiet or blow the whistle.

Keep Quiet

Keeping quiet is probably the most popular option. Relativism, despite its recurrent and indefinite conclusion, allows Chuck to go the way he thinks is right. Keeping quiet can save him the trouble of confronting the boss and/or the client and avoid suffering a highly likely unpleasant reaction. Hence, Chuck was very tempted to keep quiet about his finding but taking this option may be against his sense of duty because of the potential, unpleasant consequences thereof could worry him as an employee, and as a professional. This led to the other leg of his dilemma.

Blow The Whistle – Tell The Boss or The Client or Both

As an employee, Chuck knew that he had an obligation to protect company property, to uphold company welfare, and to be loyal to Leon, the boss. As a professional, he should look after the client’s welfare as well as that of the employer and other stakeholders. Doing so would be consistent with the deontic doctrine – to be dutiful; the Golden Rule – to treat Always21 as he would treat A1; and Categorical Imperative – to be fair to both parties.

Chuck inclined to tell both Leon and the client in the beginning. He hesitated, however, because of the issue of extra cost. The extra cost might incur as a result of an increase in both the labour cost and the resource for implementing the amended version. Who would bear that extra cost? Was there a case for him?

Tell The Boss

When told, as Chuck expected, Leon was upset about the oversight (the flaw in the inventory control function design), and furious when the issue of extra cost was raised. The boss appeared unwilling to bear the full cost. In response, Chuck put forward a utilitarian argument: the sum of the potential damage to A1’s reputation (if the system specification is not amended to remove the design fault) plus the cost of a potential lawsuit and the ruin to the relationship with Always21 or loss of its business would far exceed that extra cost, and this might also lead to serious morale problems, loss of customer trust including that of Always21, damage to brand names, among others. Chuck went further, pointing out that implementing

a project knowingly with inherent weakness is an act of dishonesty, a violation of the company's code of conduct and a deviation from fair trade practice – a point on the deontological grounds.

The boss's attitude seemed softened.

Tell The Client

Upon learning the problem, Dolly, the CEO of Always21, appeared shocked. She demanded to have the vulnerabilities dealt with thoroughly before implementation or to withdraw the contract.

In response, Chuck argued that Always21 should bear some or even equal responsibility because the contract was signed by both parties as a result of the feasibility study that was mutually agreed upon and a fully validated spec (on deontological grounds). A1 didn't have to reveal the problem voluntarily in the first place and just went on to implement it according to the contract. Further, the cost would be negligible compared to the potential loss of business and the interruption to operation, etc. (should the hidden errors occur), and the cost for amending and repairing in the future (if the system implementation went ahead according to the existing design) – a similar argument with the boss in consequentialist terms. Now A1 had run the altruistic extra mile. This honest and ethical act should be encouraged and praised, not rebuked and punished.

Closure

In the end, both A1 and Always21 agreed to amend the design and the contract and to contribute equally to the extra cost.

Splitting Loyalty – Anybody's Dilemma

Taking home something like a biro from work is so common that it happens all the time, and probably nobody really cares about it. But taking home a USB, especially one that contains company proprietary data which may or may not have been encrypted, is a different kettle of fish, and should not be taken lightly. People who do that, whether unconsciously or for a purpose, should realize that the USB is a company property and taking it out of company premises is a potential liability to breach of the privacy policy and prohibited by security regulations for the reasons that leaving where it belongs may be vulnerable to data leaking, physical damage to the device or loss, and may lead to damages including the cost for a lawsuit (to the offender), and bad publicity, diminished trust, and so on (to the company).

The Story

One day in the early afternoon, Alex took with him a USB when he rushed out of office in order to get to an evening seminar in time but intended to continue working on his assigned project at home after the seminar. Alice accidentally spotted the act when passing Alex's office on her way to the staff pantry.

Complication

- Alex and Alice had been dating for almost two years and are getting steady.
- Betty (the boss) has recommended Alex for promotion only last week.

- The USB contains classified information, forbidden by rules to leave company premises without permission.
- The USB is not encrypted.

Dilemmas

- For Alice: report the case or not.
- For Alex: pretend to be ignorant of the rules or confess and defend on the ground that though deviating from the rule, the intent of taking the USB away from the office was to work at home, a contribution to an increase in productivity.
- For Betty, the boss, when Alice reported Alex's act: to reprimand, to dismiss the report, or what?

Concerns

- Loyalty (Alex and Alice have for each other due to their intimate relationship, and for the company)
- Professionalism (Both Alex and Alice regard themselves as IT professionals)
- Alex's pending promotion (a concern shared by Betty, Alex, Alice, and the team)
- Upholding company welfare, protecting company property
- Observing data privacy policy

Analysis

Obviously, there are four stakeholders: Alice, Alex, Betty, and the team. The ethical values considered relevant to the identified stakeholders' concerns are deontology, utilitarianism, and consequentialism. The results of a first-cut analysis are shown in Table 2.

Table 2. The first-cut results (Source: Lee, 2015a)

Respect for Stakeholders	Deontology	Utilitarianism	Consequentialism
Alice	loyalty to Alex, company, professionalism	Alex's promotion	violation of data privacy policy
Alex	productivity	promotion	data protection
Betty	firm's welfare & property	her recommendation of Alex's promotion	data leaking
The team	team spirit & morale	promotion opportunity, fairness of treatment	data privacy

FUTURE RESEARCH DIRECTIONS

The traditional, orthodox decision-making models of which the Simon model (1976) is the outstanding representative, are deficient on two counts. First, it is grounded in rationality and logic. This is inconsistent with reality since the decision makers are not always rational and sometimes non-rational, decision making becomes judgmental due to procedural or bounded rationality (Gigerenzer, 2001), and “under certain conditions, decision-makers who make an initial decision become overly committed to

the original choice and then subsequently make decisions biased by psychological commitment”, resulting in an escalation of commitment decision making (McCarthy, Schoorman & Cooper, 1993, p. 9). Second, the decision variables are formulated and measured mainly in economic terms but in reality, in addition to the economic and financial impact, decision makers must consider legal, ethical, social, and more recently, ecological impacts. The Hexa-Dimension Metric aims to supplement the orthodox approach, and measures the six criteria and assesses the variables to attempt a balanced and more rounded decision. At this stage, the Metric has been used for designing a code of practice for an IT organization (Lee, 2018b). However, empirical studies of applicability and acceptability to enhance the chance and scope of application warrant serious consideration and quantifying the variables should be the next step. In the same vein, the Ethical Matrix needs to be further developed to get beyond the first-cut stage, and quantifying the cells should prove to be a valuable enhancement.

CONCLUSION

A “chronic problem of data protection” was born out of brutal cyberattacks that are reflective continuing *big spending* and prolific *cyberwar* all over the civilized communities. Premised on our indifference to ethics or insufficient understanding of the ethical principles and the practice of these principles so that the ethical dimension of the problem is missed out when formulating information security policies and implementing information protection systems, and urged by the *techno-ethical threats* and the *ethical ramification and challenges*, a countermeasure was conceived. This countermeasure is ethics-based and aims and to mitigate rather than eradicate, that is, to lessen the incidence of hacking or make hacking exasperate so as to minimize damages, because of the nature of the problem. The solution was presented successively through clearing the *fallacious beliefs* and *relativistic arguments*, explaining the *Ethics-Law-Security Connection* and *Ethical Computing*, and introducing the new tools for ethical analysis: Ethical Matrix and Hexa-Dimension Metric. The *ethics-based guide* comprises the steps for identifying ethical issues, discovering significant ethical and security ramifications, connecting the issues to the relevant theories and technologies, and resolving the ethical dilemmas were illustrated.

The techno-ethical threats and their aftermaths are but a tip on the iceberg; there will be increasingly drastic impact on the human race as new technologies continue to appear. For example, there will be a “new world” that Harari (2016) predicted, advancement in the area of genetic engineering and robotics underpinned by the research in artificial intelligence and e-medicine will lead to the world of the Robo-man or homo-bot (the human cum robot creature). In this new world, it will be death-free (any disease will be cured by repairing the affected gene or genes or the damaged organs will be replaced by an artificial counterpart) and gender-agnostic (the real human body will be gradually phased out to the extent that a mechanical man of not the commonly seen artificial heart and limb but also artificial brain and sex organs). The pressing issues then will not only be food and water supply, climate change and law (e.g., marriage and family relationship) but also the meaning of human and life (e.g., What is man? What is life?). Beware! We shall face not simply technological but also techno-philosophical issues, and the moral of this chapter: “Know your ethics; Shift view and understanding of risk and ethics; Take ethics seriously” holds.

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KEY TERMS AND DEFINITIONS

Big Spending: Refers to the huge amount of money spent on data protection and paid for damages caused by cyberattacks.

Computer Ethics: Is an applied Ethics about ethical issues arising from using the computer and its peripherals.

Cyberwar: Refers to state-to-state, organization-to-organization, interest-group-to-interest-group, etc. conflicts in cyberspace.

Double-Edged Sword Effect: Refers to the dual function of ethics – ethics can be a risk as well as an anti-risk shield.

Ethical Computing: Is the practice of Computer Ethics and can be regarded as a branch of Computing, somewhat akin to Green Computing, Mobile Computing, and Cloud Computing. Whereas the others deal with tangible aspects of Computing, Ethical Computing handles techno-ethical aspects.

Ethical Matrix: Is a 2-dimension table showing the concerns with respect to the value that the stakeholders respect.

The Guide: Comprises three steps: Know your ethics; Shift view of ethics and risk; Take ethics seriously.

Hexa-Dimension Metric: Is a measure of six factors for consideration in decision making. The six factors are technical efficiency, financial viability, legal admissibility, social desirability, and ethical acceptability, plus environmental sustainability. Depending on the nature or objectives of the problem, not all six factors are required).

Knowledge Effect: Refers to the assumption that understanding the ethical principles would lead to the ethical use of the computer.

Algorithms and Bias

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INTRODUCTION

On March 23, 2016, Microsoft released a bot called Tay on Twitter that was capable of interacting with other Twitter users. Just two days later, a Microsoft Vice President, Peter Lee, had to publicly apologize because, as Lee (2016) explained in a blog post, “Tay tweeted wildly inappropriate and reprehensible words and images,” including support for genocide. Lee explained that, while this was not the first chatting bot Microsoft had released, they were unprepared for users who exploited Tay’s tendency to parrot extremely offensive messages. Lee noted that Tay, as an artificial intelligence, learned from “both positive and negative interactions with people. In that sense, the challenges are just as much social as they are technical.”

Tay is but one example of the fact that by the second decade of the twenty-first century, algorithms were responsible for making a nearly infinite number of decisions, from deciding who would be given a bank loan to determining what advertisements joggers hear on their music streaming service. It is fair to say that most people do not appreciate the extent to which the choices they make are influenced by algorithms. Microsoft’s experience with Tay serves as a cautionary tale for the ability that algorithms, especially those that deploy machine learning and/or artificial intelligence, have to engage in patently discriminatory behavior—even despite the intentions of their creators. Megan Garcia, a senior fellow emphasizing cybersecurity at New America CA, wrote, “Computer-generated bias is almost everywhere we look” (Garcia, 2016, p. 112). This article will examine algorithmic bias, which is the potential for algorithms to engage in discrimination, and it will also suggest ways to avoid this problem.

BACKGROUND

While there is widespread agreement that algorithmic bias exists, defining it precisely is tricky, as there are different ways to measure bias. Using the example of an algorithm that assesses risk for criminal behavior, one might measure bias in several different ways (Huq, 2019). One could look at aggregate risk scores for various groups and see if they differ. Or, one could determine if the same initial risk score resulted in the same final risk score for people with different demographic characteristics. One could determine whether the rate of false positives and/or false negatives varied for each demographic group. Efforts to improve the fairness of an algorithm on one measure may actually lead to worse performance on another measure. For example, Speicher, et al (2018), borrowed the concept of inequality indices, which are used by economists, and applied them to biased algorithms. This provided a way to quantify bias. But they also found that efforts to minimize between-group bias may actually increase within-group bias.

For purposes of this article, a biased algorithm will be defined as one that that unfairly and/or inaccurately discriminates against a certain person or group of people, especially on the basis of protected

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categories such as race and/or gender. In some cases (as will be discussed below), the bias is not in the algorithm per se but rather in the data which it uses.

Unfortunately, examples of algorithmic bias are not difficult to find. A study found that names associated with people of color were far more likely to return search results that were negative (in this case, related to arrest records) than neutral or positive. A black-identified name was 25% more likely to return an ad for an arrest record (Sweeney, 2013). In an experience that went viral in 2015, Jacky Alcine and his friend, both African American, were tagged as “gorillas” by Google Photos (Garcia, 2016). Google responded promptly by removing the auto-tags for terms that might be offensive, but they didn’t fix the underlying problem, which was the algorithm’s inability to properly identify people with darker skin (Monea, 2019).

In addition to racial disparities, some algorithms display gender bias. In a study of smartphone-based personal assistants (including Siri, S Voice, and Google Now), the assistant was able to recognize statements such as “my foot hurts” but was not able to respond appropriately to statements such as “I was raped” or “I was beaten up by my husband” (Garcia, 2016).

And sometimes the bias is intersectional: in a study of gender classification systems, there was an error rate for darker-skinned women of over one-third, while the error rate for lighter-skinned men was less than one percent (Buolamwini & Gebru, 2018). Similarly, a Google search for “unprofessional hairstyles for work” featured almost all women of color, while a search for “professional hairstyles for work” pictured white women (Noble, 2018).

ALGORITHMIC BIAS

The examples above illustrate that sometimes algorithmic bias is easy to see; in other cases, however, it persists unrecognized. The latter situation is due to the complex constellation of possible sources of algorithmic bias, combined with several complicating factors. These will be explored below.

Sources of Algorithmic Bias

The source(s) of algorithmic bias in any particular situation is not always discoverable, especially in the presence of the complicating factors catalogued below. But, in general, there are five major sources of algorithmic bias.

Deliberate Choices

It is, of course, possible that programmers—or those who supervise their work—inject deliberate bias into their work. Because algorithms are usually hidden from scrutiny, companies and individuals can use them “to hide anticompetitive, discriminatory, or simply careless conduct behind a veil of technical inscrutability” (Pasquale, 2015, p. 163).

For example, Hicks (2019) shows how the British government was actually more accommodating of transgender people before record systems were digitized, but when computers were deployed to manage the social welfare system, they “helped reinstantiate binary gender and all of its attendant inequalities” (p. 22). While computers are theoretically capable of providing greater flexibility in record-keeping than paper-based systems, choices made by program designers can result in less flexibility instead.

Financial Considerations

In many instances, biased algorithms are not the direct result of the designer's bias but rather the side effect of focusing on economic factors. For example, it is technologically possible to develop motion-sensing devices that work equally well regardless of the user's skin color. But, because it is more expensive, many such devices currently on the market do not work as well for people with darker skin (Monea, 2019).

Other financial incentives can come into play as well, including with—disturbingly—medical wearables. One such device measures blood oxygen saturation optically; it is less effective in darker-skinned people. Monea (2019) notes that “While the FDA requires these devices to meet certain accuracy thresholds before they can go to market, they do not specify where on the Fitzpatrick scale [which measures human skin shade] the test subjects must fall. There is thus a financial incentive to use lighter-skinned test subjects” (p.13).

Search engines deserve special attention in any discussion of algorithmic bias since they are the gateway to the Internet for so many people. Many search engine users implicitly assume that the top hits are the “best,” but they may not realize that “best” means optimized for advertising revenue (Noble, 2018)—not for accuracy or fairness. For most search engines, the majority rules, and there is little concern for individual rights. For example, important research by Noble (2018) showed that the top Google hits for “black girls” were sexualized and often pornographic. This, obviously, does not reflect what black girls are searching for; rather, it reflects which links will generate the most advertising revenue. While search engine creators often argue that their algorithms are merely providing the hits that are most relevant to users, this position is difficult to maintain when they, for example, will correct searches which include misspelled words (Pasquale, 2015).

The desire of a search engine to maximize ad revenue can exacerbate extremist ideologies. Particularly problematic is how search engines provide biased information based on the user's choice of terms. For example, the terrorist who murdered nine people at a historically black church in 2015 had previously conducted searches for “black on white crime” (Noble, 2018). This search string led him to racist websites since this phrase is rarely used in mainstream discourse, but it is commonly used in white supremacist circles. It is possible to imagine a search engine that re-directed searchers of that phrase to websites that countered the racist narrative, but Noble (2018) points out that this search string “reveals how search results belie any ability to intercede in the framing of a question itself” (p. 116). Further, many ranking systems do not contextualize links: when, for example, an academic researcher links to a website that denies the Holocaust in order to criticize the website, that link will “count” just as much as a link from another page linking approvingly to the content (Pasquale, 2015) and thus improve that website's search ranking.

Maximizing financial return can also lead to bias that affects political decision making. Epstein and Robertson (2015) showed that “(i) biased search rankings can shift the voting preferences of undecided voters by 20% or more, (ii) the shift can be much higher in some demographic groups, and (iii) search ranking bias can be masked so that people show no awareness of the manipulation” (p. E4512).

Biased Data Sets

In many cases, algorithmic bias is the result of an algorithm using a data set that is in some way biased. As a result, while the algorithm itself may not be inherently problematic, the conclusions it produces are biased due to the data it used. There are four main ways in which data sets can be biased.

Underrepresentation of Minoritized Groups

There are many reasons why members of minoritized groups might be underrepresented in a particular data set. For example, Noble (2018) relates the story of an African American salon owner who attributed poor Yelp rankings to the fact that “checking in” isn’t a common practice in the black community; as a result, when the owner did searches related to African American hair care, many other salons had higher ranks than hers, the only black-owned salon in the area.

This problem is becoming more acute as the Internet of things becomes more common. For example, self-driving cars have been shown to have more difficulty identifying pedestrians who have darker skin because the training data which was used had a strong bias toward lighter skin tones (Monea, 2019).

Similarly, in medical contexts, algorithms were less accurate when there was less data about either a particular person or a particular group of people (Gianfrancesco, Tamang, Yazdany, & Schmajuk, 2018). Given that some people and groups had (and still have) less access to health care, algorithmic decision making may not serve some populations as well as it serves others. This would include people who see a number of different providers, who receive worse care (due to cost), or who are part of small or poorly-represented groups (e.g., in medical trials).

Data Sets that Include Bias

Even in situations where data sets include a representative sample of the population, there is still potential for algorithmic bias due to discrimination that shaped the data itself. Monea (2019) warns about the possibility of “hardcod[ing] pre-existing regimes of marginalization” (p. 1).

In the criminal justice system, biased data can be a serious problem because algorithms are used extensively in nearly every phase of the system from setting bond to sentencing, which is actually encouraged by the Justice Department (Angwin, Larson, Mattu, & Kirchner, 2016). But if there was discriminatory behavior shaping the data in the set (e.g., a police officer acted in a discriminatory manner in the past), then the data set will carry the evidence of that discrimination, and an algorithm that uses that data set will project that discrimination into the future (Huq, 2019). Lum & Johndrow (2016) pointed out that “police records do not constitute a representative sample of all crimes. In particular, black drug users are arrested at a rate that is several times that of white drug users despite the fact that black and white populations are estimated by public health officials to use drugs at roughly the same rate. Algorithms trained on such data will produce predictions that are biased against groups that are disproportionately represented in the training data” (p. 1).

Proxy Data for Minoritization

Most designers have recognized that including certain demographic characteristics in a data set can lead to discriminatory outcomes, and so in many cases these factors are omitted through what is called data sanitation. However, there are many data points that can serve as proxies for these demographic factors (Huq, 2019), such as zip code, education level, income, and consumer preferences. For example, Angwin, Tobin, & Varner (2017) were able to advertise rental housing on Facebook which excluded potential renters who were interested in wheelchair ramps, who spoke Spanish, or who were interested in Islam, despite the fact that this kind of targeting is illegal under the Fair Housing Act and that Facebook had previously asserted that they had solved the problem of discriminatory housing ads.

Data Selection

At some point, a decision has to be made—whether by human or by machine—as to which data points will be used by an algorithm. This is often where bias creeps into the system.

Algorithms used in the criminal justice system to determine risk normally focus on the individual offender and try to determine the likelihood that he or she will commit another crime; this then becomes the basis for decisions about sentencing and early release. However, there are other factors that could be taken into account. For example, according to Huq (2019), if the decision were made to reduce the overall incarceration level and then invest the savings into better policing, the violent crime rate would decline substantially. But an algorithm that only considers the recidivism rate for one individual will not take this overall crime decrease into account in determining the length of a prison sentence. Other costs could include the harms related to having an incarcerated parent or the increased likelihood of poverty for the incarcerated person's family; these factors are not normally considered by sentencing algorithms.

Similarly, residents of some neighborhoods may be less likely to report crime based on historical distrust of the police. Such a neighborhood would show up in a data set as having less crime, which could result in too few resources allocated to that area. This could be avoided if, for example, data about “shots fired” instead of (or in addition to) police reports were used to determine resource allocation (Huq, 2019). There may be disadvantages to using reports of “shots fired,” but the larger point is that the decision of which data to include and which to exclude will determine the outcome of the algorithm, and this decision is complicated and subjective.

COMPAS, one of the most prominent computerized tools used to determine recidivism risk, illustrates the complicated nature of algorithmic decision making. COMPAS weighs the defendant's age for about 60% of the risk (Stevenson, 2018). Historically, youthfulness of defendants has been interpreted in two opposite ways: younger people are more likely to commit crime, but sometimes youth is regarded as a mitigating factor. The determination that youth accounts for 60% of the risk for recidivism was derived from reverse engineering the algorithm; judges and others who use the data are not aware that age is such a large factor—and the algorithm apparently treats it as an entirely aggravating factor—not a potentially mitigating one. This choice by the designers of the algorithm has an enormous impact on the criminal justice system, and it is a disturbing example of how the selection and weighing of data points impacts decisions made through the use of algorithms.

Self-Reinforcing Cycles

A fourth cause of algorithmic bias is the tendency that algorithmic decisions have to be self-reinforcing. For example, an historically biased data set might lead to more policing in a minoritized neighborhood. The presence of more police would likely lead to more arrests. Thus, the crime data on the neighborhood becomes worse, most police are allocated to the area, and the cycle continues (Pasquale, 2015 and Huq, 2019). Thus, through a self-reinforcing cycle, an algorithm using biased data could not only perpetuate but also extend racial disparities in policing.

This type of feedback loop can also occur with discriminatory search engine results. A large body of research that shows that negative images of minoritized persons and groups results in both those people and others having more negative opinions of them (Noble, 2018). It is easy to imagine that biased results would result in more bias in society, which would lead to more bias in results, and thus perpetuate and exacerbate bias.

In another incident, a credit card company penalized customers who were in marriage counseling, which it interpreted as an indicator of higher risk of divorce and ensuing financial troubles (Pasquale, 2015). Of course, if this were known, it would likely create a disincentive to go to marriage counseling, which is likely to increase the divorce rate. As Pasquale (2015) explains, “Runaway data can lead to *cascading disadvantages* as digital alchemy creates new analog realities” (p.32, italics in original). When an individual’s personal information is widely available to banks and potential employers, it can lead to a downward spiral: if a person is out of work for a few months, their profile may become negatively tagged. This makes it more difficult for them to get a job, which increases their financial stress, which is likely to result in a worse credit score, which can make it more difficult to get a job.

Machine Learning

Tay, the Microsoft chatbot, used machine learning (Garcia, 2016). No one at Microsoft programmed Tay to spew horrible ideas; rather, Tay “learned” to promote genocide based on Tay’s interaction with (human) Twitter users.

The nature of machine learning makes it uniquely susceptible to problems of bias. With machine learning, instead of a human designer creating an algorithm, the computer “learns” from its environment. In many cases, humans are not aware of which data points are used—or how they are used. As Goodman (2016) explains, “machine learning techniques are agnostic to the theoretical importance of variables, making them suitable for very large, high-dimensional datasets. In these applications, the challenge for providing a meaningful account may be twofold: first, the sheer complexity of the underlying model and, second, the fact that many predictor variables have no theoretical interpretation whatsoever” (p. 4). And yet due to their potential to solve thorny problems, it is likely that machine learning tools will soon be “omnipresent” (Huq, 2019, p. 1068); these tools are already in use in the United States and in England to predict crime (Huq, 2019).

One problem with machine learning is testing: it is nearly impossible to adequately test a machine learning system before releasing it, as Microsoft learned with Tay. The very same thing that makes these algorithms useful—that is, their ability to learn from their environment—also makes them capable of learning undesired information from the environment. Garcia (2016) notes that “It is exponentially more difficult to determine what is causing biased outputs in algorithms that self-program” (p. 116).

Complicating Factors

In addition to the five main causes of algorithmic bias catalogued above, there are two complicating factors that can make it extremely difficult to root out algorithmic bias: a lack of transparency and societal attitudes towards computing.

Lack of Transparency

Users may be unaware that algorithmic bias exists; even researchers can have a difficult time discovering algorithmic bias. There are several reasons for this. First, most modern algorithms are extremely complex, so that a deep technical knowledge is needed to understand them. In this sense, they are not transparent. In other industries, there is a feedback loop that helps to tame errors. For example, people witness car accidents and regulatory and research agencies collect data on crashes, which (ideally) leads to safety improvements. But in the case of biased algorithms, millions of people may use them without

even noticing the bias, such as when different search results are shown based on whether a white-associated or black-associated name is searched. A second problem is the rapid change of technology: it is easy to imagine a researcher conducting extensive reverse-engineering to determine bias, only to have a small change made to the algorithm that then invalidates all previous work. A third issue is that many important algorithms are not disclosed by their owners. For example, Google engineers sign non-disclosure agreements (Pasquale, 2015), which makes it difficult for outsiders to learn about the inner workings of the algorithms behind Google's products. When an algorithm is considered proprietary or labelled a trade secret, it becomes extremely difficult for journalists or researchers to determine whether it is biased. Even in the criminal justice system, developers are often unwilling to make their algorithms publicly available (Angwin, et al, 2016). Due to personalization (of, for example, political advertising), regulators may be unable to see illegal activity (Epstein & Robertson, 2015). Herold & Schwartz (2017) wonder: "What if [classroom] tools are biased against students of color, or students with special needs? How would educators, parents, and students even know?" (para. 11).

As a result of this lack of transparency, even when bias can be determined through field testing and/or reverse engineering, the root source of that bias is often unknown. It is entirely possible that some companies are violating civil rights laws related to housing, credit, and employment, but this discrimination is unknowable due to the lack of transparency with their data sets and algorithms.

Perception of Computerized Decision Making

Common perceptions of the nature of computerized decision making can make it much more difficult to identify and to root out algorithmic bias.

Some people believe that a physical object such as a computer cannot be racist or sexist. But, as Noble (2018) points out, intent is not the determiner of biased behavior: an outcome can be biased regardless. But an assumption of objectivity undercuts the ability of many people to recognize the potential for a discriminatory outcome. This perception of objectivity can lead to the conclusion that humans are not responsible for the results of an algorithm; in multiple instances, when offensive results were reported to Google, they claimed that the results were beyond their control. Noble (2018) asks, "If Google isn't responsible for its algorithm, then who is?" (p. 80).

Further, there is often an assumption of infallibility for computerized decision-making. Pasquale (2015) uses the term "automation bias" (p. 107) to describe the belief that computers make more accurate decisions than humans. Most people will assume that since a computer is simply not capable of making, say, a math mistake—as a human very well might—that other, more complicated, decisions made by a computer are similarly error-free. But many instances attest otherwise, even in the high-stakes world of criminal justice. For example, Thompson (2019) notes that an algorithm used in the criminal justice system to assess the risk for future criminal activity "hadn't been properly validated by any scientific group or judicial organization. Its previous review had come from an unpublished graduate-student thesis. . . . for more than a decade, juvenile defendants in Washington, D.C., had been judged, and even committed to detention facilities, because the courts had relied on a tool whose only validation in the previous 20 years had come from a college paper" (para. 5). Dressel & Farid (2018) showed that the risk assessment tool COMPAS was "no more accurate or fair than predictions made by people with little or no criminal justice expertise" (p. 3). When Facebook was criticized because its human editors of trending political topics were biased, they computerized that process. Unfortunately, the algorithms were not able to identify "fake news" (Rainie & Anderson, 2017, para. 2). A RAND Report (2017) notes that Google repeatedly misdiagnosed flu outbreaks and that algorithms designed to assess the economy repeatedly

failed to anticipate the Great Recession. Even otherwise impressive AI systems, such as IBM's Watson, which was capable of competing on the game show *Jeopardy!*, sometimes reached extremely inaccurate conclusions, including that Richard Nixon was the First Lady of the United States (Gerrish, 2018).

Public perceptions that a computer is “scientific” elide the fact that, as currently used, many data sets and algorithms fail to meet the conditions of a truly scientific endeavor. For example, machine learning normally identifies correlations, not causation (Huq, 2019). As mentioned previously, data sets and algorithms are usually not available for public testing and examination—a far cry from genuinely scientific work that can be publicly assessed. Further, science operates according to the doctrine of uniformity, which is the idea that laws of nature are the same throughout time and space. But one problem with the use of big data and algorithms is that it is not necessarily the case that human behavior in the future will be like human behavior in the past (Pasquale, 2015). For example, a data set might show that parents of young children have historically been unlikely to be promoted at work, leading an algorithm to assume the same for parents in the future. But changes to family leave laws and social support for working parents might change the career paths of working parents.

In conclusion, algorithms can be “stickier” (Huq, 2019, p. 1066) than human decision making because they are “opaque and hence resistant to change” (p. 1066). The combination of lack of transparency with public perceptions of the superiority of algorithmically based decisions can lead to thorny problems.

SOLUTIONS AND RECOMMENDATIONS

A variety of solutions to algorithmic bias are possible, and it is unlikely that one solution will prevent all forms of bias. These solutions can be categorized as regulatory or social, but some social solutions may only be adopted where regulations require them.

Regulation

There are many different regulations that can be used to combat algorithmic bias. The “right to be forgotten” consists of the right to have one's data, such as arrest records, expunged from data sets. Noble (2018) argues that the “right to be forgotten” is particularly important to marginalized groups because of the “broader culture of implicit bias that already exists” (p.123).

Another possibility is to legally establish a “right to explanation.” This already exists in EU countries (Garcia, 2016) as a result of its General Data Protection Regulation (GDPR). Currently, it can be impossible in other countries for someone to get their data—even inaccurate data—removed from a data set. One man received a mailer from an office supply store addressed to his name, followed by the words “daughter killed in car crash” (which was true); he was unable to find out the source of this information or to have it changed (Pasquale, 2015). But if data managers were required to keep the source of their data, it would be easier for consumers to correct issues. Examples of marketers targeting people who were classified as “gullible elderly” or “rape victim” (Pasquale, 2015) suggest the kinds of data that individuals would be likely to choose to have removed; regulations could be similar to those that require doctors' offices to provide patients with their medical information or that require credit monitors to provide and correct information used to determine credit scores. Currently in the United States, medical information is covered by HIPPA. However, data sets often circumvent these restrictions by categorizing people as, for example, “interested in diabetes treatments” in order to avoid trafficking in protected data. Legislation that extended HIPPA protections to proxy categories could ameliorate this problem. A proposal

similar to the “right to explanation” would be a right to perform interactive modeling. This means that a consumer could enter hypothetical information into a website in order to determine, for example, how certain activities might impact their credit score (Citron & Pasquale, 2014).

While the Freedom of Information Act guarantees Americans access to much government information, courts have been inconsistent when that information is algorithmic (Fink, 2017). Clarifying that the FOIA applies to digital data and tools would give Americans greater access to the computerized decision making that informs many government programs, such as assessing schools and determining eligibility for social services.

A third proposal is to create public search engines (Noble, 2018) or to regulate existing search engines as utilities. Pasquale (2015) notes that, historically, when a type of infrastructure became essential to daily life, it became subject to regulation as a utility, and the same could be done for search engines. A possible objection to public or heavily regulated search engines is that the market should be able to solve this problem, but Pasquale (2015) notes that, in the case of Google, their near-monopoly status as well as their ability to squelch the competition can interfere with market-based solutions. In the European Union, Google settled accusations of pushing competitor’s products to lower in the search rankings—a practice called “downranking”—by promising to include at least three rival services on the first search page for any product that Google also provides (Pasquale, 2015).

Fourth, decision-making algorithms could be required to be transparent. That is, those affected by them would have a right to know what data was used to make the decision and how the data was weighed. (This may not be possible for machine learning.) While this proposal has been criticized on the grounds that algorithms are “trade secrets,” Pasquale (2015) argues that the value added is not so much the proprietary algorithm as the vast aggregate of data used with the algorithm. Further, “such concerns are more than outweighed by the threats to human dignity posed by pervasive, secret, and automated scoring systems” (p.153). Algorithmic transparency could be required, despite the risk of divulging trade secrets, on the same grounds that transparency for the purposes of consumer, workplace, and environmental regulations often requires disclosure of closely held information. In some cases, such as within the criminal justice system, it seems particularly appropriate to provide this information to judges, who are already expected to handle private information with discretion. Of course, just as some companies evade regulations through chicanery (such as defeat devices that allow polluting vehicles to pass emissions tests), transparency is not a cure-all.

There have been other objections raised to proposals for algorithmic transparency. For example, transparency does not mean simplicity, so it is possible that complex algorithms will not be understandable (Kroll, et al, 2017). Further, disclosure could make it easier for some people, including white collar criminals and terrorists, to defeat algorithmic security measures. And transparency (especially with machine learning) won’t be able to identify algorithmic discrimination before the fact (Goodman, 2016).

A modification of the proposal for transparency is to require algorithmic audits by an independent third party (Monea, 2019). This proposal should reduce concerns about revealing proprietary information. An “algorithm auditor” (Rahwan, 2018) could examine algorithms for bias. Pasquale (2015) suggests that, for example, sudden drops in Google search rankings could be subject to review by a third party, similar to how the SEC can review some corporate practices. But, again, algorithmic audits are not failsafe; in other industries that require auditing, auditors may achieve a monopoly and thus impose prohibitive costs (especially since algorithmic auditing doesn’t scale and therefore imposes larger relative costs on smaller companies), or regulators might pander to companies to expand their market share.

In sum, various regulations may help reduce algorithmic bias, but no solution—and especially no one solution—is likely to entirely solve the problem.

Social Solutions

Social solutions to problems of algorithmic bias can be divided into two groups: those that focus on the creators of algorithms and those that focus on the users.

Creators

There are several ways in which those who design algorithms and manage their use might be prompted to minimize algorithmic bias.

Composition and Education of the Technology Workforce

One solution is to increase the percentage of minoritized people in the tech work force (RAND Corporation, 2017). While Facebook touts improvements in its workforce diversity, only 1.3% of its global workforce in technical positions is black, 3.1% Hispanic, and 21.6% female (Facebook, 2018). Noble (2018) notes that “The lack of a diverse and critically minded workforce on issues of race and gender in Silicon Valley impacts its intellectual output” (p. 163). But at the same time, calls to improve diversity can be problematic to the extent that they imply that the problem cannot otherwise be fixed and/or that it is the responsibility of minoritized people to fix problems that they did not create (Noble, 2018).

An additional solution is to augment the training that technical workers receive. Noble (2018) notes that “One cannot know about the history of media stereotyping or the nuances of structural oppression in any formal, scholarly way through the traditional engineering curriculum of the large research universities from which technology companies hire across the United States” (p.70). This is because computer engineers are “underexposed to the critical thinking and learning about history and culture afforded by the social sciences and humanities” (Noble, 2018, p. 163). Expanding humanities education in general, and ethics education in particular, might make designers more aware of the potential for and consequences of bias.

Disrupting the “Tech Mindset”

Another solution involves disrupting what might be termed the “tech mindset.” This way of viewing problems, frequently called computational thinking (Wing, 2006), emphasizes taking the same approach to problem solving that is used when writing computer programs. However, indiscriminate application of computational thinking strategies can exacerbate algorithmic bias.

Disrupting the tech mindset is important because, as Amy Webb, a professor at New York University, stated, “We’re *all* discriminated against by computing” (Bogost, 2019, italics in original; para. 18) because high tech workers are their own “tribe.” Bogost (2019) concluded that “That [high tech] culture replaces all knowledge and interests with the pursuit of technological solutions at maximum speed.” That “tech mindset” can be conceptualized as consisting of several different principles that, while enormously helpful in some situations, can be problematic in others.

One principle of computational thinking is encapsulation, which is the concept of “hiding” certain portions of a program, even from the programmer, in situations where he or she does not need to be involved in the details of how something works. But in some situations, the principle of encapsulation can mean that many—if not all—people working on a project do not have enough of a sense of how its algorithms work to determine if bias is present. It is easy to imagine, for example, that the programmer

of an algorithm to determine recidivism risk could write a program that uses data without giving much thought to the biased nature of the data, while the person who manages the data may be aware of the bias in the set but unaware that the data could be used to perpetuate bias.

A second principle of computational thinking advocates for using algorithms to solve problems. Obviously, algorithmic problem solving can improve decision making substantially, but it can also introduce bias. The presumption that a problem should be solved algorithmically—instead of by a person—needs to be interrogated. For example, it is nearly impossible to imagine that a search engine that required humans to organize and rank websites would include pornographic materials as the top hits for the search string “black girls.” The decision to use an algorithm instead of human judgment is always just that—a decision. All too often, however, it is made without considering whether human judgment would be preferable. Rahwan (2018) proposes the idea of a “society-in-the-loop” framework for thinking about algorithms, which means that oversight of the algorithms would be seen as a social responsibility shared by all members of a society. This idea borrows from an older concept, that of “human-in-the-loop,” where an otherwise computerized system requires and expects some human input in order to work properly. Implementing this process will, according to Rahwan (2018), require substantial work in articulating social goals and values, negotiating tradeoffs, examining unintended consequences, and ensuring compliance by algorithms with established values.

Third, software engineering often uses an iterative approach. This means that developers do not attempt to create a perfect product at first. Rather, they release a beta version, which they know may have some flaws. They then rely on user feedback in order to correct those flaws. This approach allows for faster production and more real-world testing. However, it may also mean that extremely problematic technologies are released. An alternative to the iterative approach is what Bird, et al, (2019) calls the “fairness-first” approach: instead of waiting for problems to arise and then correcting them, algorithmic fairness can be foregrounded as a primary concern.

Professional Standards

The establishment of professional standards for fair algorithms may also be useful. One workshop, Fairness, Accountability, and Transparency in Machine Learning, has begun to examine bias in algorithms used in the criminal justice system and in journalism (Garcia, 2016). The IEEE Computer Society is currently drafting standards for algorithmic fairness. Another movement, called discrimination-aware data mining, aims to increase fairness as well.

Users

There are also some ways that individual users of algorithms can improve their experience, even if regulators and creators fail to act.

Digital Literacy Education

Many people are unaware of the problem of algorithmic bias; knowing about the possibility can help them become stronger advocates for themselves. Unfortunately, many internet users do not understand, for example, that search engines do not show the best or most accurate information. Many people may be unaware of how personalization can target them and shape their opinions. For example, a prompt to vote on Facebook increased voter turnout by 0.39%, which is enough to swing a close election (Pasquale, 2015).

Digital literacy efforts might also include teaching about tools that can be used to protect against algorithmic bias. For example, the computer science department at New York University developed a tool called TrackMeNot, which auto-generates web searches in order to confuse user profiles. This may be useful for minoritized individuals who do not want to be profiled.

Of course, digital literacy education has its limits: as Noble (2018) points out, education can only help so much when algorithms themselves are proprietary.

Crowdsourcing

Even when an algorithm is proprietary, a group of users may be able to determine whether its results are biased by using the algorithm in various contexts and then comparing results. In this way, the disparate impacts of personalization can be better assessed. Of course, this approach requires people—including, especially, minoritized and underserved populations—to commit the time, energy, and emotional labor needed to determine whether there is a problem and then, if so, to advocate for its correction.

FUTURE RESEARCH DIMENSIONS

In recent years, there has been much greater awareness of the problem of algorithmic bias in academic as well as in popular discourse. This has led to the recognition and adjustment of some biased algorithms. There is advocacy for the solutions described in the previous section, and that effort is spreading and gaining more attention.

But because the problem is relatively new, much more research is needed. A starting point would be to devote more effort to define what exactly is a biased algorithm. Interdisciplinary work is important here, as the definition will have both ethical and technical dimensions.

Additional research is needed regarding the effectiveness of the proposed solutions to algorithmic bias. Pilot projects of third-party auditing could be used, for example, to determine whether they actually lead to less algorithmic bias. Similarly, best practices for solutions such as increasing diversity in the tech industry and crowdsourcing discovery of algorithmic bias can be researched.

CONCLUSION

In the early twentieth century, reforms tamed the unsanitary practices of the meat processing industry after Upton Sinclair's novel *The Jungle* made Americans aware of the conditions under which their meat was produced. Today, the sausage-making is digital. Factors such as a lack of transparency, personalization, and machine learning can make it difficult to recognize biased algorithms. Attitudes towards computing can make it even more difficult to fix the bias. But there are several proposals for mitigating the problem that, if adopted, might decrease the problem of bias.

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KEY TERMS AND DEFINITIONS

Algorithm: A set of rules that a computer follows to generate an outcome.

Algorithmic Bias: The intentional or unintentional bias that can result from using an algorithm to make a decision.

Artificial Intelligence (AI): A process performed by a computer that, if it had been performed by a human, observers would conclude that the process required intelligence.

Big Data: A very large data set; used in a variety of fields to reach decisions.

Bot: A computer program that interacts with humans or other programs.

Internet of Things: Devices (such as household appliances and sensors) that are connected to the internet.

Machine Learning: A process where a computer program “learns” from a data set.

Training Data: The data sets used in machine learning and artificial intelligence.

Gender and Urban Local Government in Bangladesh

5

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INTRODUCTION

The Constitution of Bangladesh guarantees equality before the law to all its citizens and prohibits all forms of discrimination through articles 10, 27, 28, & 29 (Ministry of Law, Justice and Parliamentary Affairs [MOLJA], 2010). Accordingly, the Government of Bangladesh [GOB] has adopted several initiatives for the empowerment of women. The GOB declared the first National Policy on Women's Advancement on March 08, 1997 encompassing all the different aspects of women's lives. Additionally, the GOB signed the Convention on the Elimination of all Forms of Discrimination Against Women (CEDAW), Beijing Platform for Action, the Millennium Development Goals (MDGs), and the Convention on the Political Rights of Women for the advancement of women (Ministry of Women and Children Affairs [MOWCA], 2011).

The efforts of the government to empower women have been quite effective. The country has achieved commendable advancement regarding women's participation in the areas of education, health, employment, and income. The global gender gap report 2018 ranks Bangladesh 48 considering economic participation and opportunity; educational attainment; health and survival; and political empowerment between men and women. This country also ranks 5th considering the political empowerment of women (World Economic Forum, 2018). Nevertheless, a huge gender gap is prevalent in every sector of life including politics.

METHODOLOGY

This study tries to explore the status of women as elected representatives in urban local government and to identify the barriers to their participation as candidates and elected members. A qualitative methodological approach was employed to understand these barriers in the context of wider socio-economic, political, and cultural contexts. Primary data for the study was collected through semi-structured face-to-face interviews with 25 elected female representatives from two City Corporations and two Pourashavas. The researcher intended to arrange an interview with participants from diverse backgrounds. Accordingly, participants were selected considering their length of service as elected representatives (both first-timer and at least with experience of serving the office for two terms), nature of constituency (general ward or reserved) and party affiliation (Awami League, Bangladesh Nationalist Party, Jatiya Party or other).

Secondary data for this research was collected from published and or unpublished materials, books, journals, reports, newspapers, basic legal documents, and government policy papers relevant to the study and from the Internet. The researcher used secondary data to support and complement primary findings.

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The interview questions were designed into two sections: first part intended to collect background information like age, education, and occupation of the participants while the second to extract information about their involvement in politics, party membership, experience in political office and the barriers. The whole interview sessions were audio recorded with consent from the participants. Initially, the interviews were conducted in the local language “Bangla” and afterwards were translated into English. Every participant was given a pseudonym so as not to disclose his or her identities. Responses to questions obtained from each participant were coded in the same category to enable deeper analysis of those responses. Then data was coded into analytical units. A relationship between data and variables was established by interpreting statements arranged in terms of similarities and dissimilarities. The data was analyzed by organizing it into different categories based on themes, concepts, and similarities. Results were presented through narrative text, simple computations, and analytical reasoning.

POLITICAL SYSTEM IN BANGLADESH

Bangladesh is a South Asian Muslim-majority nation emerged as a sovereign state in 1971. Since independence, this country has been struggling to sustain democracy due to army intervention from time to time (1980-1990 & 2007-2008). A parliamentary form of government currently runs Bangladesh. The Parliament of Bangladesh is unicameral, comprising of 300 general constituencies and 50 reserved seats exclusively for women. Members are elected directly through the “first-past-the-post” system every five years (Jahan & Amundsen, 2012). The Awami League (AL), the Bangladesh Nationalist Party (BNP), the Jatiya Party (JP), and the Jamat-e-Islami (JI) are the major political parties. The 14th amendment of the constitution in 2004 introduced proportional distribution of women’s reserved seats among the parties represented in parliament giving up the earlier practice of electing all women in reserved seats by the majority party from its own members.

Local government is enshrined in the constitution (article 59.1) of Bangladesh. The central government covers legal, operational, and financial matters as well as control and supervise local government bodies. The local government bodies enjoy a certain level of operational autonomy; however, they are in no way self-governing. A patron-client relation exists between national and local government in Bangladesh (Siddiqui, 2005). Bangladesh mainly has two types of local government: rural and urban. Urban local governments are single-tiered and include 12 City Corporations and 319 Pourashavas (municipalities) while the rural local government has three tiers: 64 Zila (districts) Parishads, 491 Upazila Parishads (sub-districts), and 4,554 Union Parishads (the lowest tier of rural local government). In addition, there are three hill districts local Parishads to serve the ethnic minorities and others living in that region. According to the existing legislation, City Corporations and Pourashavas consist of mayor and councilors elected by the voters of the concerned locality every five years. Besides, there are one-third reserved seats for women to be elected by direct voting (GOB, 2018).

BACKGROUND OF THE STUDY

There have been many studies investigated women’s participation in Bangladesh rural local government especially highlighting on Union Parishad. For example, Khan and Ara (2016) studied the impact of the Local Government (Union Parishad) Second Amendment Act 1997 of Bangladesh on participation and empowerment of women at that level. They claimed that the law enabled women to enter into the

elective positions at Union Parishad. However, the women failed to raise their voices and influence the decisions due to lack of financial, educational and social resources.

Panday (2013) discussed the impact of a particular policy on the state of women's political participation in Bangladesh highlighting the Local Government (Union Parishads) (Second Amendment) Act of 1997. He focused on the context of reforming the Act and the role of the actors behind the reforms. He concluded that conservative attitudes in society made it difficult for women to act as political leaders. Nevertheless, the Act helped to change the traditional political culture gradually and opened the door for women in politics.

Begum (2012) examined the barriers to women's political participation highlighting on the loopholes and weaknesses of the Local Government (Union Parishad) Act 2009. She found the participation of women disappointing due to deep-rooted patriarchy. The elected female members were discriminated while trying to exercise their rights. The system of 'reservation' created an imbalanced power relation that resulted in disrespect for the elected women members and deprived them of participating in decision-making.

Islam and Islam (2012) studied the barriers to women's participation in local politics. They identified several socio-cultural, financial, and religious factors as impediments to women's participation in the decision-making process. Additionally, ambiguity regarding their roles in the law hindered their participation in Union Parishad.

Khan (2010) tried to explore the experiences of the elected women members in pursuing to establish their rights at the Union Parishad. He found that social norms and practices and patriarchal structure, in general, did not allow women to participate in politics.

Panday (2008) studied the impact of quota on women's political participation and claimed that the quotas had helped to increase their number in politics. However, their participation in the decision-making process was low, except for a few party leaders. In a comparative study focusing on the lowest tier of rural local government between Bangladesh and India, Panday (2006) found that despite the presence of affirmative actions in both countries, women were discriminated due to structural, religious, and cultural factors. Male politicians did not cordially accept them and/or allowed them to participate in the decision-making process at this level.

Khan and Ara (2006) in a study on women's participation and empowerment in rural local government in Bangladesh identified lack of operational guidelines for female elected representatives and discriminatory attitudes of the male members as impediments to their participation.

Conversely, scholarships on gender and urban local government in Bangladesh are few. Taskin (2015) investigated the status of female ward councilors elected to the reserved seats in Dhaka City Corporation. She identified non-cooperation from the male colleagues as a prime factor that hindered women's participation in the decision-making process in general, and more specifically, in the standing committee meetings.

Zaman (2012) asserted that male colleagues discriminated women councilors because of lack of specific laws regarding their roles. Additionally, family responsibility, economic dependence, lack of education, religious, cultural and social norms affected their participation in politics.

Moin (2011) tried to investigate the issues related to women's participation and empowerment in local government politics (urban and rural). She identified lack of male members' co-operation, lack of opportunity to express their own opinions, non-clarified responsibilities for women members, harassment by community people or male members as significant barriers.

In another comparative study on the nature and political empowerment of women between two urban local bodies, Zaman (2007) found that women were underrepresented and neglected due to lack of finance, lack of support from society and family, and male-dominated politics.

Hossain (2006) examined the functions of the female councilors and the obstacles they faced while performing their duties. He concluded that women councilors lack confidence and they were not given equal importance like the male councilors in the meetings and other city corporation activities.

Islam (2002) in her study identified urban local government office structure, socio-political, economic, legal, and psychological state of the country as hindrances to the work of women councilors in Bangladesh.

All these studies identified insufficient participation of women in local government politics. They have revealed that women are still marginalized compared with men at all levels of politics except as voters. However, most of the studies focused on rural local government. In addition, the studies were conducted when the local government election was non-political.

The Cabinet of Bangladesh approved amendments of the Local Government Acts and introduced partisan election for the mayor posts and non-partisan for councilors effective from October 2015 local elections (Democracy Watch, 2016; Nath, 2015). Elections took place at seven City Corporations and 234 Pourashavas after introducing the partisan system. This study is significant, as it will examine whether the new election system has improved the number of women as candidates and elected representatives in City Corporations and Pourashavas.

WOMEN IN POLITICAL PARTY STRUCTURE

Integration of women in the party structure is essential for their advancement and empowerment. It is a common practice by the political parties like the AL and the BNP to involve women workers and supporters for political campaigns, anti-government protests, demonstrations, and rallies. However, they are reluctant to promote potential female applicants as candidates and leaders in elections. Although all the parties have established branches or committees in recent years, women mostly hold feeble and non-influential decision-making positions in the central executive committees of the political parties in Bangladesh. Therefore, women have practically no voice in the decision-making process. The AL, BNP, and JP's central decision-making committees have only about 10%-12% female members while JI has none. Although female pioneers have directed both AL and BNP for over 30 years, the overall representation of women in the different hierarchical bodies of the two parties is inadequate (Ahmed, 2008; Jahan, 2014). Moreover, the parties lack specific strategies to meet the conditions imposed by the Bangladesh Election Commission (BEC) of attaining 33% women in all committees by 2020 (Jahan, 2014).

WOMEN IN NATIONAL POLITICS

Since 1990, women in Bangladesh are serving as head of the government and leader of the opposition. The Speaker at the national parliament and head of the Ministry of Education are women. However, women are far from achieving gender parity, specifically, in politics and decision-making areas. Bangladesh ranks 97 with 20.6% of women MPs in the parliament (Inter-Parliamentary Union [IPU], 2019). However, this ranking is done considering a total number of female MPs elected under quota and to the general constituencies (50 reserved seats and 22 as general seat MPs). The political parties nominate only a few female candidates to the general constituencies. Furthermore, the number of women elected

to the general constituencies has been very low ranges from 2%-3% to a peak of 7.3% in the 11th parliament (Jahan & Amundsen, 2012; IPU, 2019).

In the general election of 2018, only 3.49% was female candidates. The ruling party Awami League and its alliance nominated 22 women while the BNP, along with its alliance nominated 16 female candidates in 300 seats (Antara & Raju, 2018; Chowdhury, 2018). However, 7.33% of women candidates were elected. This result is consistent with those in the parliamentary election held in 2014 (4.9% of the total candidates were women and 6.7% of them were elected) and 2008 (4.1% of the total candidates were female and 8.3% of them elected) to the general constituencies (BEC, 2018; IPU, 2017). Therefore, it can be said that women are far behind men as candidates and elected representatives. It is mention worthy that women who are nominated to stand in the general constituencies have strong affiliations with the current leadership, or are wives/daughters of a late MP. An ordinary woman without such political connections will have to struggle a lot if she wants to make a career in politics due to the traditional nature of politics and patriarchal mindset in the society (Chowdhury, 2002).

WOMEN IN RURAL LOCAL GOVERNMENT

Although women have been entitled to exercise their voting rights in local elections since 1956, their participation at all levels of local government was limited. The Local Government ordinance 1976 first introduced the provision to include two nominated women members in Union Parishad in independent Bangladesh. The Local Government (Union Parishad) Ordinance 1983 increased the numbers of nominated female members to three. In 1993, the Local Government (Union Parishad) (Amendment) Act omitted the system of nomination and launched the system of indirect voting to elect three women to three reserved seats to be elected by the chair and members of the respective Union Parishad and dividing each Union Parishad into nine wards (Ahmed, Chowdhury, & Shefali, 2003). The Local Government (Union Parishad) Second Amendment Act of 1997 introduced the system of direct election to the reserved seats for women. Moreover, women may contest for any of the general constituencies and as chair (MOWCA, 2014). However, the participation of women at this level is frustrating; 23 women were elected as chairs in 1997 Union Parishad elections while 22 female chairs in 2011. In the general wards, the picture is similar; 24% of the elected members were women in 1997 while 13.8% women were elected in 2003 (Democracy Watch, 2014).

Additionally, the Upazila Parishad Act 2008 and 2009 reserve one seat for women between the two elected vice-chairs. As per the Local Government (City Corporation) Act 2009, one-third of the councilors' seats are reserved for female candidates, and women can contest in the general seats (MOWCA, 2014). In the 2009 Upazila election, 480 women were elected to the reserved post of vice-chairs. In addition, three women were elected directly as chair among 1,936 contestants. Some 167 women were also elected as councilors out of 3,703 seats through direct voting. However, women's participation dropped in the 2014 elections, in which a total of 1,507 women contested in 458 Upazilas (Democracy Watch, 2014) and only five women were elected as chairs (United News of Bangladesh [UNB], 2016).

WOMEN IN URBAN LOCAL GOVERNMENT

Participation of women in urban local government is more or less similar to their representation at other levels of politics. Before the Gazette notification (the Pourashava Ordinance 1977, amended in 1998,

and Gazette extra copy dated 22/3/1999) for Pourashavas and City Corporations respectively, women councilors were appointed by selection. The introduction of the indirect election in 1994 allowed women to participate in urban local government. Male commissioners in Dhaka City Corporation elected nineteen women councilors to the reserved seats in that year. Moreover, one female ward commissioner was directly elected in Dhaka City Corporation. In 1998, the ordinance was revised, and direct elections to the reserved seats were made obligatory to promote women's participation in urban local government. Furthermore, the amended ordinance announced that regardless of the number of ward commissioners in a Pourashava and City Corporation, one-third of the number of commissioner's seats should be reserved exclusively for women to be elected directly (Islam, 2002). However, the status of women in urban local government both as mayors and of councilors in the general constituencies remains insignificant.

In the history of Bangladesh, Dr Selina Hayat Ivy was the first woman elected as mayor in 2003 from Narayanganj Pourashava upgraded as City Corporation in 2011. She is serving the Corporation as mayor since then. Later on, another woman was elected as mayor in 2004 from Bakerganj Pourashava. In 2010-2013 elections of seven City Corporations, no woman was elected (BEC, 2018). In 2014, a woman, wife of slain Narayanganj City Corporation panel mayor and councilor Nazrul Islam, won the by-election as a general councilor that was previously occupied by her husband. It is mention worthy that she was defeated against a BNP nominated male candidate in the Narayanganj City Corporation Election 2016. Thus, it seems that she was elected because of her husband's image and sympathy from the voters (Karmakar, 2016; UNB, 2015).

Dhaka North, Dhaka South, and Chittagong City Corporation elections 2015 were non-partisan and male-dominated. Dhaka North City Corporation election 2015 witnessed 16 male candidates for the position of mayor with no female contestant, 289 men, and 11 women contestants to the general seats. In Dhaka South City Corporation election 2015, 20 male candidates and no female vied for mayor position while Chittagong City Corporation election 2015 had 12 men as mayor candidates with no female contestants (BEC, 2018).

Since 2016, local government elections are conducting on a partisan basis. However, the status of women candidates as mayor and general councilors has not changed. Major political parties like to nominate male candidates to these positions, as they are afraid of losing the seats by nominating female candidates. Therefore, Comilla and Rangpur City Corporation elections 2017, Gazipur, Khulna, Rajshahi and Barisal City Corporation elections 2018, all were male-dominated. Narayanganj City Corporation election 2016 was an exception as AL nominated Dr Selina Hayat Ivy as mayor candidate and she was elected (ibid). It is mention worthy that Dr Ivy is from a very reputed political family; her father was very close to AL and she has good reputations in the locality. Despite that, she found it difficult to get party support at the beginning. However, AL nominated no female candidates to vie in the general constituencies.

In Comilla City Corporation election two women (one from AL and one from Jatiya Samajtantrik Dal) contested as mayor; both were unsuccessful. Recently, another woman from Bangladesh Samajtantrik Dal vied for mayor position in the Barisal City Corporation election and failed. Two women contested to the general constituencies in the Narayanganj City Corporation election 2016 against 154 men; three female candidates vied in Rangpur City Corporation election 2017 against 207 males; one each in Rajshahi and Khulna City Corporation election 2018 contested for the general constituencies and all failed; all the female candidates contested as Independent or from minor parties. The number of women candidates as mayor and general councilors are almost nil or trivial like before (BEC, 2018).

Elections were held in 234 Pourashavas in November 2015 where 945 candidates (AL - 234; BNP - 223; JP - 74; Jashod - 21; Independent - 285; others - 108) contested for the mayor position. Among

945 candidates only 20 were women (seven by the AL, one by the BNP, three by the National People's Party and nine by other political parties). In the election, five female contestants withdrew their nominations and finally, 15 candidates vied as mayor and two of them won. Surprisingly, after launching partisan election, numbers of female candidates for the mayor position has dropped off significantly in 2015 compared to the 2011 election. In the 2011 Pourashava elections (217 Pourashavas), 26 women were indirectly supported by major political parties like AL and BNP while only eight women were supported by major political parties in 2015 election (Democracy Watch, 2016). In this election, only one woman was elected as mayor and two as general ward councilors against 216 male mayors and 1,951 male councilors (BEC, 2018).

This indicates that the introduction of partisan politics. has no impact on the participation of women at the urban local level. The parties play a dual character: they prefer and promote male candidates while delivering a lecture on the empowerment of women in public. Male leaders push aspirant female candidates toward the reserved seats. Traditionally, voters in Bangladesh cast their ballots for the party, not for the candidate. Mohsin (2004) claimed that political parties might minimize the number of female candidates because of the fear that people may not vote for their party if they have many female candidates. Therefore, Gender equality in politics is not possible until political parties and community change their attitudes towards women.

MAJOR BARRIERS TO POLITICAL PARTICIPATION OF WOMEN

Based on field data, the barriers to the political participation of women are categorized into three major groups: socio-economic barriers; political and institutional barriers; and socio-cultural and ideological barriers.

Socio-Economic Barriers

These barriers concern family responsibilities; lack of education and finance; and violence, harassment and lack of security. All the participants have identified the domestic role of women as one of the most critical barriers causing women's underrepresentation in politics. According to them, domestic responsibilities compel many women to stay away or join politics at a later stage when they become free from looking after the young children and elderly members.

According to a participant:

Lack of support from husband and in-laws is a major problem for women. I get up early in the morning and do the cooking, cleaning, and other stuff. Then I go to my political office. This way I manage my family, and politics. In addition, as I am living in an extended family, I get support from other members and my husband. However, many women do not have this opportunity.

As women mostly spend their times with children and/or senior members who barely have knowledge or interests in politics, they lack scope to discuss political affairs with people at home or with an outsider. Moreover, due to traditional rules and practices, husbands usually do not share domestic activities that keep women away from politics as Ahmed (2008), and Chowdhury (2009), and Zaman (2012) found.

The interviewees identified lack of education and specifically finance as significant barriers to their participation. A certain level of education is necessary for politics, as, without education, it is hard

to understand the rules and regulations. Although all participants have recognized the importance of education, only a few residing in City Corporation/ Pourashava had tertiary education. Majority of the participants had completed year/grade X-XII. This trend of education is consistent with the social system in Bangladesh. It is seen that a large number of girls in Bangladesh usually get married just after completing their primary or secondary education. After marriage, the majority of them fail to continue their studies due to non-cooperation from their husbands and in-laws. Moreover, many parents do not send their girls to high school due to financial insolvency as primary education is free and compulsory for all, but not so for high school. In addition, if a family has limited affordability, the preference is given to the male child (Sultana, 2012).

To vie in electoral politics, a certain amount of money is required that many women cannot avail as men often exercise control over financial resources (Ahmed, 2008; Chowdhury, 2009). Only six of the participants were engaged in the job sector while the rest were homemakers. All the participants received support from parental families, husbands, and in-laws to spend on the election campaign. It is evident that if the participants could not get the financial assistance they might find it quite difficult to participate in the election. A woman who is single or who does not have the support of their family members may find accessing financial support for their political careers extremely difficult in Bangladesh.

Regarding the importance of money, a councilor said:

Money is necessary for the election. Finance is required in the campaign; one needs to bear at least the cost of snacks and drinks for the supporters. In addition, strong finance helps to be less corrupt.

Another impediment to their participation is the ever-present threat of political violence and sexual assault in Bangladesh. Violence in society and politics act as a barrier for women who would like to make a career in politics. Furthermore, the lack of security discourages many eligible and interested women to join politics. A participant stated:

Lack of security is a major concern for elected women. Women face harassment both physically and verbally when going to work. Therefore, many women lack the courage to be in politics.

Politics is a 24-hour job that involves extensive travel and dealing with many people including strangers. A woman may be sexually harassed that may ruin her political career. Therefore, many women stay away or give up politics (Chowdhury, 2009; Huda, 2003).

Political and Institutional Barriers

Politics has long been dominated and controlled by men around the world. In Bangladesh, politics is dominated and controlled by men that have resulted in lower interest and involvement of women in politics. The participants identified politics as a place of conflict and confrontation that many women are afraid of and stay away. In addition, lack of party support and political network act as hindrances to them. Moreover, rampant corruption, poor governance, and political strikes jeopardize democratic stability and impede their political participation. According to a participant:

Politics is full of conflict and unfair competition. In addition, muscle and money are the two main elements of politics. Women usually do not have either of these. Furthermore, vote buying is a common practice in the elections. The political environment, the image of political leaders, rampant corruption all discourage women to get involved here.

The participants identified political parties' role towards women as a barrier to their political participation. The most significant barrier is the candidate nomination process to the general wards. Male

politicians do not like to select a female candidate to vie as a general ward councilor or mayor. They always prefer women to contest as reserved seat representatives. However, being nominated as a reserved seat candidate is not an easy task as male politicians make the selection. A participant expressed her opinion as:

It is difficult for women to get a nomination from the party. The male politicians possess negative attitudes towards women and show superiority over. They are not interested in giving space to women. Overall, male politicians are not supportive. It is difficult for women without a strong political network to get a nomination from the party.

All participants in this study have relatives like male councilors, MPs, or powerful political party leaders who helped them to get a nomination. It needs to mention that all the participants except two contested as reserved seat councillors.

In addition, another problem is participation in council meetings. In most of the City Corporations and Pourashavas, meetings are mostly male-dominated and women find it difficult to express their opinion. Narayanganj City Corporation is an exception. A female mayor runs this urban local government body; she is highly educated, experienced, and politically strong and influential. The mayor always encourages female councilors to participate actively in meetings and other corporation activities. In other urban local government bodies, male councilors, in general, underestimate female councilors; humiliate, and criticize them whenever they attempt to give an opinion. This type of incidents takes place due to ambiguities in the ordinances regarding the roles and responsibilities of the reserved seat councilors.

Socio-Cultural and Ideological Barriers

Cultural norms have significant impacts on women in Bangladesh. The popular tradition portrays women as physically weak and intellectually inferior requiring continuous protection of the physically strong and intelligent men (Islam, 2000). Most of the norms and values that are related to the structure of Bangladeshi society are gendered and usually support masculinity directly or indirectly. This social system upholds a rigid division of labor that controls women's mobility, roles, and sexuality (ADB, 2001). Participants identified the patriarchy, traditional division of labor, peoples' attitudes towards women in society, and the socialization of girls and women, in particular as the most serious socio-cultural and ideological barriers to the political participation of women.

All the participants recognized patriarchy as a critical issue to their advancement in politics. The traditional society is saturated with patriarchal values and norms where women are seen as subordinate and dependent on men. An unequal power structure exists in the family and wider society that favors the supremacy of men in decision-making. Moreover, men have strong reservation regarding women in leadership and management positions as Ahmed (2008) and Halder (2004) previously found. A participant stated:

Men, in general, do not accept women in politics. They mocked us during our election campaign. They show neglecting attitudes towards women. They think politics is their domain. In many ways, they try to create obstructions so that we cannot participate in politics.

In addition, the socialization process in the family and society develop girl and women in such a way that they lack the confidence to take a leading role in politics. Furthermore, Similarly, the participants

identified attitudes of society towards women's primary roles as mothers and homemakers as an obstacle to their political participation as another participant stated:

The gender division of labor creates extra pressure on women and compels women to stay away from politics due to time crisis. Men in our society, except a few, are not yet mentally ready to work with women in public spheres especially in politics. Patriarchy, male-domination, ideology, influence women's participation in politics largely.

Furthermore, they recognized religious customs as an impediment that restrict their autonomy in various ways. Likewise, Halder (2004) found that due to religious customs people in Bangladesh, in general, prefer women stay within the domestic spheres; women need to maintain a certain dress code, they are deprived of property rights that impede their entry into politics.

RECOMMENDATIONS

In Bangladesh, a number of factors restrict women's participation in urban local government politics. It is not that they are incapable; it is due to the systems that discourage them from participating. Political parties have a major role in ensuring gender equality in politics. The most difficult challenge for women is to get a nomination from the male-dominated political parties. In addition, women usually are less confident to vie against men in leadership positions. The political parties can play a key role by recruiting more women through encouraging, supporting, training, and mentoring young women. The government may adopt special laws to ensure that 50% of candidates as mayor and general councilors are women in the local government election.

Women lack access to higher education due to socio-economic reasons. The government may arrange free and compulsory education for women up to high school (year XII). Awareness building and attitude change towards the traditional roles of women also need to take place through mass media and campaigning.

Lack of finance impedes the political participation of women. The GOB has doubled the amount of honorarium effective from July 2017 for local government representatives (Bhattacharjee & Molla, 2017). However, the amount is not adequate for councilors of the small Pourashavas. Therefore, the government may establish a common fund to assist female candidates to meet the election expenditure.

Harassment, bullying, sexual harassment, lack of security keep many aspirant women away from politics. The GOB needs to strengthen and revise the existing laws to mitigate workplace harassment and violence against women.

The local government ordinances and acts clearly defined the roles and responsibilities for the general ward commissioners. However, there is no specific responsibility mentioned for reserved seat commissioners. From a legal point of view, local government councilors in the reserved seats enjoy similar rights, opportunities, and privileges as local government representatives elected to the general wards. However, there are marked differences in terms of status and barriers due to different electoral systems and processes. Women reserved seat candidates and councilors for local government elections (City Corporation and Pourashava) have electorates three times larger than their general seat counterparts. The reserved seat systems in Bangladesh are designed in such a way that there is a separate women-only tier, which results in overlapping mandates for reserved and general seat holders (Paasilinna, 2016). The

roles and functions of the reserved seats need to be clarified so that women councilors elected in the reserved seats do not face any difficulties or harassment while performing their duties.

In addition, women are discriminated during the candidate selection process by male politicians on the ground that they have scope to take part in politics through reserved seats. Bangladesh Election Commission needs to revise the Political Party Registration Regulations 2008 to ensure equitable participation of women as general seat candidates and leaders in urban local government. It seems that political parties do not take the RPO instruction seriously, as there is no mention of any disciplinary actions against failure to achieve the target. BEC can impose a penalty for disobeying the RPO. It is necessary to ensure more female candidates as general ward representatives and mayor. The Election Commission may introduce separate wards for women ward commissioners so that they will have a certain area under their jurisdiction to be managed solely by them.

CONCLUSION

Participation of women in urban local government bodies is still negligible due to a complex interplay of socio-economic, political, institutional, and cultural factors. Women are discriminated during candidate selection process in election time and in the party organizations. A critical mass (30%) of women is necessary to bring change in their status. However, ensuring 30% of women as candidates, members of the party organizations or elected representatives seem quite difficult due to political parties' reluctance to implement RPO accordingly.

The provision of reserved seats has only increased the number of women in urban local government; it has no substantive impact to increase the quality of their participation as male politicians occupy the key positions (mayor and general ward councilors). Patriarchy is deep-rooted in the society that shapes and guides the political party leaders' mindset. Therefore, they treat women as 'ornamental' not as 'equal partner.' It is a good sign that women are coming forward by breaking conventional social norms and practices and participating in politics. The leaders of political parties may play a major role by promoting women agenda as well as recruiting more women in politics. The government, NGOs, civil society groups and women organizations may work in collaboration to guide and assist the interested and potential female candidates to overcome the barriers to their participation in politics.

FUTURE RESEARCH

The study deals with elected female urban local government representatives. Future study may be conducted on the unsuccessful female candidates to know their reasons for failure. In addition, a study on interested women who want to join politics can give important insights regarding their reason to join and knowledge about politics. A study on male mayors and ward commissioners' opinions regarding female councilors elected to the reserved seats may provide new ideas while adopting new programs and strategies for the advancement of women in politics. Further, a comparative study on urban and rural local women representatives to explore their problems will provide new insights.

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KEY TERMS AND DEFINITIONS

Hill Districts Local Parishads: The three Hill District (Rangamati, Khagrachhari, and Bandarban) Local Government Parishads were created in 1989 to grant autonomy to the ethnic minorities living in this region. The chairs of the three Hill District Local Government Parishads are elected from among the tribal people.

Representation of the People Order (RPO): In 2008, GOB gave instruction to all the political parties registered with the Bangladesh Election Commission (BEC) to ensure at least 33% women representation in all committees by 2020.

Reserved Seats: Reserved seats keep a specific number of seats for women in a parliament or local body, mentioned in the constitution or by laws. The Government of Bangladesh (GOB) reserves a quota for women in the national legislature to secure their participation. At first, there was a quota of 15 reserved seats for 10 years. Afterwards, the GOB increased the quota to 30 in 1990, to 45 in 2004, and finally, fixed at 50 in 2011. There is also a provision of one-third seat reservation for women in local government.

Union Parishad: It consists of a chair, nine general councilors and three women councilors from three reserved seats. The chair and all the members – including women members holding reserved seats – are directly elected for five years.

Upazila Parishad: It consists of a directly elected chair, one male and one female vice-chair, representative members, female members in reserved seats, and official members. The representative members are the Upazila Parishad chairs and Pourashava mayors of each Upazila. All heads of government departments working in the Upazila are ex-officio members without voting rights.

Zila Parishad: It consists of a chair, 15 open seats, and five additional women's reserved seats. An electoral college elects the chair and the members.

Section 6

Business Technological Innovations

ICT, Smart Systems, and Standardization

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INTRODUCTION

According to the definition adopted by the International Organization for Standardization (ISO) a standard is a document, “established by consensus and approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context” [ISO, 2015]. The fact that standards are established ‘by consensus’¹ distinguishes them from legislation. Typically, the use of standards is voluntary. However, through legislation they may become mandatory (e.g. many health and safety standards) or ‘quasi-mandatory’ (e.g. Harmonized European Standards).

Standards – in a very general sense – have been with humankind for quite some time. About 4,000 years ago the first alphabets emerged, enabling new forms of communication and information storage. Around the 7th century BC the Lydians invented the first coin-based currency; it established the basis for easier inter-regional trading. The advent of the railroad in the 19th century resulted in a need for technical standards, e.g. those that enabled compatibility between individual parts of technical artifacts, defining e.g. the width of railway gauges, the diameter of screws, etc. This was once more reinforced when mass production generated a demand for interchangeable parts. In parallel, the invention of the electric telegraph in 1837 triggered the development of standards in the field of electrical communication technology. In 1865, the International Telegraph Union – to become the International Telecommunication Union² (ITU) in 1932 – was founded by twenty nation states. The other major international standards setting bodies, the International Electrotechnical Commission (IEC) and ISO, were founded in 1906 and 1947, respectively.

In the field of Information and Communication Technologies (ICT) international standards are the major mechanism to ensure interoperability between systems. Frequently, ICT standards also describe a commonly agreed platform upon which innovations can be based. Moreover, standards in general are a valuable means of technology transfer. They have also been used as policy tools – for example, they are a major pillar of the European Single Market. Standards’ potential economic implications must also not be under-estimated. A new standard may be used to extend a market, or even help open up a new one. Intellectual Property Rights (IPR), mostly patents, also play a major role here. That is, standards must also be considered as strategic tools for firms.

The above suggests that standards are not just technical documents but that they may have ramifications well beyond technology. Accordingly, they should no longer be considered as pure ‘public goods’, i.e. as something that is non-rival and non-excludable [Deneulin & Townsend, 2007]. Rather, these days standards are typically seen as impure public goods, or club goods; they are non-rival and excludable, just like e.g. satellite TV, cinemas or private parks (see also e.g. [Hawkins, 2009]). This is largely due to the frequent incorporation of IPR into standards.

Against this background, this chapter will first briefly look at the links between standards and standardization, innovation and economics. It will then offer a brief description of the complex ‘web’ of

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Standards Setting Organizations (SSOs) in the ICT sector. Subsequently, a flexible tool to describe the characteristics of an SSO will be discussed. It can be deployed by firms to identify the SSO that is best suited for a planned standardization activity. This will be followed by the description of a typical standards setting process. These are only parts of the fairly complex task of standardization management, which will be described next. The subsequent section will briefly discuss national standardization strategies. Finally, some likely future research directions are sketched.

BACKGROUND

Some Brief Economical Aspects

Not so long ago standardization and innovation were considered as almost mutually exclusive (see e.g. [Hemenway, 1975], reported in [Farrell & Saloner, 1985]). This has changed by now. In fact, close links between standardization and innovation may often be identified. Today, standardization is no longer considered an impediment to innovation. However, the unqualified claim that ‘standards foster innovation’ does not fully reflect reality either. Swann & Lambert [2010] observe that standards do both – enable and constrain innovation – but that the enabling aspect is much more important. Specifically, they note that “... *standardization does constrain activities but in doing so creates an infrastructure to help trade and subsequent innovation. Standardization is not just about limiting variety by defining norms for given technologies in given markets. Standardization helps to achieve credibility, focus and critical mass in markets for new technologies*” (p. 370).

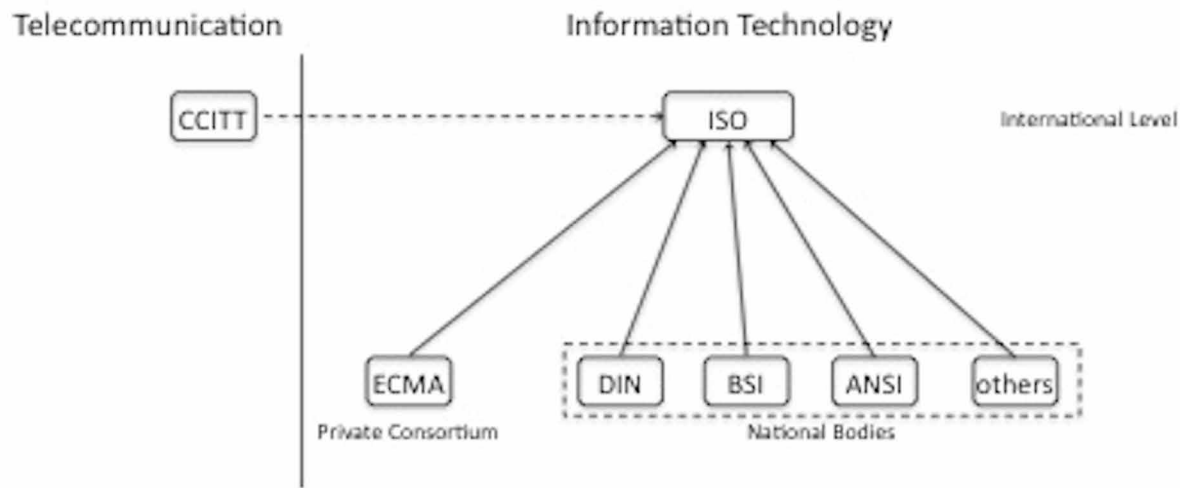
That is, especially in the field of ICT many standards describe a commonly agreed platform upon which innovations can be based and marketed. Accordingly, standards may be, and indeed are, used as strategic tools. For example, a new standard can extend a market, or even help open up a whole new one (just think what GSM did for mobile communication). On the other hand, backing and subsequently being locked into a ‘wrong’ technology (i.e. one that does not get standardized) may well ruin at least smaller companies.

What’s more, “*Standards are not only technical questions. They determine the technology that will implement the Information Society, and consequently the way in which industry, users, consumers and administrations will benefit from it*” [CEC, 1996; p. 1]. That is, those that develop ICT standards today at the same time shape much of the ICT environment we all will use in the future. And if they do their job properly, i.e. if they develop standards that meet the needs of all stakeholders (including e.g. individuals, communities, businesses, and governments) society at large stands to benefit.

From a macro-economic perspective, DIN [2004] finds that “*standardization contributes to GDP growth at the rate of about one percentage point per annum*”. This is in line with a number of similar studies from other countries. Blind [2013] reports that the contribution of standards to the growth rate in different countries was equivalent to 0.9% in Germany, 0.8% in France and Australia, 0.3% in the UK and 0.2% in Canada. Adopting a micro-economic perspective, ISO [2011, 2012] did a number of studies in companies from different business and countries. Based on Porter’s value chain [Porter & Kramer, 2011] these studies show that the implementation of standards can provide economic benefits to firms between 0.5% and 4% of their annual revenues.

By now, participation in standards setting has become a major strategic tool for many firms. Frequently, a firm’s aim will be to influence the process for its own benefit. This holds particularly – though by no means exclusively – for large companies. Other potential motivations include e.g. networking, intelligence

Figure 1. The ICT Standardization Universe in the 1970s (adapted from [Jakobs & Kritzner, 2009]).



gathering and increasing credibility (see e.g. [Jakobs, 2013]). In addition, standards are a valuable means of technology transfer, which makes them also relevant also for academia and research institutions. Standardization also provides a legal platform for co-operation with competitors and (potential) customers.

SETTING ICT STANDARDS

The ICT ‘Standardization Universe’

Back in the 1970s, the standardization universe was still rather simple and well-structured. Telecommunications standards (called ‘Recommendations’) were developed by the Consultative Committee for International Telephony and Telegraphy (CCITT; the predecessor to ITU-T), a then quasi-monopoly UN organization. This sector was almost completely separate from IT standardization, which was lead by ISO and its national member organizations. That is, standards were almost exclusively set by ‘formal’ SDOs (Standards Developing Organizations; i.e. those with some sort of official legitimation, such as ITU or ISO). The one private consortium in existence was the European Computer Manufacturers Association (ECMA). Figure 1 depicts this situation.

These days, an extensive web of Standards Setting Organizations³ (SSOs) are active at the international (e.g. ISO and ITU), the regional (e.g. the European Telecommunications Standards Institute, ETSI) and the national level (e.g. the American National Standards Institute, ANSI; see Figure 2). Their output is frequently referred to as ‘de-jure’ standards, although these standards do not have any regulatory power per-se. In parallel, a plethora of private industry fora and consortia (a couple of hundred), such as the World Wide Web Consortium (W3C) and the Open Mobile Alliance (OMA), produce what is often termed ‘de-facto’ standards. The processes through which both types of standards are developed are typically very similar (see below). The required level of consensus may differ, though. It should be noted that both ‘de-facto’ and ‘de-jure’ standards may gain some regulatory power, e.g. through references in legal documents.

Figure 2. The ICT Standardization Universe Today (excerpt; adapted from [Jakobs & Kritzner, 2009]).

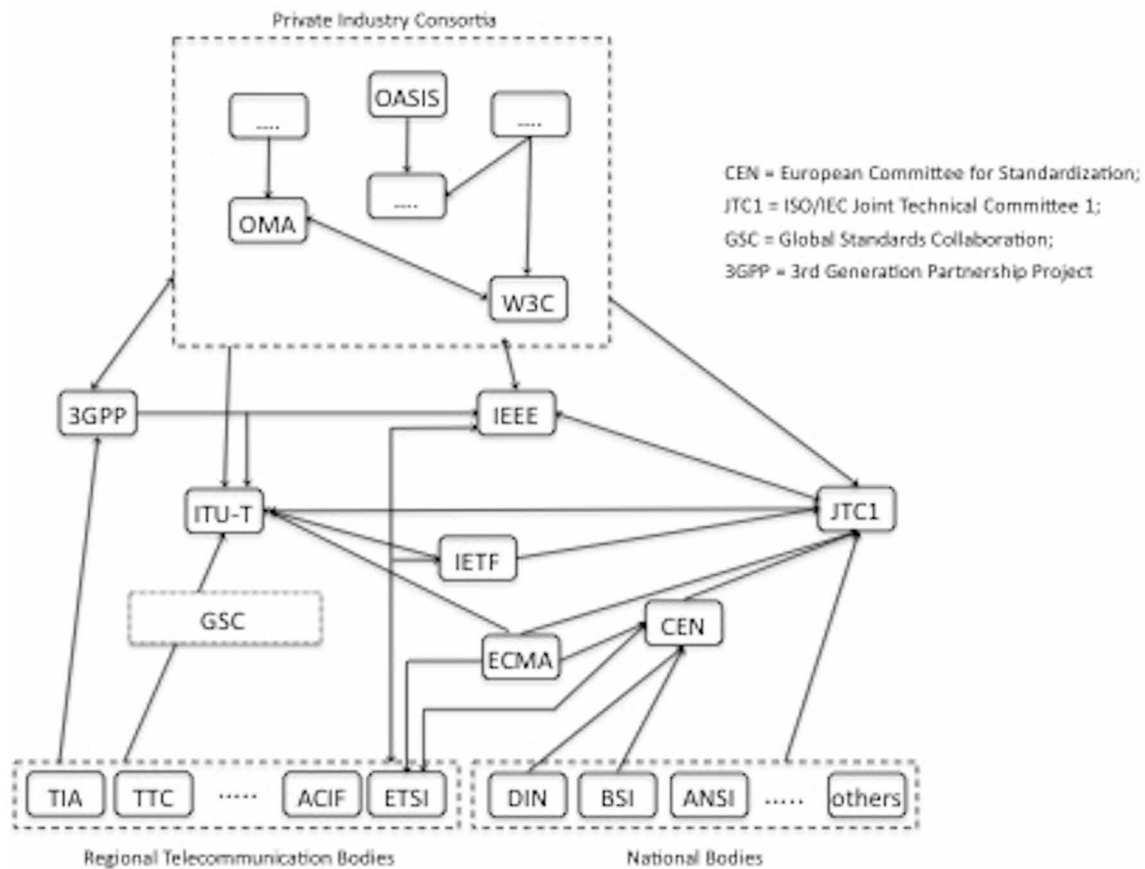


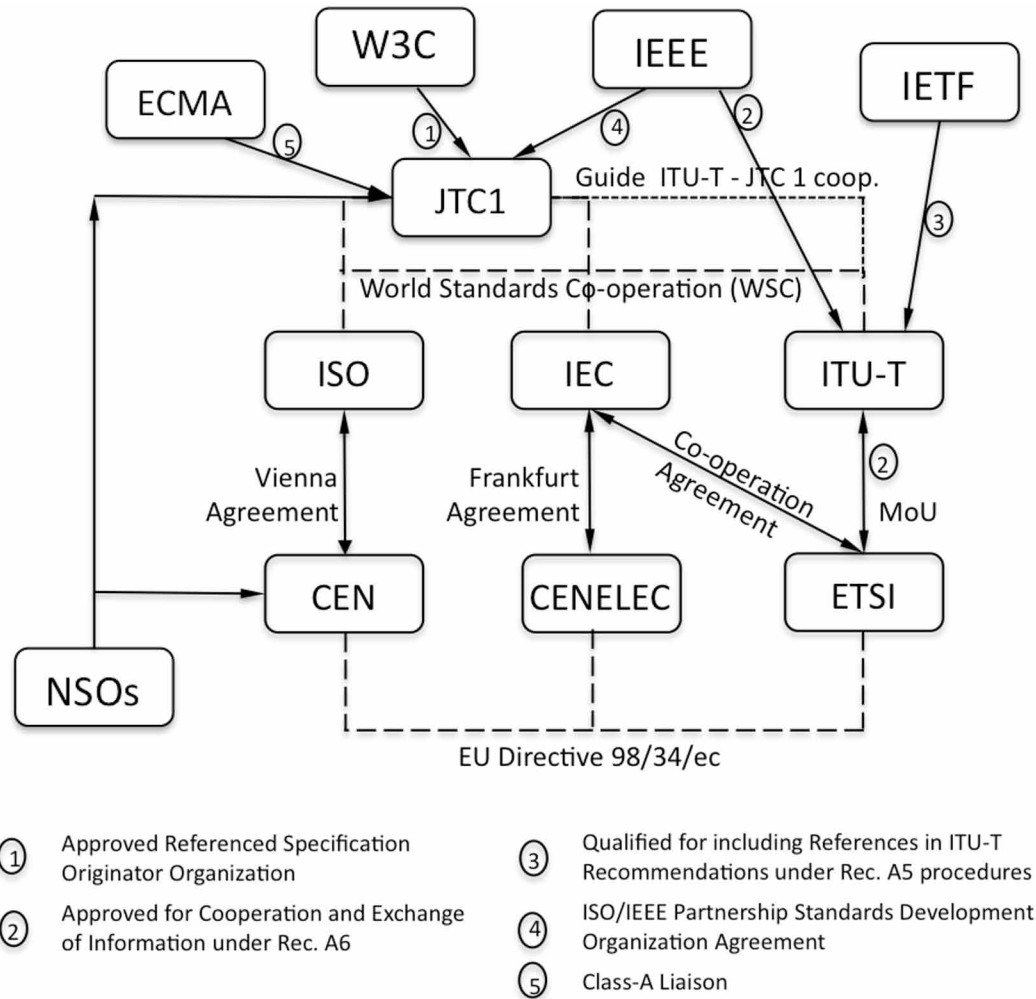
Figure 2 also shows that the former clear-cut distinction between Information Technology on the one hand and the Telecommunication sector on the other has largely disappeared. This reflects the situation in the market, where the two sectors are hardly distinguishable any more (virtually every computer can communicate and every smart phone is also a small computer).

This highly complex structure has led to a considerable degree of fragmentation. Frequently, several SSOs are active in similar or overlapping domains. As a result, there may well be competition either generally between SSOs that cover similar ground or temporarily between different SSOs' Working Groups working on similar projects. Consequently, there is an urgent need for co-ordination. Given the diverse nature of the individual SSOs (see also below) this may be extremely difficult to achieve.

Nevertheless, a comparably high level of coordination exists between ISO and the regional and national SDOs, to avoid inconsistencies and contradictions between international, regional and national standards. This coordination is based on the WTO's agreement on 'Technical Barriers to Trade' [WTO, 2015]. In a nutshell, it states that national bodies shall use international standards and remove contradicting national ones whenever possible. Figure 3 shows different types of bi-lateral agreements.

Following a different approach, the Global Standards Collaboration (GSC; see Fig. 2) provides for the regular exchange of work programs and other information between its members, the regional Telecommunication standards bodies and the ITU. ETSI Partnership Projects represent a related approach

Figure 3. Different Types of Bi-lateral Agreements Between SSOs (adapted from [Jakobs, 2013]).



to co-ordination. These projects coordinate groups of regional SDOs working towards a common goal. 3GPP⁴, which is active in the field of wireless communication, is a prominent example.

Coordination of the activities of consortia working in overlapping fields is not always desired; some consortia were primarily established to compete with others. Where this is not the case, cooperation is in most cases based on different types of bilateral liaison agreements. These agreements are, in most cases, either rather generic (e.g. a general Memorandum of Understanding) or very specific (e.g. relating to one specific standard). Overall, cooperation between consortia is not nearly as pronounced as between SDOs.

The Standards Setting Organizations (SSOs)

The characteristics of individual SSOs may differ considerably, in various respects. This holds for both SDOs and consortia. Therefore, the traditional distinction between these groups is not overly helpful. A more flexible and meaningful approach was introduced by Updegrove [2006]. It is based on a set of attributes that can be applied to describe an SSO. These attributes fall into four categories:

- General
- Membership
- Standards setting process
- Output

An attribute is a tuple <type, value>. Table 1 summarizes the defined types and provides a brief description for each; the values need to be determined individually for each SSO.

Table 1. SSOs' Attributes and Descriptions (taken from [Jakobs & Kritzner, 2009]).

General Internal	Description
overall goals business models	These provide some general background information.
governance	'Governance' is important for those who wish to influence the goals and activities.
finances staffing	'Finances' and 'staffing' are important to evaluate the chances of an SSB's long-term survival.
IPR policy	IPR policy should not deter any stakeholders.
External	
reputation	Joining an SSO with a poor reputation, or with a poor record, will not make too much sense in many cases.
competition	Do competing SSOs exist, or are they likely to emerge in the near future?
liaisons	Is the SSO prepared to co-operate with other entities?
Membership	Description
Quantitative: • overall # of members • membership levels • membership fees	Provides some information about the relevance of the SSO. In many cases, some are more equal than others. Who decides, who does the work, and are these the same? May also help to determine a prospective new member's chances of active contribution and decision.
Qualitative: • key players involved? • 'active' members • individuals' capacity	Are those organizations important in the specific sector on board? Which are missing? Which members are prepared to invest resources into activities like e.g. editing documents, leading WGs, etc.? Is there a 'corporate whip', or do reps decide independently? What are the SSO's rules?
Standards setting processes	Description
Timing: • time for TC/WG establishment, • average time until finalization	Indicates the effort/time required to finalize a new standards project. Helps to determine whether or not a (perceived) window of opportunity can be met.
Process characteristics: • openness • transparency • required level of consensus • observation of due process • decision mechanism	Basically to determine how fair the process is? Do I have a say, or do the big guys determine? Can I complain, and to whom? Etc.
Beyond standardization: • implementations required? • proof of interoperability required • conformance testing	Indicate a more 'praxis-oriented' approach; crucial if products/services are to hit the market pretty soon.
Output	Description
Types of 'products'	Do an SSO's deliverables suit my needs? I do not always need a full blown standard, and may be prepared to swap consensus for speed.
Quantitative aspects: • standards output • # of implementations	Do they actually produce standards that are widely implemented? Indicates importance of output; if nobody implements the standards participation is hardly worth the effort.
Dissemination: • PAS submitter? • specifications for free?	Related to 'liaisons' above. Is an SSO prepared to bring its specifications into the public domain? And are they prepared to do it for free?
Follow-up activities: • standards maintenance • impact considered? • consistency checks in place?	How does an SSOs react to changes in technology/ requirements? And to errors/inaccuracies? Do they reflect on what they are doing? Are standards checked for consistency with others?

An SSO's IPR policy is probably the single most important criterion. In principle, each party that contributes to the work of an SSO on a specific standard is required not only to disclose any IPR that is relevant for this standard, but also to license it. This holds particularly (though not exclusively) for any 'Standards Essential Patents' (SEPs). If a standard cannot be implemented without infringing a patent this patent is called an SEP. Under the 'Royalty Free' (RF) regime licenses for such patents have to be granted for free⁵. Under a '(Fair), Reasonable and Non-Discriminatory' (F)RAND regime the IPR holder may ask for licensing fees⁶. The SSO does not normally interfere with the negotiations between the IPR holder and the potential licensee(s). No generally accepted definition or algorithm for the calculation of FRAND exists and the courts are frequently called upon to settle disputes (see e.g. [Updegrove, 2013]).

The Standardization Process

In general, the standardization process should make sure that its outcome (i.e. the standards) meets the needs of as many groups of stakeholders as possible. To come at least close to this goal, the World Trade Organization (WTO) has defined a set of "... *principles and procedures that should be observed, when international standards ... are elaborated ...*" [WTO, 2015]. Specifically, these include transparency, openness, impartiality and consensus, effectiveness and relevance, coherence and to address the concerns of developing countries. Most major SSOs more or less observe these principles although formally they are only relevant for national and international SDOs.

Terminology, procedural and structural details may differ⁷, but all major SSOs have adopted a standardization process that is subdivided into several stages. Table 2 exemplary summarizes the stages of the ISO/IEC process. Once a new Work Item has been agreed upon, a Working Group (WG; either an existing one or a newly created one) is charged with the development of the associated standard. When the WG has agreed upon a draft specification the members of the parent Technical Committee or Subcommittee (TC/SC) need to reach consensus. Depending on the number and nature of comments received the specification may be returned to the originating WG for further elaboration. Eventually, a vote will be cast at TC/SC level. If the approval criteria (in terms of majority and number of negative votes) are not met a revised version will be produced. The latter two steps may differ between SSOs and may have several iterations.

Table 2. Project stages and associated documents in the ISO/IEC process (taken from [ISO, 2015]).

Project stage	Associated document	
	Name	Abbreviation
Preliminary stage	Preliminary Work Item	PWI
Proposal stage	New Work Item Proposal ^a	NP
Preparatory stage	Working Draft(s) ^a	WD
Committee stage	Committee Draft(s) ^a	CD
Enquiry stage	Enquiry Draft ^b	ISO/DISIEC/CDV
Approval stage	Final Draft International Standard ^c	FDIS
Publication stage	International Standard	ISO, IEC or ISO/IEC
a	These stages may be omitted.	
b	Draft International Standard in ISO, committee draft for vote in IEC.	
c	May be omitted.	

It should once more be highlighted that virtually all SSOs follow a variation of this process⁸.

Not unlike the processes, the organizational structures of major SSOs are similar. In most cases both their technical work and their internal organization are hierarchically structured. Figures 4 and 5 exemplary show ISO's governance and work structure, respectively.

Figure 4. ISO's Governance Structure

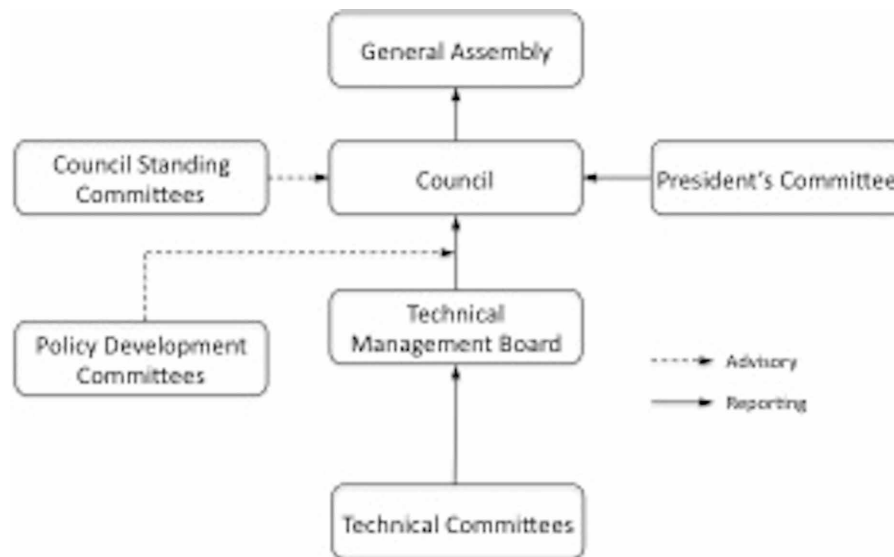
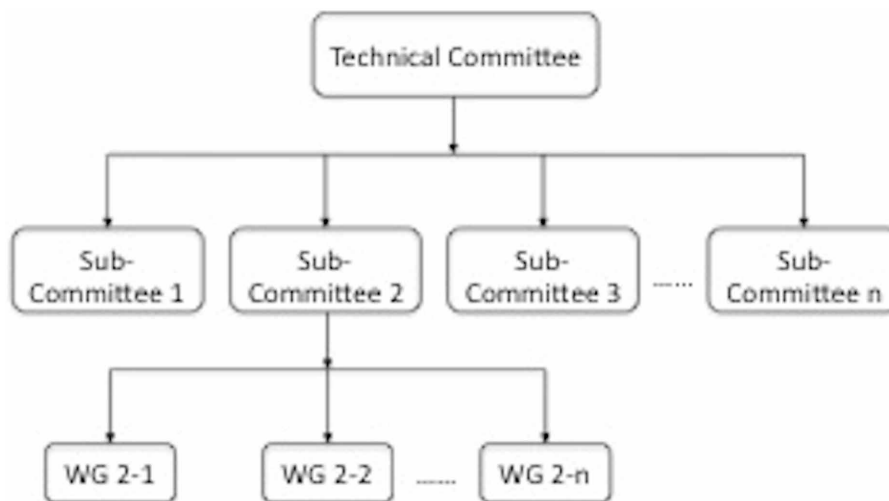


Figure 5. ISO's Work Structure



Typically, a TC covers a rather broad field. For example, ISO/IEC's Joint Technical Committee 1's (JTC 1) scope is 'Information Technology'. It is subdivided into 20 Subcommittees (SCs). Each Sub-committee, in turn, may comprise a number of Working Groups (WGs; more than 100 in total in JTC1). This is where the bulk of the actual technical work is done⁹. The more strategic decisions are normally taken at SC/TC level. This is also where the decisive voting is done.

Managing Corporate Standardization

Standardization management refers to the set of activities a firm needs to perform in order to achieve its goal(s) in standards setting. That is, it needs to be clear about these goals in the first place. In many cases, standardization will be used as a tool to support a firm's business strategy in a given sector. To this end, standards setting activities and the business strategy need to be aligned. Potential activities in standardization may range from simple intelligence gathering via pro-actively starting standardization initiatives to the foundation of a dedicated standards consortium to develop and promote standards for a particular field.

Once these corporate goals are clear, a number of factors need to be taken into account, including.

- The (potentially) relevant legal, moral, ethical, societal boundary conditions.
- The characteristics of the individual SSOs and the links that exist between them (see above). Here as well IPR issues will play a major role in many cases.
- The obvious allies and opponents that will also participate and their technical and strategic interests.
- Potential alliances that could be formed based on similar/complementing interests..
- The nature of the contributions to be made (e.g. technical, requirements, editorial).
- The content of the contributions.
- The size of the team, the roles and the necessary capabilities of its members.

The latter point is frequently ignored. However, at the end of the day standards are developed by a group people who may cooperate or compete in a WG. These people's capabilities, backgrounds, views and agendas will to a considerable degree shape the final standard (see e.g. [Isaak, 2007], [Jakobs, 2011]). It should be noted that in addition to their technical expertise these people also need to be good communicators with a reasonable level of diplomatic and negotiation skills. It is, however, not always clear up-front whether or not they will actually act in the best interest of their respective employer [Jakobs, 2011]. Not least because of this uncertainty the selection of representatives with suitable expertise and experience and their briefing is a managerial issue whose importance should not be under-estimated.

Figure 6 summarizes and illustrates the different factors that need to be taken into account in corporate standardization management (without claiming completeness).

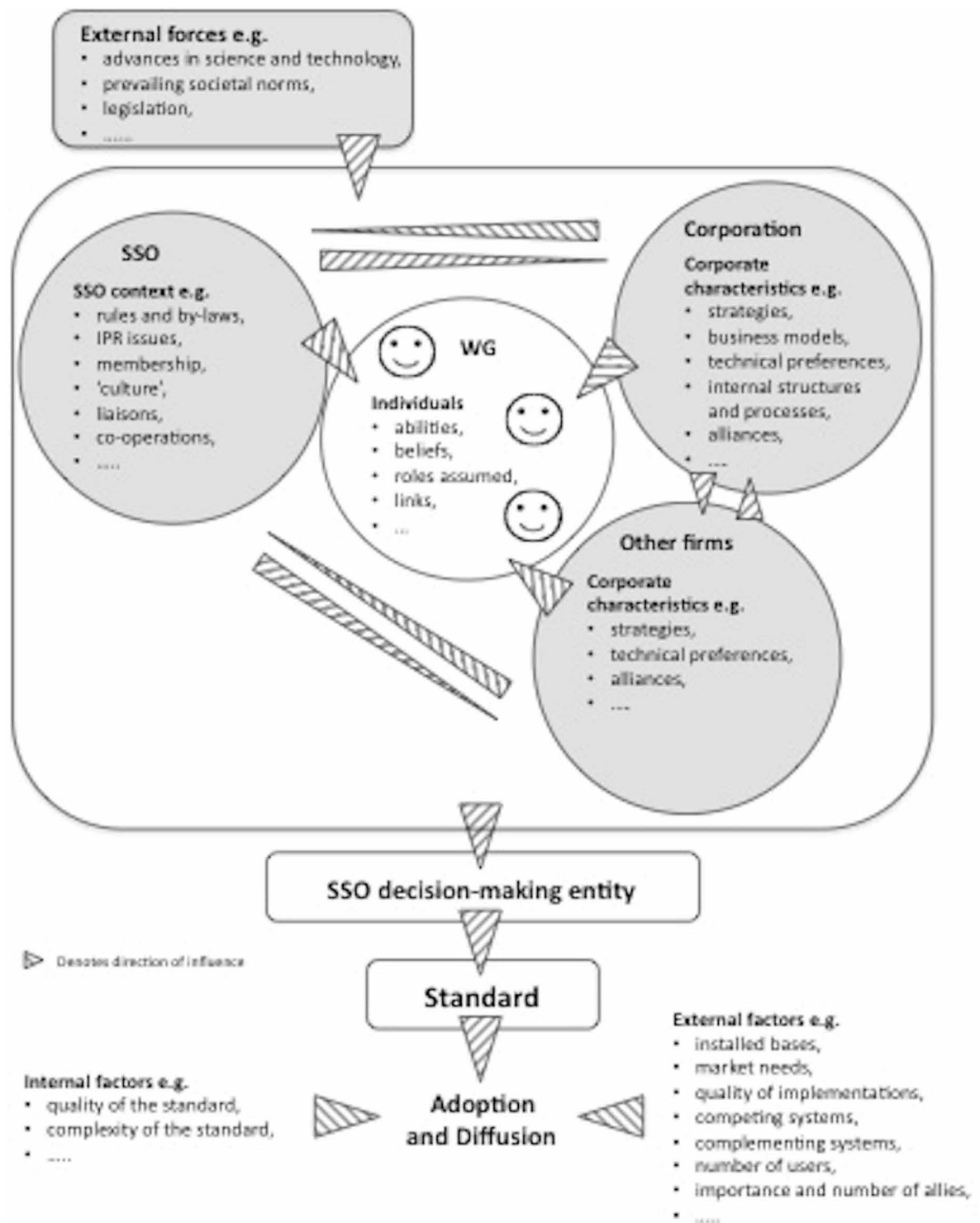
National Standardization Strategies

Not only firms have realized the importance of standards. Almost all industrialized nation states now have developed their own national standardization strategy¹⁰. Typically, standards are seen as important for the economy, policy making and societal issues. A typical statement reads "*Standards are a fundamental building block for the economy and society*" [NSSF, 2003, p. 4]).

Almost all national strategies highlight the increasing globalization of markets and the resulting equally increasing need for globally valid, unique and accepted standards. At the same time, they also aim to provide a competitive advantage for the respective national firms and to strengthen the respective national position in the global market.

A number of other aspects may also be found in most national strategies. These include, for instance, the links between research, innovation and standardization. Along similar lines, they highlight the role of standards as a vehicle for the transport of innovations to the market as well as for the convergence of

Figure 6. Some Factors that Influence Standards Development (based on [Jakobs, 2013]).



technologies (e.g. broadcasting, telecommunications and IT). The support of adequate education about standardization is another goal. This holds for both formal curricula and training on the job.

To achieve these goals, the need for an adequate national standardization infrastructure is stressed. This also includes the adaptation of current processes to shorter product life cycles and increasing consumer requirements. Specifically, the need for adequate (public) funding of the standardization infrastructure is also highlighted, not least in the light of the economic importance of standards.

Despite these similarities a number of differences between national strategies may also be identified. For one, the special needs and requirements of Small and Medium-sized Enterprises (SMEs) are only addressed in the strategies of the European countries. And while all strategies aim to improve the national performance in globalized markets the US strategy quite openly aims to ‘export’ its sector-based national standardization system, not least to counter the export of European technology and practices to other nations through the European standards processes. The Chinese strategy is the only one that explicitly highlights ICT. ‘Next Generation Information Technology Industry’ is the second of the 13 major areas identified where science and technology shall support the development of new technical standards. The support of R&D (Research and Development) for standardization is another focus of the strategy, an aspect the other strategies only touch upon.

FUTURE RESEARCH DIRECTIONS

Despite standards’ long history ‘Standards and standardization’ is a fairly new research topic. Initially, the economic dimension of standards attracted researchers’ interest (see e.g. [David & Greenstein, 1990]). Eventually, other topics emerged, including e.g. legal problems (e.g. Intellectual Property Rights, IPR), policy aspects (e.g. standards as policy tools), stakeholder-related issues (e.g. stakeholder influence, process credibility, etc.), corporate standardization management and many others. De Vries et al. [2018] present a (probably slightly biased) overview of what researchers in the field see as major future research topics.

In the following the impact that emergence of smart systems (e.g. the Smart Grid, Smart Manufacturing, Intelligent Transport Systems, Smart Homes and Smart Cities) may have on the world of standards setting will be discussed in a bit more detail.

Smart systems are a comparably recent trend that is increasingly gathering momentum. The ‘smartness’ is the result of the integration of Information and Communication Technology (ICT) into ‘traditional’ technologies, thus providing them with advanced control and amenability functions previously available only in the virtual world. To offer the user smart applications, these systems need a communication infrastructure which, in turn, will typically be based on the Internet of Things (IoT). Forecasts indicate about 24 billion IoT devices for the year 2030¹¹.

Basically, the standardization of smart systems faces two major problems. One is the (technical) multi-disciplinarity of the task, the second, related one is the urgent need to also include a range of societal stakeholders; this is primarily due to the sheer ubiquity of such systems and the societal, environmental and economic ramifications this ubiquity causes.

Technical Multi-Disciplinarity in Standardization

The standardization of smart systems requires the co-operation of different technical disciplines. Table 3 below shows (some of) the technical disciplines that contribute to individual smart applications.

This multi-disciplinarity represents a considerable problem for standards setting. Traditionally, either one (occasionally several) Technical Committee (TC) covers one field. While close links exist between some TCs, co-operation in general is not overly well developed (see above). Moreover, these

Table 3. Sample Disciplines Contributing to Smart Applications

Smart Manufacturing	Intelligent Transport Systems	Smart Grid	Smart Buildings	e-Health
Production Engineering, Computer Science, Robotics Control Engineering, Telecommunication	Transport Telematics, Traffic Engineering, Power Engineering, Automotive Computer Science, Telecommunication	Power Engineering, Computer Science, Telecommunication	Architecture, Civil Engineering, Computer Science, Telecommunication	Medicine, Computer Science, Mechanical Engineering, Robotics, Telecommunication

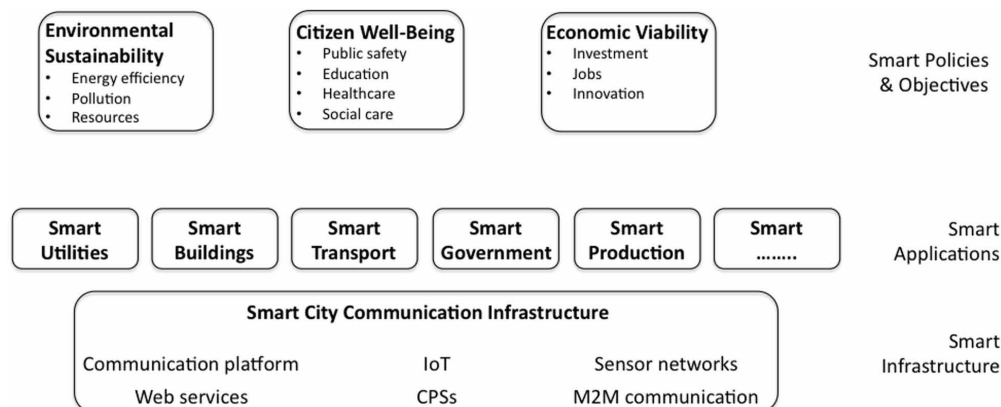
smart applications will require co-operation between both standardization entities and individuals with very different cultures coming from equally different backgrounds. Plus, very different technology life cycles will need to be aligned somehow (speed has always been a major issue in ICT standardization, not so much in e.g. mechanical engineering). On top of that, applications like e-health and smart cities need to address issues of information security and safety and of trust, which adds yet another dimension and increases the complexity of the task. If and how the current standardization system can successfully address these issues or if any changes need to be made and if so, which ones remain open issues.

Smart and Responsible Standardization

Billions of sensors will collect data and make them available for smart applications and their users. A considerable part of this data will be personal or private. Moreover, the results of the analysis of this massive amount of data may have major e.g. economic, environmental and societal ramifications and directly impact citizens and businesses alike. Accordingly, potentially severe policy, societal, economic and even ethical issues need to be addressed in the development of smart systems. To be able to actually do so it will be necessary to integrate these aspects into smart systems' design as early as possible (not unlike the 'privacy by design' approach; see e.g.. [Langheinrich, 2001]).

In a way, a smart city represents a superset of the other smart applications. Figure 7 shows a popular model of a smart city. On the one hand, this model shows that a number of other smart applications contribute to the objectives of smart cities. On the other hand, it highlights the relevance of a smart (ICT) infrastructure as the basis of a smart city.

Figure 7. Smart city model according to and adapted from Navigant [2011]



For each layer, dedicated standards (or best practices) will be needed. Today, almost all standards for smart systems address the communication infrastructure level. At this level, standards almost exclusively deal with purely technical aspects and are thus less complex to develop (plus, many of these standards pre-date smart systems and only need to be incorporated).

Standards for the ‘smart policies and objectives’ layer will provide guidance to (city) leadership for the development of an overall strategy, the identification of priorities, the development of a practical implementation roadmap and for an effective approach to monitoring and evaluating progress. Accordingly, most non-technical aspects will be located in this layer. In order to make the associated standards (and thus the resulting technologies) widely acceptable, active involvement of a wide range of stakeholders in the process would be one way forward. Accordingly, especially when policies and objectives are concerned (and, to a lesser but still considerable degree, smart applications) special care should be taken to ensure broad and active stakeholder participation. To this end, contributions relating to e.g. societal, ecological, economic and ethical issue will be essential. This, in turn, will require involvement of a broad variety of (non-technical) stakeholders who are not normally represented in standards setting (including e.g. citizens, NGOs, unions, sociologists and city councils), but who can contribute the necessary expertise. How to actually achieve this in practice will be another crucial problem for which research may help finding a solution.

BRIEF CONCLUSION

Standards are crucially important, both economically and technically. This holds especially for the ICT sector and for the emerging smart systems, which simply would not function without globally accepted and implemented interoperability standards. Especially standards for smart applications will further increase the importance of standards and the underlying standardization processes, but will also require considerable interdisciplinary co-operation, thus further complicating the standards setting process.

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KEY TERMS AND DEFINITIONS

Information and Communication Technology (ICT): Encompasses computer hardware and software as well as the communication networks necessary to process and transmit data.

Innovation: The implementation of a new or significantly improved product (good or service), process or new organizational method.

Intellectual Property Rights (IPR): IPR is the legal right granted with the aim to protect a creation of the intellect. These include patents, trademarks, and copyright.

Smart System: A smart system incorporates ICT functionality into ‘traditional’ technologies, thus providing them with advanced control and amenability functions.

Standard: Document, established by consensus and approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context.

Standardization: The process through which a standard is developed.

Standards Setting Organization: An organization that provides a platform for the development of standards.

World Trade Organization (WTO): The WTO deals with the global rules of trade between nations. Its main function is to ensure that trade flows as smoothly, predictably, and freely as possible.

ENDNOTES

- ¹ In short, according to [ISO, 2015] consensus means a general agreement, characterized by the absence of sustained opposition to substantial issues. Consensus need not imply unanimity.
- ² ITU is a United Nations agency for information and communication technology issues.
- ³ This term is used to denote both formal SDOs and private standards consortia.
- ⁴ <https://www.3gpp.org/>.
- ⁵ The World Wide Web Consortium applies the RF regime.
- ⁶ All SDOs and most consortia apply the (F)RAND regime.
- ⁷ In the following, ISO terminology will exemplarily be used.
- ⁸ See [Morales-Trujillo et al., 2015] for a detailed description of a process leading to a de-facto standard.
- ⁹ Depending on the SSO’s bylaws WG members either act in a personal capacity or represent their employer or country, respectively.
- ¹⁰ A compilation of such national strategies may be found through <http://www.strategicstandards.com/Perspectives.html>.
- ¹¹ <https://www.prnewswire.co.uk/news-releases/global-iot-market-will-grow-to-24-1-billion-devices-in-2030-generating-1-5-trillion-annual-revenue-831981056.html>

Digital Organizations Enhancement With Information and Operational Technologies Convergence

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INTRODUCTION

The new technologies open the space for changing the way that business works. During the process of changing business environment the organization successfully take new position on the regional and global scene. The old tools of organizational design are not well-suited to success in new markets. Competitive advantage in new markets requires a capability to sense, shape and take new market opportunities. This means that continuous improvement of existing capabilities is not enough, but organizations should develop new capabilities that anticipate and respond to new opportunities in marketplace. Currently, digital environments push new demands on information processing in organizations. For an organization to gather these opportunities it must obtain and process current and reliable information and it asks for dynamic organization capabilities. Thus, in the process of designing organizations for dynamic capabilities there is a need for capturing information, knowledge, and experience and use it all in collective decision making. The mission of the organizational designer is to design structures that put employees in contact with their appropriate environments, and to design processes that help learning, sharing and aggregation of individual knowledge so that the collective organization can make appropriate decisions. The individual capabilities of actors must be turned into collective capabilities making an organization prepared for operating at new market environments. Opposite to traditional organization design that is centered on structural relationships actor-oriented design is centered on shared access to information and other resources as well as the protocols and infrastructures by which actors connect and collaborate. Digital organizations can apply an actor-oriented design at their origin. However, traditional organizations must be redesigned. Redesign involves changing a predominantly hierarchical system supported by legacy technologies to an actor-oriented system (Langer, 2017). Having targeted a particular area for redesign, designers and decision-makers need to address each of the components of the actor-oriented scheme (Snow, Fjeldstad & Langer, 2017).

Organization response to technological changes was dominantly gradual and enabled by information technology improvements that provide larger scope and dimensionality of organizational control and coordination. Such adaptive responses were made within existing hierarchical organization. In the context of digital technologies deployment, traditional organizations are not appropriate and require adaptation through collaboration as well as self-organization around situation awareness and knowledge commons. It is due to the fact that self-organization and collaboration, as an adaptive response, is faster and more effective than a hierarchical response. Furthermore, Rachinger (2018) states that new forms of cooperation between organizations lead to new products and service offerings as well as new forms of organization relationships with customers and employees.

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With the huge developments in information technology and the continuing globalization, the environment for businesses changes rapidly. Changes in technology form new markets and industries and have sustainable impacts on the competitive environment. Digitalization is ubiquitous and new performances of information technology create new businesses. Furthermore, digitalization is the most powerful driver of innovation over the past few years and is acting as innovation generator making the business model concept highly relevant for research activities (Buck, 2018). One impact of digitalization on business models is business model creation, which enables new business models due to the usage of evolving digital technology. New data driven business models are exclusively build on the usage of data which is called datafication (Mai, 2016). This is caused by the reduction of marginal costs that tend to lowest level due to the high number of users. Customer experience moves towards digital integration leading to customized products improved with digital services. Hence, Engelbrecht et al. (2016) identify new categories for data-driven business models using three dimensions of data origin, target group and technology. Organizations adopting a data-driven approach have opportunities to improve their business, and outperform other organizations. Any organization planning widespread adoption of analytics and data-driven culture needs to put suitable tools to all departments. The next move is implementing data mining tools that allow users to do predictive analysis. Regardless of where advanced analytics is placed within the organization, the information technology system needs to change its focus in a way that enables easy access to data, for all the employees (Berndtsson et al., 2018).

Successful digital transformation requires a cultural shift which impacts all processes, systems, actions, and people across an organization. Companies worldwide are now highly focused on updating their business processes and adopting digital platforms that will help them serve customer needs more effectively and reliably. The recent developments that took place from 2010s, such as the mobile revolution, social media, and big data analytics, led to the digital transformation of business modeling. Anything-as-a-service models emerged were platforms with business networks and ecosystems are promoted. In the meantime, business partners can receive pervasive access to information through Internet and have multiple channels to choose from. With the help of new business modeling concepts, an organization is able to describe its business in terms of “what it does,” “what it offers” and “how the offer is made” (Ritter & Lettl, 2018). It opens the space for new organization based on an actor-oriented design in which the key element is infrastructure that relies on technologies, both operational and information technologies. These two technologies are converging with interchangeable devices, software and data connected through the same network infrastructure modeling new digital organization.

BACKGROUND

Digital technology is changing the ways of organizations activities. Organizations increasingly include digital and human agents who share means of communication, control, and coordination. Traditional organization design is centered on structural relationships. Actor-oriented design, by contrast, is centered on shared access to information and other resources as well as the protocols and infrastructures by which actors connect and collaborate. Thus, digital organizations can apply an actor-oriented design at their beginning but traditional organizations should be redesigned using actor oriented architecture. The actor-oriented architecture is composed of three elements: actors who have the capabilities and values to self-organize; commons where the actors accumulate and share resources; and protocols, processes, and infrastructures that enable multi-actor collaboration. In actor-oriented organizations, control and coordination are based on direct exchanges among the actors themselves rather than on hierarchical

planning, delegation, and integration (Snow, Fjeldstad & Langer, 2017). The data-driven organization should take digital technology change to enhance its competitive advantage. It should carefully align its business processes (supported with the proper implementation of information technology) with its environment and assure the flexibility and continuous adaptations of its core processes (Rkman, 2010). It should therefore establish which business processes are key processes and contribute to the competitive advantage creating unified infrastructure needed to support such changes. The key is infrastructure that relies on technologies, both operational and information technologies.

The increasingly prevalent role of technology in business impacted the view on information technology system strategy. Information technology strategy was seen until recent time as a functional strategy that had to be aligned to business strategy. Furthermore, information technology strategy was often presented and functioned as subordinate to business strategy. However, digitalization activates new form of business strategy that becomes digital business strategy. Hence, information technology system strategy that in past was traditional aligned to business strategy should be treated in different way because a digital organization should presume the concept of the digital business strategy. By its nature, digital business strategy is in fact an organizational strategy formulated and executed by digital resources to create differential value.

People, business, data and infrastructure are all key elements belonging to the digital transformation. Organizations use digital devices and technology for many reasons. Business benefits from technology for implement innovative processes and procedure aimed at increase profits or decrease costs. Things become smart things which include robots, autonomous vehicles, connected Internet-of-things and many other innovative technologies. Further, data represent the business assets aimed at power business and cloud represents the technological infrastructure.

Digitalization, which is defined as the exploitation of digital opportunities gain digital transformation that is then defined as the process that is used to restructure economies, institutions and society on a system level (Unruh and Kiron, 2017). Digitalization by means of combining different information technologies opens new possibilities and offers the potential to create new products and services. As a result of this new embedded usage of digital technologies, organizations can achieve further success in business activities. The digital transformation requires a methodological approach that incorporates technology and business. The digital business model should be based both on a managerial and technology language. Data-driven value propositions offer a great advantage over the traditional one. Digital data are clean, accurate, and precise but most important, provide real-time information giving business the possibility to change and adapt the value proposition to the market changing needs. Regarding operational technologies, Caylar, Noterdaeme, and Naik (2016) suggest that for the industrial sector, digitalization through the deployment of big data, analytics and the Internet-of-things brought up opportunities to increase the industry value chain. With the big data revolution many organizations are experimenting with advanced analytics as a tool to help them stay competitive. Advanced analytics go beyond traditional business intelligence solutions based on performance indicators, dashboards and the querying of data warehouses to incorporate algorithmic techniques from machine learning, artificial intelligence, natural language processing and other computer science disciplines (Rose et al., 2017). Thus, advanced analytics could be defined as the process of testing data or content using sophisticated techniques and tools to discover deeper insights, make predictions, or generate recommendations.

A central transformative force that largely influences modern organizations is digitalization that is the business effects deriving from the adoption of digital technological advancements. As a power of change, digitalization is not only seen as new applications that improve business activities, but is bringing fundamental changes to how organizations function as business entity. Hence, digitalization is pres-

ent in many different industries such as mobile applications, big data, machine-to-machine platforms, Internet-of-things, industrial Internet, and Industry 4.0. With the increasing focus on data, the business is becoming increasingly data-oriented through the increase of connected, data-collecting sensors.

The process of digital transformation can be broken down into the three separate phases including mobilization, coordination and acceleration. The first phase focuses on choosing a position based on strengths and weaknesses. The second phase involves choosing the most appropriate wave of change based on the current position. The third phase means making the most of the wave of change by entering and exiting at the right moment in time (Jansson & Andervin, 2016).

DIGITAL ORGANIZATION

An organization is a goal-directed activity system maintaining within its borders. In traditional organizations, technology, devices, and computers are controlled by human operators. With the decreasing costs of global communication and information processing, hierarchy is being replaced by new ways of organizing the digital elements that include cloud computing, big data analytics, cognitive computing, and collaboration platforms. Hence, organizing business and production activities digitally means collaboration with more entities and less dependence on hierarchy for control and coordination. This trend creates the base for new digital business strategy focused on the scope, scale, speed, and value creation according to successfully implemented technological trends such as artificial intelligence, interactive platforms, cloud computing, and the Internet-of-things.

Digital organizations strongly rely on collaboration of people and resources. According to Snow, Fjeldstad & Langerm (2017) collaboration is supported by two fundamental commons: situation awareness and knowledge. Situation awareness asks for actors a shared awareness of the resources and activities in their environment. The second common, a knowledge commons is information and data that is shared by the actors who make up the organization. Thus, the process of designing digital organization is coupled with the people, data and technology in aim to support organization's business goals.

Digital organizations operate through digital infrastructure that can be seen as complex system that goes beyond organizational and system domains, reducing information fragmentation. A digital infrastructure in its nature is an open, dynamic, complex and networked object; it contains a finite number of constituent systems that are independent and operable (Rukanova et al, 2017). Based on the new digital technology and smart devices, the digital infrastructure is evolving to new type of socio-technical information technology entity. Thus, digital infrastructure becomes a set of heterogeneous, interoperable information and operational technology systems that support business and production processes as well as technical and business actions.

The process of digital transformation makes new forms of design and works in both the processes and practices of organizations. These changes impact the conventional documented business processes and opens the need for agility and flexibility in the configuration of organizational processes during digital transformation. In the real world deployment of new technologies it is difficult to make successful control of business processes and technology infrastructures, required for flexibility, and creation of new processes. Thus, Baiyere (Baiyere et al., 2018) suggests four principles of agility during digital transformation - mindfulness, light touch routines, flexible infrastructure and ambidextrous organization. Hence, digital is not just about organizations that deliver primarily digital products and services. A digital organization is one that can operate effectively in digital age meaning that leaders in all organizations and from all sectors need a basic level of digital competence, interest and confidence. Digital organizations

are able to both understand and respond to market's rapidly changing needs, habits and expectations. Caylar, Noterdaeme & Naik (2016) state that organization that tend to be digital would treat data as a competitive advantage and must begin taking advantage of digital opportunities in order to avoid losing the value to others where a commitment to digitalization from top management is critical for success.

Digital technologies are used for learning, decision-making, and design where intelligent digital design tools are used in engineering and creative industries (Snow, Fjeldstad & Langer, 2017). Moreover, in digital organization digital technologies play a role in all aspects of operating, controlling, and coordinating the activities of organizations. It is also followed with strong collaborative decision-making and operational activities among digital and human agents. New information technologies such as artificial intelligence and machine learning embedded in machinery and tools play key role in emerging digital organizations. As a result, employees within digital organization collaborate with the technology in use, and organizational designs have to include human and digital agents. Organizing digitally means collaboration of entities without hierarchy for control and coordination. It includes partners who use digital tools for the co-creation and co-production of products and services.

Fast-moving business environments take open organization and self-organizing processes as a tool that convert individual capabilities into actionable collective intellect. Such self-organizing processes require forms and tools to design process management and execute them (Felin & Powell, 2016). It opens cooperative activities needed for digital organization. Digital technology also enables vast amounts of information to be easily compressed, preserved, and transmitted. In recent years, digital technology has disrupted one industry after another, and it is rapidly transforming how people communicate, learn, and work. Many products and services are fully or partially digital and increasingly work is being done digitally. As Langer (2017) states, the digitization of society is affecting customer needs, product and service properties and delivery mechanisms, and organization design. Thus, digitalization of organization is unavoidable task through constant adaptive learning for any organization to be competitive and agile.

Digital Business Process Management

Business process management is compilation of activities needed to create, and analyze the organization's processes that make up the core of its business. The source and fundamental order of business process management has clearly evolved over the years. During the information age the process improvement initiatives evolved by technologies such as management information systems and computer automation. The basis of structured processes led to process re-engineering using advanced technologies such as customer relationship management, enterprise resource planning and enterprise architecture, which then lead to business process management. And, as a result of more than two decades of inter-disciplinary research and excess of diverse business process management initiatives in various organizations across all industries, business process management has become a holistic management discipline. Consequently, it requires that a number of complementary elements needs to be addressed for its successful and sustainable deployment (Rosemann & Brocke, 2015).

According to Smith and Fingar (2006) the business process management is relating to the 3-tier integration and unification of data, computation and interaction. It is acceptable approach to cleaning huge data sets in new data driven organizations. Further, Anderson (2015) state that data-drivenness is about building tools, abilities, and a culture that acts on data. He also states that a data-driven organization will use the data as critical evidence to help inform and influence strategy. There will be an evidence-based culture in which data can be trusted and the analysis is highly relevant, informative, and used to determine next steps. Considering the issues with current solutions in information technology based

organizations, there is a solution with machine learning for data cleaning which consider all types of data quality issues in a holistic way and scale to large datasets.

In the process of digital business strategy development, it would be worthy to consider the development of an aligning process model that is comprised of three phases (exploratory, building, and extending) and establish organizational aligning actions that form the organization's sensing, seizing, and transforming capacities (Yeow, Soh & Hansen, 2018).

Business process management has emerged as a consolidation of disciplines that leverage process orientation to increase performance. Today, business process management has evolved into a widely deployed and comprehensively studied discipline (vom Brocke & Mendling, 2018). It also has emerged as a consolidation of disciplines that improve process orientation to increase performance. Despite the fact that business process management has disappeared as the top issue for most of organizations, process-aware management and supporting methods and technologies remains very high. Thus, the business process management is now a real opportunity.

The goal for digital organizations using business process management is to take control of their multitude processes and constantly endeavor to optimize them to create a more efficient organization better capable of delivering its end products and services. Here we can find the term maturity grid, as an assessment tool for evaluating an organization's level of progress towards a goal that could present the success of business process management deployment. Maturity grids provide an organization with a data showing how an organization is developed in regards to the criteria being assessed. They are also useful tools for leading discussions and providing management with directions for next steps. Maturity grid also represents how an organization's capabilities evolve along an established path where the basic purpose of maturity grid is to outline the stages of maturation paths. Here we could find the term hyper-collaboration. The idea here is that a process with simultaneous actions and decisions is faster and more efficient than doing them separately. In hyper-collaboration, process actors think and make decisions together simultaneously solving problems and achieving common goals.

DIGITAL TECHNOLOGY

The term frontier technologies is increasingly being used to refer to the latest generation of technologies, especially digital technologies empowered by artificial intelligence and machine learning. Further, one of the most influential advancements for an organization in the digital age is the technology that capitalizes on extremely large volumes of business data. Today, the huge volume of valuable data held in organizations is not being fully utilized. Here is the place for artificial intelligence solutions to improve data coverage and optimize the data usage.

Artificial Intelligence

At its core, artificial intelligence based system is generated by data, which can come in many different forms for many different uses. These data sets may not always seem useful and this is the scenario where artificial intelligence comes into play. One of the most universal drivers for artificial intelligence is aimed toward automation. Areas like administrative work (such as data processing and data collection) are widely seen as function where artificial intelligence technology will support workers.

Speaking of artificial intelligence, it will be strongly connected with prescriptive analytics technologies. Prescriptive analytics, which uses artificial intelligence-enabled software, will not only collect and

analyze data, making predictive statement about how that data is affecting business of entire organization, but it will also be able to define paths of business action. For many modern businesses becoming data-driven is a key priority. With more businesses looking to utilize the data they collect there is a need for new business intelligence potential of big data, artificial intelligence, and prescriptive analytics in an organization setting. This way is followed by emerged solution with augmented analytics. At the heart of this trend is the use of artificial intelligence and machine learning to augment human efforts to analyze data.

The ability of artificial intelligence based tools to quickly provide clear insights from data makes it a capable complement to Internet-of-things deployments. Further, with such tools large amounts of information can be collected, and essential patterns and insights from it can be found and automated, simplifying the process of using data. Artificial intelligence technology will be great for Internet-of-things deployment in areas such as increasing operational efficiency and enhancing risk management. Through artificial intelligence technology an organization is also able to monitor more data points and integration of artificial intelligence tools and Internet-of-things creates new and improved products and services. It opens new possibility for an organization using artificial intelligence tools with the effective process of using Internet-of-things devices to collect data from the products they are selling and generate insights about their usage. With the devices that can have embedded intelligence opens up a space for new products that couldn't have existed before. In this process, machine learning can forecast, predict and identify new forms of business processes. Thus, important outcome from the machine learning and data science process is business insights.

Internet-of-Things

Ubiquitous computing creates an environment where embedded processors, computers, sensors, and digital communication technologies are available everywhere. Ubiquitous computing will surround users with suitable information environment and a smart space that merges physical and computational infrastructures into an integrated environment. This environment will feature a large number of computing devices and sensors that will provide new functionality, offer specialized services, and increase productivity and interaction among the devices and the users.

The Internet-of-things creates a new era of networked computing where advanced applications intelligently monitor and control remote sensors, mobile devices, and smart machines. It has the ability to remove the boundary between traditional operational technology systems and information technology systems. It is also one of the most important technology trends facing business today. The Internet-of-things is actually a network of devices, appliances, vehicles and other devices that are embedded with sensors, electronics, software and connectivity enabling them to connect and exchange data. Deeper and wider knowledge about the Internet-of-things can give organizations the chance to identify operational efficiencies as well as sales and services opportunities. In many instances the Internet-of-things is driven by consumer gadgets and smart appliances that promise to transform people's lives. But the technology will not only be ubiquitous in the consumer world. It will also be deployed in the business strategies, processes and architectures of organizations across numerous industries.

Although studies show that not only product and process but also business model innovations are essential for future organization's success, both researchers and practitioners mainly focus on the technological implications of The Internet-of-things through the Industry 4.0 (Burmeister et al. 2016; Kiel et al. 2016). Additionally, studies show that business model innovators are more successful than pure product or process innovators. Business leaders and technology planners view the Internet-of-things as

a catalyst for change. Many are implementing standards-based operational control systems and replacing isolated meters, sensors, and actuators with smart, Internet based enabled devices. As a result, the Internet-of-things initiatives present a perfect opportunity to connect isolated, parallel technologies in a digital organization.

Operational Technology

Accordingly to the information technology dominance in today's organizations, proprietary operational control systems are giving way to new, open solutions based on standard information technology platforms and protocols. Further, unlike legacy operational control systems, new operational technology systems and solutions use standards-based information technology infrastructure and communications protocols to cost-effectively achieve greater flexibility, and scalability. Here we find the term operational technology as a complex set of hardware and software that detects or causes a change through the direct monitoring and control of physical devices, processes and events in the organization. In fact, operational technology means the application of computers and digital devices to monitor and control some aspect of the physical world.

We can define operational technology as technology that uses data from connected devices to monitor changes in physical processes. Operational technology is actually one application of the Internet-of-things technology. They often depend on the same server, network and operating systems that information technology systems utilize, leading to the process of information and operational technology convergence. Hence, some of the biggest changes to operational technology systems are that they are no longer stand-alone systems. In many cases, they are now connected to corporate networks to provide business information and data. And their telecommunications are increasingly being connected to the Internet in order to respond in real time to respond to system or consumer demands.

Industry 4.0

Here we find the new term in the information technology environment coping with operational technology in business processes, the edge computing. In the context of the Internet-of-things, edge refers to the computing infrastructure and devices that exist close to the sources of data. These devices typically reside away from the centralized computing system available in the cloud. Further, these computing systems are consisting more computing, storage, and analytic power to consume and act on the data at the device location. This capability will be extremely important to industrial organizations and it is opening the place for Industrial Internet-of-things known as Industry 4.0 as new, the fourth industrial revolution. It is covered by cyber-physical systems and Internet-of-things that enable smart production. Process elements can independently communicate and exchange information with each other, trigger and control the next actions, and steer the production (Pereira & Romero, 2017).

Gearing traditional industries towards the opportunities and challenges of digitalization creates the convergence of classic industrial production with information technology and new frontier technologies (Weking et al., 2018). The term Industry 4.0 also describes the digital transformation and a new manufacturing paradigm for traditional industries. With big data, advanced analytics and machine learning, industrials can reduce unplanned downtime, improve asset performance, lower cost of maintenance, and open up potential for new business models that capture value from machine data. As more computing, storing, and analytic capability is embedded into smaller devices that are installed close to the source of data edge computing will be an important tool in enabling edge processing. The important factor in

the deployment process of operational technology systems is integrated work of edge computing and cloud computing in order to fully realize the value of the massive amounts of data being generated by ubiquitous Internet connected digital devices. Using Industry 4.0-based technologies related to mobility, networking, augmented reality, and virtualization, manual procedures can be digitally transformed to help field operators execute tasks using non-electronically connected devices.

CONVERGENCE

Converging Technologies for Improving Digital Organization

Converging technologies is the process by which existing technologies merge into new forms that bring together different types of media and applications. Thus, the technology convergence capability for organizations is the ability to embed technology in devices and products leading them to business innovation, competitive differentiation across the business and increased efficiency within the organization. By convergence of information and operational technology data, devices and machines will communicate with each other without human intervention and can perform tasks that would otherwise be extremely complicated, weighty and time consuming.

The idea behind operational and information technology convergence is to integrate business process management over the whole business activities from production to market sections. In this process, the batch management system could take the initial role. The digital transformation for management activities enhance organizations to increase the usage of digital technology due to many dynamic technical and economic factors, including the use of newer complimentary technologies, such as cloud and edge computing, predictive analytics, extended reality, interoperability platforms, mobility, and artificial intelligence. As companies transform digitally, newer batch management systems will be implemented to improve processes making new possibilities for organizations to cut costs, increase performance, and drive innovation that can help them bring higher quality products to market more quickly. The trend towards real-time batch manufacturing requires greater integration between the batch management and organization's information system.

Data has become a basic organization asset that is quickly revolutionizing the business, enabling better, faster, cheaper business processes. By enabling employees at every level to use the right data at the right time, data can foster decision-making and becomes part of the organization competitive advantage. Becoming data-driven is an objective for many organizations in order to achieve digital transformation, by successfully managing data in all its forms across the whole organization processes. Hence, the organizations start to treat data as an important asset, evolve their cultures in a more data-oriented direction, and adjust their strategies to deploy data and analytics.

Thus, data-drivenness is about building tools, abilities, and, most crucially, a culture that acts on data. Culture is the key. This is a multifaceted problem that involves data quality and sharing, analyst hiring and training, communication, analytical organizational structure, metric design, decision-making processes, and more (Anderson, 2019). In the same time, a business model has many moving parts, all of which must work together in compatible way. At the heart of most digital organization ecosystems lies the unified platform. Platform is a combination of hardware and software that provides standards, interfaces, and rules that allow providers of components to add value and interact with each other. Digital technologies allow inter-operability of systems based on common standards thus unifying platforms in

entire organization. Once separated entities are now more easily integrated, creating opportunities for new business models.

With a digital setting in mind, El Sawy and Pereira (2013) included the design of a service platform and customer interface as part of business model design. This introduced questions such as whether the digital platform would be based on open or proprietary standards, and how easily the interface could be customized by users. In many industries, business and systems architects attempt to create software applications that accurately reflect their business. Unfortunately, most organizations treat information technology and operational technology as isolated technologies and project, maintain, and use each for different purposes.

Information technology systems are managed by the information technology department and support general business applications. Operational technology systems support industrial control processes or other specialized applications, such as manufacturing execution systems, energy management systems, and supervisory control and data acquisition systems. The operational technology domain favors reliability and access protection while the information technology domain favors manageability and data protection. Further, operational technology department want mission and process critical systems installed at each process place whereas information technology department prefer these systems installed in a data center. These two teams should work together in any project and deployment phase to integrate technologies across an entire organization. Smart and intelligent organization could with information and operational technologies convergence reduce the waste of energy, raw materials, time and data processing costs. This move requires a more holistic approach where two disparate team structures, different programming languages and infrastructures must be integrated. What are needed are a common strategy and architecture, increased interoperability, shared processes and a common Internet protocol. The fact that a single device or system has some Internet-of-things-enabled capabilities makes it potentially a smart device only within an interconnected technological ecosystem where it supports well-defined and purposeful business functionality.

Digital transformation or digitalization of an organization goes much further than satisfying some user demands or needs. It is no longer enough to implement silo projects that standardize business processes and role of information technology should be set changing it from an information technology supplier towards a partner within entire organization. Therefore, information technology system needs to follow operational technology deployment and adapt its services to general business plan. This is accompanied with the notion that operational technology systems are changing rapidly: and they are becoming more like information technology systems, using the same communication Internet based architecture becoming in this way more interoperable.

DISCUSSION

In the process of information and operational technology convergence there is a notion about each technology. Information technology is considered to be the whole technology stack, including the hardware, infrastructure and software applications used to transform data. An information technology system can therefore be defined as a tool that accepts data flows as an input to deliver a new data flow, but does not interfere with the physical world. Contrary, operational technology as the set of devices and processes that act in real time on physical operational systems follows its specific performances that is, up to now, generally active within its own infrastructure. Therefore, a major issue in the convergence of information and operational technology lies in adapting the organizational form to provide for common structures.

Information and operational technology convergence also requires the application of the same management framework and information technology infrastructure.

A major step in successful integration of information and operational technologies is the harmonization of their strategies. There are two aspects with regards to process harmonization. First, the common governance model will provide harmonized processes that will govern the definition of policies, workflows and structures. Second, information and operational technology convergence will also imply the harmonization of the business core processes to which the information technology and operational technology solutions will be applied. Digital organizations relied on information and operational technologies convergence have to build an agile enterprise application platform which helps a company to be proactive in carrying out its core activities. To facilitate effective integration in a modern organization, a service oriented architecture to support both macro and micro-planning is applied. In order to successfully deploy an integrated convergent information and operational technology environment, the implementation of strategies and concepts will be critical. However, their implementation will not be automatic. It will require a substantial change management effort to achieve acceptance by all subjects involved.

Information technology systems are managed by the information technology department and support general business applications. Operational technology systems support industrial control processes or other specialized applications. The operational technology domain favors reliability and access protection while the information technology domain favors manageability and data protection. Further, operational technology department want mission and process critical systems installed at each process place whereas information technology department prefer these systems installed in a data center. These two teams should work together in any project and deployment phase to integrate technologies across an entire organization. Smart and intelligent organization could with information and operational technologies convergence reduce the waste of energy, raw materials, time and data processing costs.

By unifying operational and information technology solutions around common protocols and building blocks, enterprises can connect different systems and practices to eliminate redundancies and improve business results. The implications of the integration of information and operational technology are significant. One of the issues that will occur is the cultural change required to bring these two technologies together. Additionally, this change will require a redesign of the organizational structure with a shared common purpose and strategy. New leadership is required that builds this shared strategy and direction forward. Beyond that, this convergence will require the adoption of new technical solutions, languages and skills. This will also require a significant effort to retool new processes, skills and capabilities. By unifying operational and information technology systems and practices in converged system architecture, businesses can eliminate inefficiencies and barriers to interoperability, improve automation, and accelerate innovation. Further, by adopting standards-based operational technology existing isolated operational and information technology environments, digital organization can reduce infrastructure cost and complexity and improve performance.

In most organizations, operational and information technology functions are handled by separate organizations, with distinct goals, budgets, and strategies, as well as different backgrounds and skills: This is due to the fact that operational technology systems implement and support highly specialized control systems for continuous availability for critical applications. However, information technology systems implement and support large-scale, complex, and open systems that rely on standards-based networking. To achieve a successful converged information and operational technology environment, digital organizations should coordinate programs, align plans, and share resources. By collaborating, they will be able to take advantage of integrated ability and knowledge of information and operational technology systems to successfully deploy a unified organization infrastructure.

FUTURE RESEARCH DIRECTIONS

A new area for the digital organization will presumably be merging of information and operational technologies. This direction leads to the term of convergence that becomes the imperative for future of any organizations doing business digitally. The research into information and operational technologies convergence is limited to several technological issues so there are a number of interesting directions for future research. Researching a business scenario from beginning to end where information and operational technologies convergence is actually being fully implemented is therefore an interesting direction for future research. Further, longitudinal research into the benefits of such convergence is another scope of research based on historic data that is used in advanced analytics and simulation tools predicting future states to find real ROI level of the convergence.

Since information and operational technologies convergence enables Internet-of-things utilization changing organizational management it will provide certain technological barriers that are therefore another topic to investigate. The convergence of technologies will ask for merging information technology and operational technology departments with settlement of new rules, procedures, business processes, and responsibilities that is a very complex process and is definitely a subject for future research. With new knowledge about technological opportunities and information and operational technologies convergence capabilities, the new integrated and unified ecosystem will provide opportunities for business transformation, growth and innovation. The convergence will enable and introduce new business functions improving cooperation between technology departments through digital organization enabling new ways of working and organization culture. Cultural differences between departments should be another area of future research providing a framework for successfully combining the information and operational technology staff ensuring in the same time both data availability and confidentiality.

The information and operational technologies convergence is related to the need for quantitative management reporting, assisted by big data and physical technology, artificial intelligence, cloud computing, and analytics enhancing overall business productivity. To reach all of these tasks requires network connectivity and access to both information and operational technology systems that were previously closed and are now interconnected. When they are connected they are also exposed to a huge set of risks that existing in the information technology environment. When digital organization adopts information and operational technologies convergence as its business strategy it will be exposed to new kinds of risks. Thus, the research on these newly discovered system vulnerabilities, data breach and the integrated system security is an emerged scope for the future focusing on security solutions that will effectively protects digital organizations.

There will be plenty of opportunities with information and operational technologies convergence for any digital organizations ready to implement digital integration solutions. Technology and organization development trends will remove the separation between information and operational technologies that would become the unique technology platform. It will ask for collective work of both information and operational technology sides toward the same business goals providing optimal security and productivity. This collaborative work through information and operational technologies convergence will provide hyper-collaboration scenario as a new way of teamwork in which digital organizations will process simultaneous actions and decisions in much faster and efficient way combining their skills, resources and assets in order to achieve common business goals.

CONCLUSION

Convergence of technology has been a continuous process in the industry. With recent advent in information technology, the convergence has accelerated significantly providing new concepts such as smart organizations and the Internet-of-things. Hence, information technology is developed and implemented independently of operational technology systems, thus solving different problems and employ different system architectures and communications protocols. Information technology is actually responsible for the creation, transmission, storage, and securing of data. Information technology systems were designed to connect applications and share data but operational technology systems were designed as standalone entities and were not originally intended to be connected to organizational information technology infrastructure. Operational technology is focusing on establishing and maintaining control processes with physical connections. As a result, operational technology systems were closed, independent and isolated. However, information technology and operational technology environments are inefficient and costly and new technologies can be slowed down by the resulting technological and financial limitations. Although information technology and operational technology systems coexist in many organizations they often do not work together. Such scenario is beginning to change due to new knowledge in organizational ecosystem forcing understanding of the importance of converging information and operational technology to optimize business operations and to achieve the benefits of technology implementation. With the advent of the Industrial Internet-of-things and integrating network sensors and associated software with complex physical machinery, the frontier between information and operational technologies is rapidly disappearing.

Recent developments in digital technology are making the prerequisites for these traditionally separated environments to converge. Many organizations have already begun integrating networking and digital communications into the operational technology space by deploying new Industrial Internet-of-things devices. Further, there are plenty of opportunities going forward, as more devices start to join the same network over the whole organization ecosystem. The converging information and operational technology will offer various predetermined integration solutions for plant automation, batch management and production systems with information technology applications providing new applicability for business analytics tasks. With the continuous trends in technology deployment in digital organizations, the disconnection of information and operational technology would disappear and these two technologies will become integrated entity.

To ensure this, it is important that information and operational technology systems, teams and projects jointly consider expertise and point-of-view and work together toward the same business goals of providing optimal security and productivity. By unifying information and operational technology systems and practices in a converged system architecture, digital organizations can eliminate inefficiencies and barriers to interoperability, improve automation, and accelerate innovation creating new enterprise convergence. Hence, a digital organization having a good converged technological infrastructure enriches the culture, efficiency, and relationships of its business.

In the context of the smart and ubiquitous computing devices utilization, digital organizations are reengineering their businesses by integrating activities of information and operational technology systems that manage the equipment, devices, and other components of the operational infrastructure. A huge set of shared data and tools opens new opportunities for continued collaboration and modification of the organization, business processes and investment optimization through the understanding and insight of the data. The collaboration between information technology and operational technology provides digital organizations greater capability in cost reduction of the operations, improvements in resources utilization

and lower operational risk. Integrating these environments requires digital organizations to address both technological and organizational requirements. Implementing a unified intelligent system infrastructure ensures high scalability, availability, and security, while integrated Internet-of-things gateways efficiently link information and operational technologies. In these processes of convergence deployment, effective converged infrastructure requires digital organizations to create teams that share knowledge and activities according to strategic business goals.

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KEY TERMS AND DEFINITIONS

Artificial Intelligence: The simulation environment of human intelligence in computers and machines helping people and machines execute tasks and make decisions similar to a human.

Digital Organization: An organization that uses digital technology in its internal and external operations. The objective of digital organization is to transform the core of business operations and processes across entire digital organization.

Industry 4.0: The fourth industrial revolution as the cyber-physical transformation of manufacturing based on information and operational technology convergence.

Information and Operational Technology Convergence: The integration of information technology systems used for data-centric computing with operational technology systems used to monitor events, processes, and devices.

Information Technology: The infrastructure and components that enable interconnected devices, networking components, applications and systems to interact in the digital world.

Internet of Things: A system of interconnected computing devices, mechanical and digital machines, objects, or people with possibility to transfer data over a network without requiring human-to-human or human-to-computer interaction.

Operational Technology: An integrated set of hardware and software that monitors and controls how physical devices perform.

Network Organizations as a Catalyst for Innovation

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INTRODUCTION

Inter-organizational networks in the economic sphere are nowadays one of the indispensable elements of the organization's functioning. Kay (1996, p. 118) describes them as "groups of companies concluding relative contracts with each other. It is also visible in Prahalad's and Ramaswamy's works (2000, p. 79). They emphasize the need to use the resources and skills of external partners, which are not connected by a connection of a proprietary or organizational nature. They stress the necessity of using so-called a deeper network that is co-created by the company and its partners, suppliers and customers. The development of network activities is possible thanks to the rapid development of computer networks and IT management infrastructure.

In its cyclically repeated report, Gartner annually identifies trends and technologies that will have a significant impact on the functioning of the organization and our daily lives. The 5 basic IT trends listed are: the democratized AI, digitalized ecosystems, do-it-yourself biohacking, transparently immersive experiences and ubiquitous infrastructure (Panetta, 2018). These technologies are based on dispersed resources, both technical and human. None of them would have a chance to grow if different, and often unrelated, resources or organizations were not used to create them. All of these modern technologies are the result of network collaboration. They are also a natural environment for its further development.

BACKGROUND

The network organization emerge as a result of the transformation of traditional structures organized in a hierarchical way into modern forms relying on the use of ICTs. These are structures that are not affected by functional and geographical constraints as much as classical organizations. Their driving force is an IT network allowing them to cross both geographic and institutional boundaries without much impediment. M. Castells (2007, p. 189) even speaks of a new type of economy (information economy) that is replacing the old-fashioned industrial approach. In the previous type of economy, the competitive advantage was generated by economies of scale, while today's new economy relies on the economics of networks which involves expanding the reach of the network, whereby the network can significantly increase its value by connecting to other networks (Castells, 2007, p.191). The establishment and operation of network organizations under the new management approach is driven by the desire to find modern and non-standard solutions, the development of knowledge and the support for innovation.

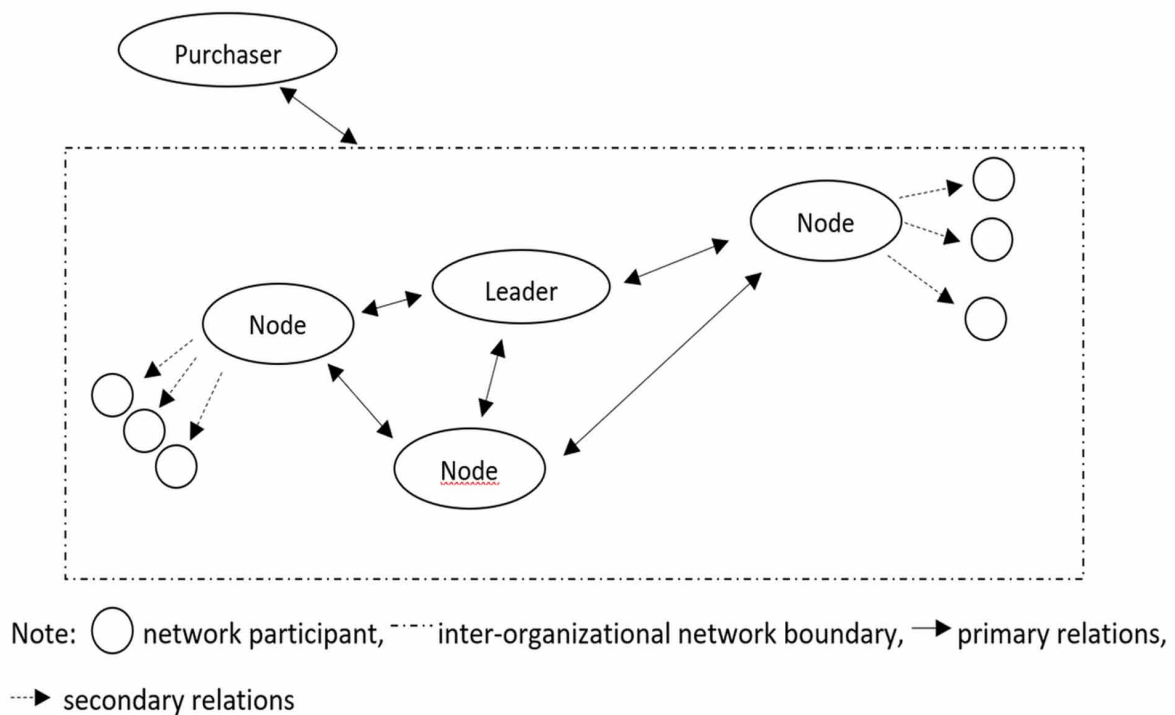
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A network organization is defined by P. Collin (2004, p. 268) as one that functions as long as possible in isolation from the traditional structure. In order to implement specific projects and defined goals, such organizations form teams. These teams are inherently impermanent since they are dissolved after project completion and the organization looks for new projects and new resources to support their implementation. The concept of network organization is often identified with the notion of virtual organization, which is also evident in P. Collin's works, where, nonetheless, the difference is that it is the structure that distinguishes a network organization, whereas a virtual organization is unique due to its operational manner that fully relies on modern ICTs (Collin, 2004, p. 442).

Network organizations are ones that are formed as a result of a merger of different, often independent, units (Figure 1) This connection may be temporary, often confined to the completion of a defined, specific task. Collaborative relationships among organizations can be varied and may involve both material and non-material organizational resources (Zott & Amit, 2010; Niemczyk, Stańczyk-Hugiet, & Jasiński, 2012; Kisielnicki & Sobolewska, 2019). The primary goal behind the formation of such structures is to achieve synergies – faster or more efficient attainment of defined goals by pooling resources. Hence, a particular emphasis on informational connections can be seen in network structures.

Figure 1. Network organization – nodes and relations

Source: based on: (Chrisidu-Budnik, 2012, p. 52)



In this case, the nodes of the network are people or organizations joining the network. Depending on the goals pursued by the network organization, its individual members can work together, or such relationships may not occur at all. Cooperation may be of primary nature, which is a direct consequence of established cooperation. This is a relationship that results from the goals of the network organization

(Chrisidu - Budnik, 2012, 52-53). The second type of relationship - secondary, is one that results from the membership of network members to their parent organizations. These relationships are not mutually exclusive, and their existence is often a condition for the emergence of a networked organization.

Cooperative action in the form of network offers organizations the opportunity to use not only their own knowledge, skills and competences but also those of their partners. For an organization, it is a chance to build or strengthen its market position. An important role in network arrangements is played by ICT systems that support the development of new models of work, communication and collaboration. In consequence, more and more various organizational networks are being established as “extended organizations.” (Turbilewicz, 2013, p. 387). These are structures that are strongly focused on sharing, exchanging and generating knowledge, skills and competences, thereby often being the place for innovative solutions. A network is a model or metaphor that describes a system of relationships among a specified number of units. While this number can be very large in social relationships (the case of social networks), it is usually clearly defined in economic relationships. These relationships include (Easton, 1994):

- Links and interactions among units within the network, where links are long-term and interactions are short-term relationships;
- The structure and position understood as the interdependence of the elements that make up the network and, as a result, the way in which they form interrelationships;
- The process understood as a change of ties among companies as an effect of jointly implemented tasks.

NETWORK ORGANIZATION MODEL – NETWORK’S NODES AND RELATIONSHIPS

The concept of network organization is not clearly defined in the related literature. It can even be assumed that due to the unprecedented pace of changes, including changes in network organizations themselves, this definition will undergo further modifications. However, the description of a network structure in terms of the classical graph theory will form the basis for a whole range of concepts introduced to illustrate such structures. A graph is a set of vertices that can be linked by edges in such a way that each edge ends and starts at one of the vertices (Wilson, 2000, p. 19)

The vertices, in the case of a network organization, are partners and organizations that co-create it. The concept of network nodes is often used in this case (Kay, 1996, p. 118). H. Thorelli talks about the network as a minimum of two organizations operating in stable relationships (Thorelli, 1986, p. 37). Often the concept of pointing to an organization that initiated network collaboration or is of key importance in this structure (the dominant node) will also appear, as not every network relationship must be equivalent (Niemczyk 2006, p. 28). However, what is important, the variability of the environment causes that the position and its strength in the relationship may change. The organization’s position in the network structure is always dynamic and relative (Grandori & Soda, 1995, pp. 183-214). Taking into account the fact that the basic process taking place in the network is the flow of tangible and intangible resources (including knowledge), nodes that act as flow stimulators (organizations that look for sales markets) and nodes that are a flow reactor (accept orders from others) can be distinguished.

In the literature on the subject there is also the notion of so-called network capacity, which, according to research (Håkansson & Snehota 2006, p. 138), affects and can determine the position of the organization in the network. This network capacity is often determined by resources and market position, but

also by the ability to negotiate, the ability to observe the market, or the ability to interact and self-adapt to changing conditions. In such situations, it happens that the dominant node becomes not the one with the strongest resources, and the one with the ability to adapt (Andersson & Mattsson 2010, pp. 917-924). This, in turn, is largely a derivative of the ability to collect and manage knowledge resources. Network capacity is a set of processes and routine organizational behaviors aimed at exploiting the opportunities associated with embedding a company in an inter-organizational network (Mitrega, 2010, p. 101). Analyzing nodes in the inter-organizational network, their common features can be determined (Niemczyk, Stańczyk-Hugiet & Jasiński, 2012, p. 25):

- nodes create relations between each other based on the flows of resources and knowledge,
- nodes are independent of each other by capital and legally (nodes related by capital or legally occur in network organizations),
- nodes independently decide whether to enter or leave the network,
- the sum of nodes' activities brings a synergistic effect (systems of strategic, tactical and operational co-operation),
- mutual interdependence of nodes is based on the implementation of both a common and individual, subjective goal (which in the individual approach may be different),
- nodes have the ability of flexible adaptation, consisting of the ability to enter into modular interactions,
- nodes have the ability to actively learn from other participants and use synergy (the so-called team work skills),
- nodes communicate with other network members despite the high degree of heterogeneity,
- the nodes are mutually complementary (mutual provision of competencies),
- nodes can enter into a risky relationship.

INNOVATION AND THE NEED FOR CHANGES IN THE MANAGEMENT SYSTEM

The literature lists a number of factors influencing the readiness to undertake innovative activities by organizational units (Zott & Amit, 2010; Tubielewicz, 2013; Koziół-Nadolna, 2014; Kisielnicki & Sobolewska, 2019). Networking is also considered to be a particularly desirable activity, as it ensures that extra unmanaged resources (both tangible and intangible, of which human resources form important part) are guaranteed. Networking can facilitate mutual learning, which is particularly important in the innovation process. However, there is a parallel theory that does not deny the importance of network cooperation, but it speaks of the importance of close (spatially speaking) relationships and their impact on organizational creativity. It is a concept by D. Maillat and J.-C. Perrin that dates back to the early 1990s, known as "*milieu innovateur*" or "French school of proximity" (1992). This approach highlights the essence of physical space as a condition that is essential for initiating any relationship between project members. This implies that, in line with the approach of the school of proximity, innovation requires a variety of cooperative relationships, but this cooperation should not be remote and should be implemented as closely as possible in the physical sense of the word, so that interactions between participants can take place. Organizational proximity must not, however, be reduced to a geographical dimension, as is recalled by B. Pecqueur and J.-B. Zimmermann (2004). They emphasize that proximity is made up of a number of factors, such as historical or social determinants. The French school of proximity points to three basic types of proximity, which are (Pachura, 2015, pp. 54-55):

- Geographic proximity, understood as the physical distance between organizations in a given territory;
- Organizational proximity, represented by principles and formal rules of cooperation between companies;
- Institutional proximity, taken to be a common sphere of organizational behavior, including informal behavior based in many cases on trust.

At present, two types of businesses can be distinguished in terms of innovation. The first group is faithful to traditions and relies on proven methods and means, while the other is a company striving for success by introducing innovations and novel technologies to the market. The first group is focused on maintaining good relationships with regular customers and offering them proven products or services. This activity is to focus attention on the interior of the organization and to treat customers as passive consumers (Prahalad & Ramaswamy, 2005, p. 121). The actions are centered around the exchange of products between the company and the customers. Companies that use innovation in their activities are mainly geared toward the development of the organization, taking into account the dynamically changing environment they operate in. This way of running a business is reduced to developing new technologies, gaining new clients and conquering new markets. It is also important to meet customer expectations that change along with the progress of their environment. Innovation management is a highly necessary activity in modern times marked by rapid technological advancements and constant striving for change.

Factors determining innovative undertakings are (Trzepizur, 2016, pp. 55-56):

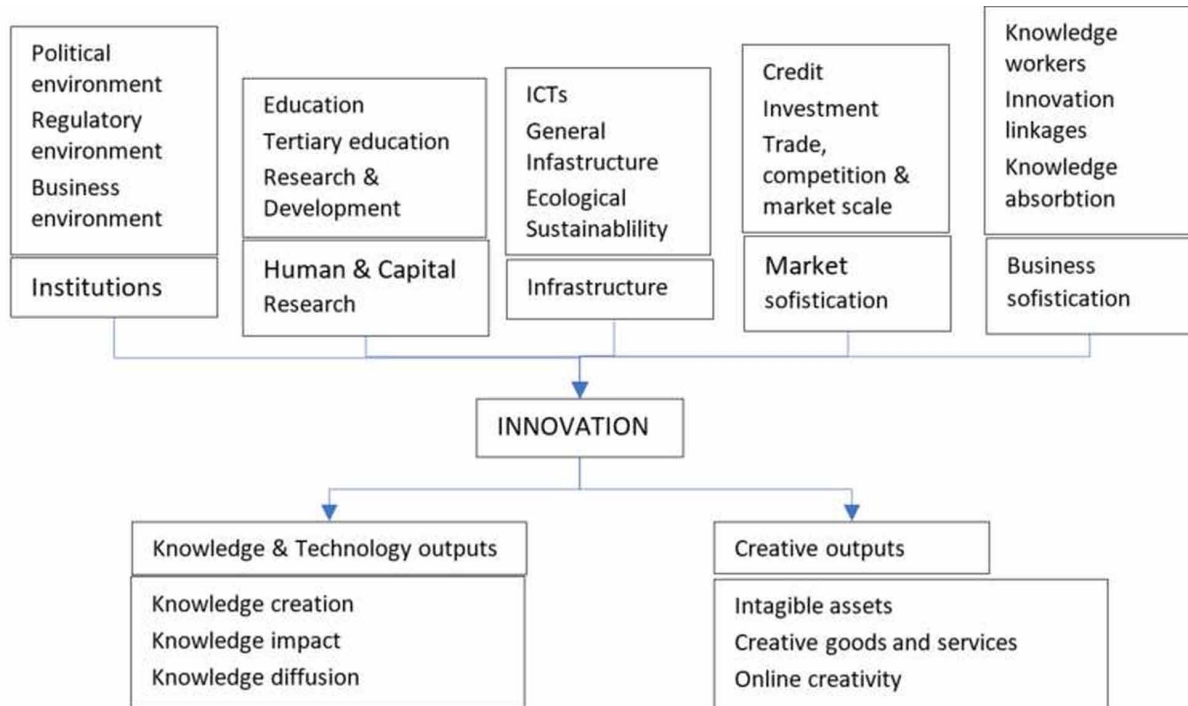
- Level of satisfaction of the needs of both individual and business customers.
- Supply structure transformations, taking advantage of the market gap.
- Possession of human and material resources, or lack thereof.
- Competition among companies - it is much more difficult to implement a new product with a large number of competitors.
- Market feel, i.e. knowledge of customer needs and the ability to estimate whether a product or service will be able to attract buyers.
- Business size - large companies are more likely to implement a new product, among other factors because of their greater financial resources and properly trained staff.
- Readiness to assume risks associated with the launch of an innovative product or service. This is due to the fact one can never be 100% sure if the novelty will prove successful and attract customers.

These factors are also evident in Figure 1, where they are elements of innovation, as represented by S. Dutta, B. Lanvin and S. Wunsch-Vincent (2017, p.11) whose view of innovation is more universal. While the above-mentioned factors were microeconomic, they were strictly dependent on the organization itself (the determinants of size or risk-taking were analyzed), whereas the second approach is more global. Economic factors influencing innovation are: institutions, human and financial resources, and infrastructure. Under the global economy, it is possible to map the factors in a transnational context that exceeds the boundaries of one country or region. It remains clear, however, that regardless of the scope of innovation and its outreach, the ultimate product is knowledge, as highlighted in Figure 2 as well.

Undoubtedly, regardless of the scope of innovation and its scope, the product that arises is knowledge, which is also indicated in Figure 2. The fact of co-creating knowledge resources is also one of the key factors in the formation of network organizations. The importance of the fact of building knowledge as

Figure 2. Innovation's inputs and outputs

Source: based on: (Dutta, Lanvin & Wunsch-Vincent, 2017, p. 11)



an additional product of networking cooperation was emphasized in numerous publications. V. Pronskikh and O. Sobolewska (2018) analyze network cooperation in international scientific projects and point out that cooperation between teams has a positive effect on the quality of knowledge created as a result of scientific projects. This factor is crucial for entities from the field of science. The quality of knowledge is critical for further development prospects and for the strategic position of every organization (Chuang, 2004; Andreeva & Kianto, 2012; Myers, 2015) and it is also truth in case of a scientific unit. The quality of knowledge created in scientific units manifests itself not only in the number and the quality of publications but also through patents and implementations. All these activities influence the position of a unit as a centre of expertise (in case of universities) and as a cooperation partner (on the part of other organisational units of a scientific nature or of a business nature). It is an extremely important element of building the market position of an organisation and then strengthening its competitive advantages. At the same time, the complexity of scientific projects, limited access to tangible and intangible resources makes it necessary to create partnerships and cooperate to achieve scientific goals. Coopetition is a new phenomenon in the history of science development. The situation when rival scientific units start cooperating happens often in this market branch.

A company that intends introduce innovations needs to perform a number of activities in order to make the first use of new technical, technological and organizational solutions. These processes are represented by two types of linear models: *technology push model* and *market pull model*. The difference between them concerns identification of the source of innovation. In the push model, fundamental research becomes the cause of innovation, and further use leads to the emergence of a new product or solution. The customer is treated as a passive user who benefits from an innovation but is not expected to cooperate in creating or developing an innovative product. The second model is an innovation that has been perceived

as a market need (P. Drucker, who mentions the importance of environmental and market observation in the novelty process, wrote about this type of innovation). In this case, the inspiration and immediate cause for the work on the new solution are customer expectations that remain unsatisfied. The recipient and the existing market gap are the driving force behind the commencement of basic research. This is referred to as a demand model, given that it is the unsatisfied demand that inspires an innovative action undertaken by the organization. The interaction of the supply and demand side in innovation is being increasingly discussed these days, and many examples of implemented and commercialized solutions show that the two sides of the classical market (demand and supply) are elements that, in the process of introducing innovation, should complement each other. The impact on innovation on the part of its potential customers is present in digital economy, a phenomenon that is more and more commonplace. This state of affairs results, to a great extent, from the ever stronger network-based cooperation between market participants.

The literature distinguishes two key approaches to the innovation process - closed and open (Chesbrough, 2003; Koziół-Nadolna, 2013; Kisielnicki & Sobolewska, 2019). The closed model is based on own resources and protection from competition. It refers to tradition and the classical trend in the sciences of organization and management. It is based on the assumption that a company is self-sufficient and that all required resources can be acquired independently, without the need for other organizational units to be involved. Limited to internal resources only, this process demands from organizations to be prepared to spend a considerable amount of both physical and financial resources as well as the need to update their knowledge, including through research and development. This is an important barrier that is particularly evident in the automotive industry, which P. Drucker described as *“the industry of industries”* (Drucker, 1946, p. 149) The sector in question leaves practically no room for small organizations and its participants are companies with strong market positions and well-known brands. These are the businesses that regularly decide to take joint action even if the partner is an active competitor. The reason for such atypical behavior is the limited access to resources, including the knowledge base, as well as the enormous costs associated with the development of further innovative solutions. In this case, there is the possibility of sharing both costs and risks between partners. Closed innovation appears to be a very convincing solution, but in a constantly changing world, fewer and fewer companies can afford to implement this strategy, precisely because of the constraints in their resources and the access to possible desirable means of production. Another factor that further hampers the choice of closed innovation is time. Even well-established organizations that do not normally struggle with access to all sorts of resources are forced by today's market to innovate as quickly as possible. Time may be another strong constraint for choosing a closed innovation strategy. The basic assumptions of closed innovation are (Koziół-Nadolna, 2014, p. 297):

- Employ properly trained staff, smart people and experienced professionals.
- Motivate employees to come up with and develop new ideas.
- If pursued, unique ideas offer a chance to become a pioneer in a given market.
- Being the first to do something in a given market in most cases is identified with a win.
- The right amount of innovation, efficient implementation and being first in the market can contribute to market leadership.
- Controlling intellectual property to prevent employees from using the innovation to the company's disadvantage later on.

The closed innovation model relies on the use of own resources. On the other end of the spectrum, one will want to manage innovation based on an open system. In today's world, most innovations are related to interactions between individuals, organizations and the environment in which they operate. This assumes, mainly, the sharing of ideas and the acquisition of good solutions from other companies. There are also ideas that are not pursued by the organizations they originate in. In such cases, it is in many respects beneficial to sell a license for such idea to another company, which at the same time contributes to additional economic benefits for the author (Kozioł-Nadolna, 2014, p. 298)

The open innovation model, mentioned in the earlier section of this chapter, is based on the assumption that in today's market environment, relying solely on the resources held by the organization no longer suffices to introduce actual innovations. Coming up with innovative solutions forces organizations to use a wider pool of resources, often those that do not directly belong to the organization. The traditional (closed) approach was based on the premise that one of the key tasks of the organization was to protect its intellectual property. Organizations that are interested in developing innovative solutions, based on the assumption of the closed model, benefit from external sources, but this is primarily reduced to market observation and the acquisition of patents, licenses or copyright to specific solutions. In the open model, meanwhile, an organization – in addition out using internal sources of knowledge - is open to partnership (Fig. 3). The list of partners for further cooperation can be very extensive and may include organizations (sometimes direct competitors) or scientific and research units.

Figure 3. Closed and Open Innovation Model

Source: (Chesbrough, 2003, p. 36)

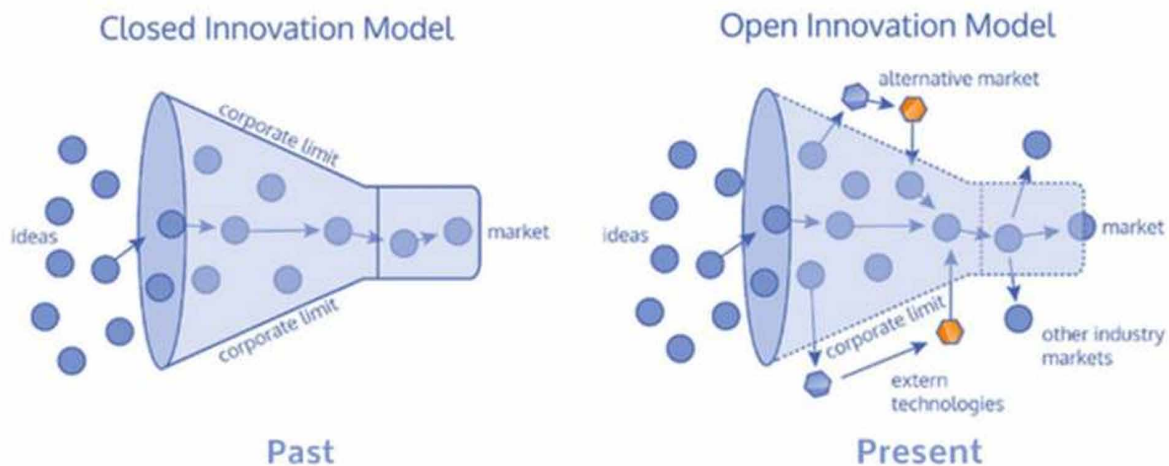


Table 1 lists the reasons why organizations are increasingly shifting from the closed to open model in the innovation sphere. This requires the organization to update the way it thinks and perceives its surroundings, and sometimes it is strongly linked with the need to introduce a new organizational culture that differs from the current one. As pointed out by various authors – among them A. Osterwalder and Y. Pigneur (2012) whatever the case, it must be a culture founded on a solid business model that will serve as a canvas for further activity. This model will guide developments and account for change management, which has become a determinant of modern economics.

Table 1. Closed innovation vs Open innovation

Closed innovation	Open innovation
The smart people in our field work for us	Not all smart people work for us. We need to work with smart people inside and outside the company
To profit from R&D, we must discover it, develop it and ship it ourselves	External R&D can create significant value. Internal R&D is needed to claim some portion of that value
The company that gets innovation to market first will win	Building a better business model is more important than getting to market first
If we create the most and the best ideas in the industry, we will win	If we make the best use of internal and external ideas, we will win
We should control our IP, so that our competitors cannot profit from it	We should profit from other's use of our IP (license-out) and we should license in other's IP whenever it advances in our business model
We will own all results from contract research with universities	We will partner with universities to create knowledge and encourage use outside our field

Źródło: (Chesbrough, 2003)

Market changes, strongly correlated with the development of information technology, have caused a gradual blurring of boundaries between the organization and its environment. Increasingly, the value provided by the company is co-created as a result of dialogue between the organization and its "stakeholders", as noted by C.K. Prahalad and V. Ramaswamy (2005, pp. 2-5). A value co-creation model that fits perfectly into the reality of today's organization stems from interaction with the recipient of the product or service. Customers today are not just passive recipients of the finished product, but rather their co-creators (Rossi, 2011, p. 48). The shift that is taking place within organizations towards interaction and co-creation of values, as well as the emphasis on the importance of the customer and other stakeholders in this process, is shown in Table 2.

Table 2. Migrating to co-creation experiences

	Traditional exchange	Co-creation experiences
Goal of interaction	Extraction of economic value	Co-creation of value through compelling co-creation experiences, as well as extraction of economic value
Locus of interaction	Once at the end of the value chain	Repeatedly, anywhere and any time in the system
Company-customer relationship	Transaction based	Set of interactions and transaction focused on a series of co-creation experiences
View of choice	Variety of products and services, features and functionalities, product performance, and operating procedures	Co-creation experience based on interactions across multiple channels, options, transactions, and the price-experience relationship
Pattern of interaction between firm and customer	Passive, firm-initiated, one-in-one	Active, initiated by either firm or customer, one-on-one or one-to-many
Focus of quality	Quality of internal processes and what companies have to offer	Quality of customer-company interactions and co-creation experiences

Źródło: (Prahalad, Ramaswamy, 2004, p. 8)

At this point it is important to note that cooperation aimed at developing innovative solutions, services or products, can take very different forms and cover a wide range of individuals. Such interaction

can occur among active competitors, companies of similar structure operating within the same market sector – in which case one can speak of relations of cooperation. They may also be activities that are undertaken by individuals from different sectors of the economy, differing in size, organization and management model, or organizations belonging to very diverse cultures

COMMUNICATION IN NETWORK ORGANIZATIONS

The communication structure can be defined as a set of elements of a given system with different relations between them. Communication structures can be analyzed and assessed against a variety of criteria. The central criterion is the number of intermediate levels. The number of levels (intermediate tiers) determines both the degree of organizational complexity and the way in which knowledge and information are transmitted and absorbed. There is a tendency to reduce the number of intermediate levels and transmit information and knowledge directly. In many organizations, however, the traditional hierarchical communication system is applied.

Contemporary communication systems are becoming increasingly network-based and relational.

The network communication system bears the following essential characteristics (Kisielnicki & Sobolewska, 2019, 101-109):

- Flexible actions undertaken in order to continuously improve the effectiveness and efficiency of the organization as a whole;
- A constant flow of information and knowledge among all those involved: employees, investors, suppliers, customers, which is connected with cooperation in different cultures and time zones within a uniform global network;

Building teams that can quickly deliver high-quality solutions based on the knowledge gained from work in network teams.

The operation of the network communication system is described later in this chapter. It concerned the implementation of MRP systems and the design and implementation of BI systems in large organizations such as banks, trading and manufacturing companies. The network communication system was well received by the project workers. It turned out to be both efficient and effective. The use of this type of communication made it possible to achieve obvious results such as increased speed of information transfer and a reduced scale of disinformation. What is the added value? This communication model enabled the application of agile methodologies during a research project.

Apart from sets of information and knowledge, communication systems also comprise networks of relations between individual elements and their aggregates. Sets of notions as aggregates are often termed concepts. Their presentation creates conceptual schemas that, as a description of a certain domain of knowledge, can serve simultaneously as a basis for inference. Such a set of information and relations is defined as ontology. Ontology is a formal representation of a user-defined knowledge domain. It is the records of sets of concepts and relations between them. Creating ontology fulfills the tasks of the users of the communication process in a formalized way (Fensel et al., 2006). Thanks to the communication system, users will obtain the needed data, information, knowledge, ideas, and strategies. Thereby, their information needs are satisfied. The analyzed part of the communication system also includes a set of concepts, techniques and notations aimed at projecting the semantics of data, or their meaning in the outside world. The literature uses different types of notations to present information, knowledge and

their aggregates in accordance with the facts (Dumas, La Rosa, Mendling & Reijers, 2013; Karagiannis, Mayer, & Mylopoulos, 2016).

The establishment of network organizations is aided by the emergence and development of mobile technologies. It is their development that contributes to the enhanced computing power of mobile devices, increased data throughput, and users gaining access to databases and knowledge whenever and wherever they need them. Mobile technologies contribute substantially to the changes in both business and society. They have led to the formulation of new rules and patterns of communication behavior. In their works, researchers clearly pointed to the immense potential of wireless solutions for the development of communication systems (Wan, Zhuohua, Keliang & Rongshuang, 2013). Even the most complex management structures can work in this way. The intensive advancement of mobile technologies in recent years has enabled the improvement of communication processes. This has been achieved through: deployment of mobile infrastructure, smartphones, and accelerated data transmission processes. With the rapid development of mobile technologies, it will soon be possible to talk about organizations whose employees have access to the data they need, regardless of place and time. As a result, mobile technologies allow for the minimization of constraints ensuing from the distance between the sender and the receiver. These changes are aimed at supporting the management of network organizations. The contemporary communication model within a computer network provides all hosts with the same authorizations. This is interchangeability depending on the specific client-server architecture.

As argued by M. Castells, mobile solutions result in the emergence of a new power theory based on the management of communications networks in the information era. Hence, we can recognize that hierarchical structures typical of traditional organizations are gradually making room for network structures. Network organizations use BI systems, in particular Business Activity Monitoring (BAM)

The analysis of the research evaluating successes and failures of IT projects was performed on the basis of the ISBSG database (Kisielnicki & Sobolewska, 2019, 105). The database contains historical data on completed IT initiatives from a number of public and private institutions operating in various industries and administrations. These initiatives concerned both development of new and modification of existing software. The analysis shows that most IT projects exceed the pre-defined cost and time. Many publications offer a more detailed examination indicating the reasons for IT project failures list the following reasons for failures: lack of communication within the team and with stakeholders, unrealistic budget and schedule, complexity and a prototypic nature of IT systems, lack of sufficient resources or team qualifications.

The research focused on comparing two most popular communication systems used in project teams: traditional (hierarchical) and network. The research on communication systems in project teams was done for projects carried out in different years (1996–2015). The investigation covered 28 management systems for R&D projects concerning the design or implementation of IT systems. The author participated personally in 18 projects as a performer of tasks or a project manager. The data for research on other projects were obtained from documentation and interviews with project participants. Author's involvement in those projects concerned supervision over their implementation. Difficulties in conducting the research were caused by the practical impossibility to compare the effects produced by two teams using different communication systems, due to the unique nature of the analyzed situations (which is a rule in research projects). Such an experiment would require identically qualified teams carrying out the same project, hence the quantitative results are based only on expert estimates.

This set of projects provides a picture of a very broad research spectrum. The investigation covered both business (20 projects) and administrative (8 projects) organizations. Although most projects (19) were successful, they had encountered many threats in the course of implementation. The success was

assumed to be a situation where the planned project scope, implementation time and costs had not increased by more than 10% in the previous two years.

Teams of 20–60 people took part in the implementation of each project. These were both designers and cooperating specialists in various industries. Such a minimal size of the implementing team was chosen because the survey was focused on teams where implementation required cooperation of various teams. The research questions were:

- What is the effectiveness of basic communication systems in project teams (do the team members feel that they received full information and knowledge about the performed tasks from other team members)?
- What rules should be applied to manage a project team so as to ensure the best flow of information and knowledge in achieving the set objectives?
- What communication system can be recommended for the implementation of R&D projects?

The effectiveness of a communication system is understood as the degree to which the project objectives have been attained, i.e. the success as specified above. The analysis covered: documents (conceptual design and documentation of project implementation including: costs, times, scopes), special questionnaires filled in by both selected managers and designers, reports on the implementing team's discussions (in which I participated) about the causes of failures or difficulties in project implementation.

Discussions were the primary research method, supplemented by the analysis of documents and questionnaires. Documents and questionnaires showed that there were problems to be solved. Discussions about changes in the management system provided recommendations on what should be done to address these issues. Experts were very often involved in the discussion on the causes of threats. They were outsiders including specialists from cooperating teams as well as users. Any major deviation from the assumed standard (plan, schedule) was debated and considered. The analysis of documents and questionnaires verified the answer to the question of whether the decisions taken had been effective. One of the basic questions asked after project completion was: Would you like to work on the next project in the same team?

In order to enhance the analysis of the communication system, the examination occasionally covered the time within which the information given to a particular person would reach all team members. In that case, the information was transmitted as an e-mail, and the time when the message would be read was analyzed. The frequency of using a database or the frequency of sending and receiving e-mails was also investigated. The ancillary question concerned the degree of understanding and usefulness of information to the recipient. The combination of the speed of information transmission, information comprehension, usefulness and appropriate use has a decisive influence on project success understood as its implementation within the planned time span, scope and costs.

The factors that disturb communication processes in project implementation can be divided into the following groups:

- Caused by external factors: delay in the delivery of technical and financial resources, inadequate documentation provided by the user, change of legislation, change in the management system of the organization for which the project is carried out, random factor, and a team member's incapacity for work (illness);
- Resulting from internal factors such as: poor communication, lack of knowledge and experience in project implementation, conflicts between team members, errors in project management.

All the factors listed as internal are very strongly linked with the communication system. The research results formed the basis for improving the existing information transmission system. Communication systems were also analyzed against the following criteria:

- Deviations from planned costs, time, adopted parameters;
- Failure to spot threats in time;
- Conflicts during task performance;
- Lack of cooperation and failure to share knowledge with partners;
- Willingness to work on the next project in the same team.

The examination of those communication systems revealed that:

- Out of 18 network communication systems, 15 projects had been successful (i.e. over 80%) according to the previously adopted criterion;
- Out of 10 traditional communication systems, 5 projects had been successful (i.e. 50%).

Certainly, not only communication systems are responsible for success. However, the answer to the previously mentioned question: “Would you like to work again in the same team?” was symptomatic. The following responses were given in this respect:

- Traditional – hierarchical communication system: positive responses: 60–70% of managers and about 30% of designers.
- Network communication system: positive responses: 70–80% of those surveyed (it was impossible to make a precise differentiation between managers and designers for this system).

The number and gravity of conflicts were much lower in teams working in network communication systems than in hierarchical systems. The analysis of the results showed that data transmission time was about 30% shorter in network systems than in hierarchical ones.

The research on the functioning and effectiveness of communication systems make it possible to argue that the network system has an advantage over the traditional (hierarchical) one, notably as regards the following elements:

- Monitoring of implementation. Risks to implementation and deviations from planned costs, time, adopted parameters of IT systems were spotted earlier than in hierarchical systems, hence intervention decisions could be made in good time. Also, almost all staff working in network systems felt responsible for the project;
- Cooperation and knowledge transfer in task performance. There was good cooperation between co-workers in task performance and transfer of information and knowledge to their partners. No artificial barriers existed such as leaders and employees. Generally, each worker is a leader and a performer of tasks, depending on the situation;
- Problem solving. Conflicts in task implementation were much less severe than in hierarchical systems, and if they arose, they were quickly resolved within the team.

The communication system used in a network team requires a number of conditions to be met. The level of qualifications of individual employees and their willingness to work together are most important.

Such a system is difficult for individualists and people wishing to make an administrative career. In the recommended system, the career path is directly associated with professional development. Nonetheless, it should be realized that this is a system where projects are difficult to manage. The leader of the entire project bears a great responsibility, being in charge of team selection and organization and creation of an appropriate climate. Compared to the hierarchical system, the project leader should give up many managerial powers and delegate them to the implementing teams. Yet, the leader's responsibility for project implementation does not change. Therefore, many project managers, even realizing its limitations, prefer the hierarchical system as allowing for easier control of the work done by their subordinates and strengthening their formal authority.

It is quite difficult to provide unequivocal answers to the questions:

- Which of the analyzed communication systems is more effective under all circumstances of research project implementation?
- What is the economic efficiency of replacing a hierarchical communication system with a network one?

Effectiveness and efficiency depend on manifold factors. The research found that about 20% of the surveyed employees in various business areas were concerned about network communication systems. The respondents believed that such communication systems did not ensure adequate security of transmitted information. For that reason, I would like to conclude by noting that it is not only the communication system that determines the working efficiency of the project team. It is also very important to select project team members and decide on the incentive system for those implementing the project.

CONCLUSION

Managing contemporary organizations is a multi-faceted issue. This is no longer just a search for excellence by optimizing the processes carried out within the organization. While the efficiency and effectiveness of the organization process is invariably a desirable feature, the management of the human factor and its potential is at the forefront of the foreground. Human capital, initially in theories on organization and management, was treated as another, quite expensive resource at the disposal of the enterprise. Nowadays, in the conditions of a knowledge-based economy, human capital is gaining more and more importance not only at the microeconomic but also at the macroeconomic level. Man is no longer just a productive factor that affects the implementation of processes in the organization, their excellence, but becomes a potential that plays a role in a much wider scope than that set by the organization's boundary. Knowledge is the basic resource not only of a single organization but of whole economies. It is the foundation that allows the creation of innovations that are so awaited and desired in the modern world.

Contemporary innovation also changes its shape. This is no longer a closed-end innovation, created within the boundaries of a research laboratory or in the research and development department of a company. Innovations are more and more often open in nature. They are a response to expectations formulated by the recipients. This requires constant communication and exchange of opinions between the organization and its surroundings. One of the elements of this environment are customers who formulate their expectations and needs. They are an important element, but not the only one.

FUTURE RESEARCH DIRECTIONS

Modern organizations conduct an uninterrupted dialogue not only with clients, but also with partners, with competitors, with scientific entities or with administration. It is not a closed list, because in conditions of an increasingly networked world - everyone is invited to the conversation and exchange of opinions. And every opinion is valuable, because it can be an inspiration for further actions, for creating innovations

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KEY TERMS AND DEFINITIONS

Communication Structure: In an organization is a set of elements of a given system with various types of relationships established between them – relationships. In the case of organizations with traditional structures, it is often a consequence of its formal structure. For a network organization, it takes a more flexible form because it is the result of achieving the objectives pursued by network nodes.

Innovation: A series of activities leading to the production of new or improved products, technological processes or organizational systems.

Network Node: A component of the network. It is a person or organization undertaking a cooperation relationship within a network structure Innovation - is a series of activities leading to the production of new or improved products, technological processes, or organizational systems.

Network Organization: Organized, polycentric structures in which traditional hierarchy-based coordination has been replaced by strengthening horizontal links. These are temporary structures created to achieve specific goals.

Open Innovation: An innovation that results from the exchange of knowledge and cooperation between organizationally independent units: enterprises, universities, or public institutions. Open innovation is based on the assumption that in modern market conditions it is no longer sufficient to introduce real innovations, relying only on the resources owned by the organization. Creating innovative solutions requires organizations to use a wider pool of resources, often those that do not belong directly to the organization.

How IT–Enabled Dynamic Capabilities Add Value to the Development of Innovation Capabilities

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INTRODUCTION

Many organizations face intense pressure to transform their current business model and operations toward more sustainability, and innovation-driven organization (Dao, Langella, & Carbo, 2011; Hanelt, Busse, & Kolbe, 2016; Seidel, Recker, & Vom Brocke, 2013).

Major technology trends and developments like big data analytics, robotics, Internet of Things, and the rise of artificial intelligence are making firms' ability to change and adapt its organizations' structure, architecture, and people as crucial as its competitive strategy. However, merely possessing valuable, rare, inimitable and non-substitutional (VRIN) information technology (IT) resources within this day and age, is not enough to enhance organizational benefits and to maintain a competitive edge (Eisenhardt & Martin, 2000). Organizational capabilities, rather than IT assets, resources or products, have been suggested to be a critical competitive differentiator (Strønen, Hoholm, Kværner, & Støme, 2017; Teece, Pisano, & Shuen, 1997). These capabilities represent an organization's potential to achieve specific business strategies and management objectives using focused deployment and are considered the building blocks on which organizations compete within the business ecosystem. Eisenhardt & Martin (2000) suggested that managers use these particular capabilities through integrating, building and reconfiguring internal and external competencies to achieve competitive advantage, rather than 'simply' possessing the capabilities (Eisenhardt & Martin, 2000; Strønen et al., 2017).

As the need to innovate increases in today's business environment, IT is often an important supporting factor through adapting to its environment and meeting new demands while maintaining quality and efficiency (Rowe, Besson, & Hemon, 2017; Van de Wetering, Mikalef, & Helms, 2017). Previous studies posited the term IT capabilities, in this particular context, in an attempt to measure a firm's proficiency in exploiting its IT assets. IT capabilities—firms' ability to mobilize and deploy IT-based resources in combination or co-present with other resources and capabilities in order to differentiate from competition (Bharadwaj, 2000)—, have been viewed by past literature as complex, multidimensional constructs (Kim, Shin, Kim, & Lee, 2011; Pavlou & El Sawy, 2006; Sambamurthy, Bharadwaj, & Grover, 2003). Although there is a growing body of knowledge underscoring the pivotal role IT-enabled capabilities in the process of enhancing an organization's competitive or financial performance gains (Kim et al., 2011; Mikalef, Pateli, & van de Wetering, 2016), there is considerably less scholarship about leveraging IT capabilities and obtaining innovation, and maintain a competitive edge in the business ecosystem through the development of IT-enabled dynamic capabilities (ITDCs) (Agarwal & Selen, 2009; Mikalef et al.,

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2016; Wade & Hulland, 2004). We define ITDCs as an organization's ability to leverage its IT assets, resources, and IT competencies, in combination with other organizational resources and capabilities, in order to address rapidly changing business environments (Mikalef et al., 2016). Organizations that optimally deploy and enable their assets, resources, and organizational IT capabilities are more innovative and effective, and more promptly respond to constitutional changes in industry and market conditions than competitors (Aral & Weill, 2007). Hence, there is a clear call for scholars to investigate and unfold the mechanisms on how IT-enabled innovation is achieved, what the antecedent and conditioning role is of IT flexibility and ITDCs capabilities, and under which market conditions innovation can be achieved (El Sawy & Pavlou, 2008; Mikalef & Pateli, 2017; Van de Wetering, Mikalef, & Helms, 2017).

This chapter aims to investigate whether or not IT flexibility facilitates the formation of ITDCs, as well as if the development of ITDCs results in any significant innovation gains. Also, we want to explore how environmental complexity shapes the effects of ITDCs in this nomological path. We argue that ITDCs reflect a firm's capacity to utilize its flexible IT infrastructure to support evolutionary fitness with the external environment (Helfat & Peteraf, 2009). In sum, we develop a conceptual model and empirically validate this model at 138 Dutch firms. Hence, in this article, we address three research questions:

“(I) To what extent does IT flexibility influence the formation of ITDCs, (II) what is the influence of ITDCs on a firm's innovation capability, and finally (III) what is the conditioning effect of environmental complexity on the above relationships?”

We structured this chapter as follows. In the next section, we outline the theoretical background and propose our research model. Next, we present that methods section, including the data collection and analyses procedures. Then, we present the outcomes of this research and discuss the results. This chapter ends with the limitations of our work, avenues for future research, and conclusions.

BACKGROUND

Resource-Based and Dynamic Capabilities View of the Firm

We ground this current work on the resource-based view of the firm (RBV), as well as the widely acknowledged dynamic capabilities view (DCV). The RBV provides a solid foundation upon which firms can identify and evaluate all relevant resources (including IT assets, infrastructure, resources, and capabilities) toward their importance and deploy them to achieve and sustain competitive advantage (Barney, 2001; Van de Wetering, Versendaal, & Walraven, 2018).

Notwithstanding the theories' pivotal role in the literature, it does not explicitly address and define how they collectively should be leveraged to derive business value. The DCV addressed these particular shortcomings as a means for firms to evolve in changing environments and maintain a competitive edge (Schilke, 2014). The DCV has been one of the most influential theories and perspectives in the study of strategic management and information systems (IS) and attempts to explain—by extending the RBV—the processes through which a firm evolves in changing environments and maintains a competitive edge (Teece et al., 1997). Due to conditions of high environmental uncertainty, market volatility, and frequent change, scholars have raised questions regarding the rate to which traditional operational and existing 'resource-based' capabilities erode and cease to provide competitive gains (Drnevich & Kriauciunas, 2011). In the context of IS literature, previous investigations examined how IS/IT and architectural assets

and resources infused in organizational capabilities can help firms renew or reconfigure their existing mode of operating (Mikalef & Pateli, 2017; Pavlou & El Sawy, 2006; Van de Wetering, 2019) and which IT investments are deemed necessary to derive sustained competitive value (Kohli & Grover, 2008).

Following the tenets of the DCV, previous scholarship argued that it is more relevant to identify the organizational and dynamic capabilities that should be targeted by IT, rather than the aggregation of IT capabilities (IT resources and IT competencies). If an organization can combine its IT resources and competencies with other organizational resources and capabilities to respond to changes in the business environment, they possess the so-called ITDCs (Mikalef et al., 2016).

IT Flexibility

The configuration of all IT interlinked assets, systems, and components, network and communication facilities, and applications within the organization is called the IT infrastructure (Kim et al., 2011). IT flexibility refers to a shareable and reusable architecture, enabling IT resources to develop and support system components quickly, allowing the organization to be innovative and react to new market opportunities as business conditions change (Kim et al., 2011; Tallon & Pinsonneault, 2011) and has emerged as a *de facto* standard (Wilkinson, 2006) for the development of the organization's IT infrastructure. The extant literature unfolded the value of IT flexibility as an enabler of digital business strategies (Overby, Bharadwaj, & Sambamurthy, 2006; Sambamurthy et al., 2003) and as a critical component to adapt IT to changing circumstances (Bharadwaj, 2000; Ray, Muhanna, & Barney, 2005).

Synthesis from past studies shows some key qualities can be defined concerning IT infrastructure flexibility. These are modularity (i.e., loose coupling), standardization, and transparency and scalability (Byrd & Turner, 2000; Duncan, 1995; Tafti, Mithas, & Krishnan, 2013). In particular, the collective and complementary effect of these qualities enables organizations to develop ITDCs that are essential to cope with changing conditions (Mikalef et al., 2016), facilitate IT-based competitive actions (Overby et al., 2006) and acts as a facilitator of evolutionary fitness and adaptiveness.

Based on the preceding discussion, we argue that higher levels of IT flexibility will enhance the formation of ITDCs. Hence, we define the following hypothesis:

Hypothesis 1: *IT flexibility positively affects the development of ITDCs.*

Innovation Capabilities

Organizations continuously need to renew. This renewing process involves their processes, products, and services, and sometimes even their culture and identity. Innovation is a necessary condition to meet the demands of high volatile markets (Mikalef & Pateli, 2017; Strønen et al., 2017). Innovation capabilities can be defined as organizations' ability to generate innovations. These innovations include fundamental changes to products, services, or technologies where incremental innovations are just refinements of the same. We broadly distinguish two types of capabilities within the innovation spectrum, i.e., incremental and radical. An innovative incremental capability is defined as: 'an organization's ability to generate innovations that refine and reinforce existing products and services' (Subramaniam & Youndt, 2005). Accordingly, a radical, innovative capability is the capability of an organization to generate innovations that substantially transform existing products, services, and technologies (Subramaniam & Youndt, 2005).

Breznik and Hisrich (2014) stressed the importance to understand the relationship between dynamic capabilities and innovation capabilities. The dynamic capabilities view goes beyond heterogeneous firm

resources and capabilities (Barney & Clark, 2007, p. p. 257) and stresses the importance of grounding a business strategy in strong dynamic capabilities (Teece, 2014). Only dynamic capabilities support evolutionary fitness and innovation within the turbulent business ecosystem (Teece, 2009, p. 7) which helps organizations to create value and prosper in the marketplace (Kindström, Kowalkowski, & Sandberg, 2013).

Finally, by leveraging ITDCs, organizations can gain access to previously unavailable sets of decision options which can ultimately enhance their ability to innovate and thus provide the potential for higher performance contributions (Drnevich & Kriauciunas, 2011; Eisenhardt & Martin, 2000). Hence, we expect that ITDCs will help organizations in the quest to incrementally and radically develop new processes, products, and services. Hence, we define the following:

Hypothesis 2: *ITDCs have a positive impact on the development of innovation capabilities*

Some studies argue that IT flexibility facilitates the development of innovation capabilities (Ahuja & Chan, 2014). Recent scholarship also contends that the coevolution and the complex interactions of flexible IT infrastructures and organizational capabilities are considered cornerstones of innovation (Van de Wetering, Mikalef, & Helms, 2017). Others studies claim that the impact of IT flexibility on innovation capability is indirect and that this effect is readily mediated by strategic IT alignment (Tallon & Pinsonneault, 2011; Van de Wetering, Mikalef, & Pateli, 2017). Hence, Tallon (2011) explains how IT flexibility creates digital options, which can help organizations transform and align IT with business strategy (Tallon & Pinsonneault, 2011). Apart from this, researchers have argued that IT flexibility can strengthen the sensing, responding, and reconfiguration routines that are part of ITDCs. Overall, the combined effect of ITDCs and flexibility offered by the organization's IT infrastructure is expected to enhance innovation capabilities. Hence, we define the following hypothesis:

Hypothesis 3: *ITDCs positively mediate the effect of IT flexibility on innovation capabilities*

Environmental Complexity

In today's business environment, unpredictable rapid changes and uncertainties have become 'the new normal' (Kim et al., 2011). Research has acknowledged the influential role of external environmental factors on the relationship between IT capabilities and business outcomes (Chen et al., 2014). These environmental factors are environmental hostility, dynamism, and complexity (Chen et al., 2014). Hostility defines the scarcity of resources and level of competition; dynamism denotes the unpredictability of environmental changes, and complexity concerns the diversity of the market and the heterogeneity and range of an industry and/or an organization's activities (Chen et al., 2014; Mikalef & Pateli, 2017; Wade & Hulland, 2004). Unexpected market changes can force organizations to change their business strategy, thus, sensing the need for developing new combinations of IT capabilities and resources becomes a necessity in dynamic markets (Strønen et al., 2017; Tallon & Pinsonneault, 2011; Teece et al., 1997).

Studies have acknowledged the permeation of IT in all aspects of organizations and the importance of IT assets, resources, competence, and capabilities in enabling business abilities that help firms survive, thrive (Aral & Weill, 2007; Dao et al., 2011; Kim et al., 2011), and support evolutionary fitness with the external environment (Helfat & Peteraf, 2009). Innovation capabilities are crucial for organizations to achieve congruence with this dynamic environment (Kindström et al., 2013; Teece, 2007, 2010; Van de Wetering, Mikalef, & Helms, 2017). Previous research contends that a firm's proficiency in IT capabil-

ity development and flexible IT infrastructures in highly complex environments is strongly associated with efficient operations management and competitive process capabilities (Byrd & Turner, 2000; Rai & Tang, 2010; Wade & Hulland, 2004). That is, organizations that have a sophisticated IT capability and flexible infrastructures are better equipped to sense, analyze, seize opportunities, and more likely to transform and disseminate information and business opportunities in the day-to-day operations. Thus, sensing, responding, and innovation capabilities become a necessity in uncertain environments. We, therefore, assume that the environmental complexity will be an essential catalyst for the likely effect that ITDCs have on innovation capabilities.

Based on the above rationale, we formulate the following two hypotheses:

Hypothesis 4a: *A considerable degree of environmental complexity positively moderates the effect of IT flexibility on the development of ITDCs.*

Hypothesis 4b: *A considerable degree of environmental complexity positively moderates the effect of ITDCs on the development of innovation capabilities.*

EMPIRICAL STUDY

Research Approach and Data Collection

This research follows a positivistic research philosophy. This philosophy emphasizes that new knowledge can only be acquired through the correct application of a strictly scientific method where the focus is on discovering observable and measurable facts (Saunders, Lewis, & Thornhill, 2016). The method should be designed to yield pure data and facts which are not influenced by bias or interpretations (Saunders et al., 2016). We apply quantitative research because of the highly-structured data collection techniques. Through a deductive approach, we use and analyze data to evaluate a priori defined hypotheses related to an existing theory. The developed hypotheses will be tested and confirmed or refuted, allowing further development of the theory (Saunders et al., 2016).

We approached respondents directly through our (social) networks. This method is called respondent-driven sampling. We only identified and selected respondents that have sufficient knowledge and experience to avoid uninformed and unreliable responses. Thus, the target audience was selected based on convenience sampling. We identified Chief Information Officers (CIO's), Chief Executive Officers (CEO's), Chief Technology Officers (CTO's), innovation managers, IT managers and enterprise architects to be most familiar with our study concepts. During the data collection, we kept track of which respondent from which organization completed the survey, to make sure that every organization completed the survey only once. We also ensured that different organizations from a wide range of businesses, industries of various sizes were included. Respondents were given an incentive to take part in the survey. They were offered a benchmark report to gain insights on how well their organization scores compared to others in the same industry.

The data collection phase started on the 26th of February 2018 and ended on April 9th of 2018. In total, 610 respondents from different organizations were asked to fill in the survey. Based on the final response, a total of 138 usable questionnaires could be included for the analyses, i.e., a response rate of 23% which is acceptable for these type of studies (Baruch & Holtom, 2008). The majority of responses were from the private sector 62,3%, 30,4% from the public sector and a small percentage from non-profit (4,3%), non-governmental organizations (1,4%) and other categories (1,4%). Most responses were from

large organizations with 250+ employees (71%), 50-249 employees (14%), 10-49 employees (9%), and the remaining 6% had less than 9 employees. More than half of the organizations were founded over 50 years ago.

We controlled for potential common method bias (CMB). We, thus, performed Harman's single factor test using IBM SPSS Statistics™ v25 on our main study constructs. Hence, we loaded all construct variables on to a single construct in an Exploratory Factor Analysis (EFA). Outcomes of this analysis showed that no single factor attributes to the majority of the variance. We, therefore, conclude that our sample is not affected by CMB (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003).

Items and Constructs

The survey started with questions on the background information of the organization, such as size, industry, and age of the organization. All the primary constructs of our based on past empirical and validated work to increase the internal validity of the questions (Chen et al., 2014; Mikalef et al., 2016; Newkirk & Lederer, 2006). The entire survey was pre-tested by six Master students and a small panel of expert, including three managers/consultants from practice and two academics to ensure face and content validity. We evaluated all survey items on a 7-point Likert scale. We included the entire survey in Appendix A.

We included the following dimensions for IT flexibility, i.e.: (1) loose coupling, (2) standardization, (3) transparency, and (4) scalability. The following routines for ITDCs were adopted: (1) sensing, (2) learning, (3) coordinating, (4) integrating and (5) reconfiguring routines (Mikalef et al., 2016; Pavlou & El Sawy, 2011; Teece, 2007; Teece et al., 1997). Next, the measures for the two types of innovation capabilities (i.e., incremental and radical) are based on the items provided by Subramaniam and Youndt (2005). Finally, we used the construct items assessed by (Chen et al., 2014; Mikalef & Pateli, 2017; Newkirk & Lederer, 2006) to measure the degree of environmental heterogeneity, complexity.

DATA PREPARATION AND ANALYSES

We analyzed the obtained data using the software package IBM SPSS Statistics™ V25 and hence test the hypotheses. All constructs and measurement items were subjected to various assessments, including internal consistency, reliability, construct, and discriminant validity assessments. For operationalization purposes, we conceived all the model's constructs to be reflective of nature. Hence, the manifest variables are affected by the latent variables (Wetzels, Odekerken-Schröder, & Van Oppen, 2009). Hence, at the construct level, we checked internal consistency reliability using Cronbach's Alpha values and check whether they all exceeded the threshold of 0.7 (Santos, 1999). Also, we calculated the composite reliability (CR) values for each construct as this measure takes into account the loadings of the manifest variables (Hair Jr, Hult, Ringle, & Sarstedt, 2016). Typically, CR values should be between 0.60 and 0.90, as is the case in our research (see Table 1). Also, we assessed the construct-to-item loadings. We assessed the convergent validity by examining if the average variance extracted (AVE) of each construct is above the lower limit of 0.50 (Fornell & Larcker, 1981). Next, to convergent validity, we also discriminant validity through three different, but related tests (Farrell, 2010). First, we examined if the cross-loadings on other latent constructs are less than the outer loading on the associated construct. Next, we assessed the Fornell-Larcker criterion. In doing so, we investigated if the square root of the AVEs of all constructs is larger than the cross-correlation. All correlations among all constructs were below the common threshold (0.70). The outcomes of these assessments in Table 1 suggest that the constructs are valid and reliable.

Table 1. Assessment of convergent and discriminant validity of the model's constructs.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1. Loose Coupling	0.803											
2. Standardization	0.292	0.765										
3. Transparency	0.600	0.484	0.792									
4. Scalability	0.563	0.359	0.518	0.880								
5. Sensing	0.384	0.341	0.397	0.358	0.844							
6. Learning	0.401	0.359	0.429	0.341	0.587	0.914						
7. Coordinating	0.478	0.452	0.467	0.463	0.613	0.591	0.870					
8. Integrating	0.439	0.448	0.459	0.474	0.706	0.625	0.736	0.868				
9. Reconfiguring	0.589	0.280	0.488	0.474	0.644	0.576	0.664	0.654	0.845			
10. Incremental innovation	0.412	0.160	0.353	0.270	0.516	0.373	0.391	0.386	0.501	0.936		
11. Radical innovation	0.401	0.209	0.434	0.255	0.485	0.375	0.433	0.380	0.475	0.668	0.926	
12. Env. Complexity	0.104	0.155	0.086	0.113	0.206	0.031	0.059	0.224	0.133	0.166	0.083	0.834
Cronbach's Alpha	.89	.90	.85	.84	.86	.93	.89	.89	.86	.93	.92	.78
Composite reliability	.92	.88	.89	.93	.91	.95	.93	.93	.91	.96	.95	.87
AVE	.65	.59	.59	.76	.71	.71	.76	.76	.71	.88	.86	.70

We used principal component analyses (PCA), and the preceding Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) (Kaiser, 1974) scores and Bartlett's test of sphericity tests, to assess whether or not we could reduce the multiple items per construct to a single construct measure. Hence, we subsequently used the average values of the constructs items to represent the latent constructs.

Before running the multiple regression analyses, there are some necessary assumptions to be checked that make sure this dataset is appropriate to use linear regression to give a valid output. First, we excluded seven detected outliers to prevent any adverse effect on the regression analyses. Next, we checked the data for normality using a normal P-P plot. We used scatterplots for homoscedasticity analyses. We met all the underlying assumptions. Therefore, the linear regression analyses results can be considered valid. We used a macro for SPSS called 'PROCESS' (Hayes, 2013) to run our analyses.

RESULTS

We use PROCESS to assess our research model, thereby examining the proposed complete set of hypotheses. Results of the regression model are as follows. 33% of the variance for innovation capabilities can be explained ($R^2 = .33$) through the research model. The model is significant ($p = <.05$).

The results in Table 2 support **H1** in that two organizations that differ by one degree in the flexibility of their IT infrastructure differ by 0.747 units in their indication of being effective in using IT systems to sense, integrate, coordinate, reconfigure and learn. The regression coefficient for ITDCs on innovation capabilities, $b = 0.351$, subsequently supports **H2**, i.e., two organizations having the same degree of IT flexibility but differ by one unit in their ITDCs are estimated to be relatively stronger in their perceived innovation capabilities by 0.351 units.

Table 2. Model coefficients for the mediating model

		Consequent						
		ITDCs (M)				Innovation capabilities (Y)		
Antecedent		Coeff.	SE	p		Coeff.	SE	p
Constant	i_M	0.779	0.387	<.050	i_Y	2.210	0.328	<.001
IT flexibility (X) (H1)	a	0.747	0.081	<.001	c'	0.165	0.087	.061
ITDCs (M) (H2)		-	-	-	b	0.351	0.074	<.001
		$R^2 = 0.40$				$R^2 = 0.33$		
		$F(1, 129)=85.6, p=<.001$				$F(2, 128)=31.5, p=<.001$		

Mediation Model

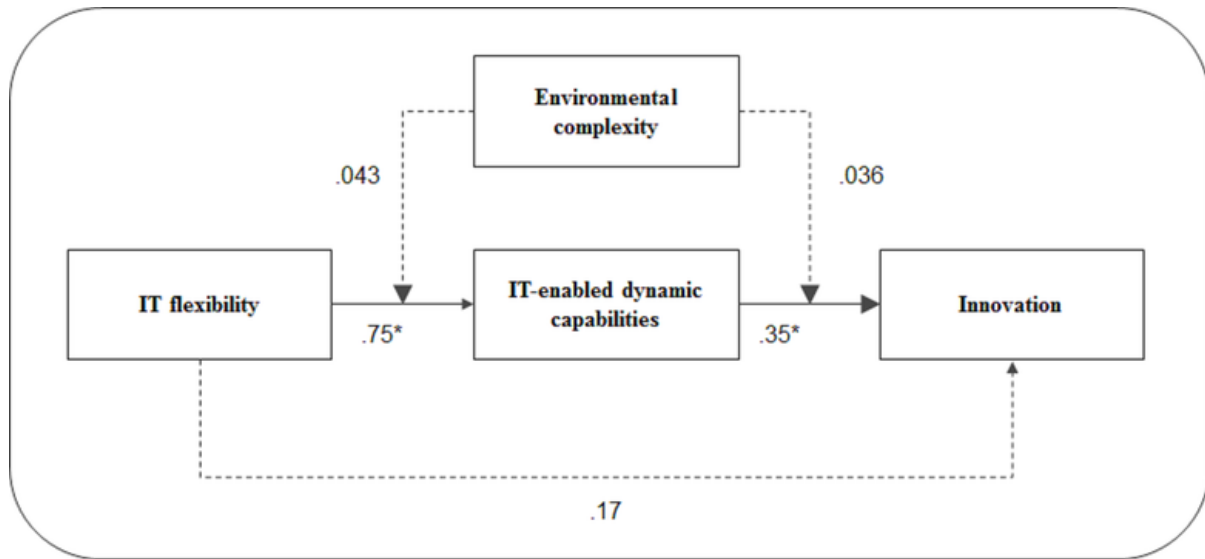
We used ordinary least squares path analysis to analyze the mediation effects. Hence, IT flexibility indirectly influences innovation capabilities through its effect on ITDCs. This indirect effect was calculated through the product of path a and path b (ab). The bootstrap confidence interval for this indirect using 5,000 bootstrap samples, is between 0.160 and 0.378. This confidence interval is entirely above zero. Therefore, this outcome supports the conclusion that the indirect effect is positive and, thus, provides evidence for ITDCs role as a facilitator of the effect of IT flexibility on innovation capabilities. Next, we will analyze if this effect is fully mediated or partially. The estimated direct effect (c') of IT flexibility on innovation capabilities is $c' = 0.165$, but misses statistical significance using an $\alpha = 0.05$ decision criterion, $t(2, 128)=1.894, p = 0.061$. So, this research finds no evidence of IT flexibility affecting innovation capabilities independent of the mediated effect of ITDCs. The total effect of IT flexibility on innovation capabilities is $c = 0.427$, and since c' is not statistically significant, ITDCs is marked as a complete mediator of the interaction, supporting **H3**. What this means is, that without the influence of ITDCs the flexibility of an organizations' architecture cannot affect its capability to innovate.

Moderated Mediation Model

Although the estimated difference in strength of ITDCs caused by IT flexibility is significant for $b = 0.747$ at $p = <0.001$, the regression coefficients for the direct effect of environmental complexity on ITDCs $a_2 = -0.043, p = 0.868$, as well as the interaction effect IT flexibility and environmental complexity $a_3 = .019, p = 0.728$ miss statistical significance. So, this research rejects **H4a** as it finds no evidence for the conditioning effects of environmental complexity. The absence of a direct moderation effect means no two conditional direct effects can be considered statistically different from each other. The same applies to the effect of environmental complexity on the development of innovation capabilities through ITDCs. The direct effect of environmental complexity on innovation capabilities is not significant at $b_2 = -0.124, p = 0.475$. Next, the product of ITDCs and environmental complexity also misses statistical significance at $b_3 = .036, p = 0.367$. Thus, the degree of environmental complexity does not moderate the effect of ITDCs on the development of innovation capabilities. Therefore, we also reject **H4b**; a particularity that we will discuss.

Figure 1 summarizes all the assessed relationships.

Figure 1. Estimated causal relationships of the research model. The * is used to denote a significant relationship.



DISCUSSION

This study examined if IT flexibility facilitates the formation of ITDCs, as well as if the development of ITDCs results in any significant innovation gains. An important outcome of this study is that the development of ITDCs is positively affected by the degree of IT flexibility. This outcome confirms previous findings by Mikalef et al. (Mikalef et al., 2016), although we even find an even stronger beta coefficient ($\beta = 0.75$).

Previously, Breznik and Hisrich (2014) called for empirical validation of the relationship between ITDCs and an organization's innovation capabilities. Our study finds a significant relationship between ITDCs and organization's aggregated innovation capabilities ($\beta = 0.351$). The combined impact of IT flexibility and ITDCs explain 33% of the variance in innovation capabilities. These outcomes also corroborate with previous claims that strengthening ITDCs in isolation is not sufficient to substantially enhance organizations' capability to innovate (R. Van de Wetering, P. Mikalef, & A. Pateli, 2017). Therefore, our current study extends the current practical and theoretical knowledge base that has paid little attention to organizational innovativeness, and IT-enabled business transformations in complex environments.

We would expect that the previously discussed mediation effect would be moderated by environmental complexity (Strønen et al., 2017; Tallon & Pinsonneault, 2011; Teece et al., 1997). However, we currently did not find any evidence to support that the diversity of the market fosters the value-adding effects of ITDCs. This outcome means that within our study, the effect of IT flexibility, through ITDCs on organizations' capability to innovate is not influenced by the market diversity. This rather weak conditioning effect might be attributed to a large part of the respondents that work in the public sector. Various respondents argued that environmental complexity questions were less relevant for their particular organizations (operating in the public sector and non-profit sector). Many other environmental factors can be taken into considerations.

This work has some interesting practical implications. Our study provides insights for organizations, mainly for IT and business managers, regarding the usage of IT to develop innovation capabilities. Hence,

we highlight the importance of maintaining the organization's IT infrastructure modular, scalable, and transparent, but organizations should mainly strategically invest in developing their ITDCs. Thus, if organizations want to achieve significant innovation capability gains, it is strategically imperative to develop their respective capabilities to sense, learn, coordinate, integrate, and reconfigure.

FUTURE RESEARCH DIRECTIONS

Despite its contributions, this study includes several limitations. First, we conveniently sampled our data. A potential disadvantage of this particular method is that our sample might not be representative of the full population (Heckathorn, 2002). A stratified sampling method that a priori includes various subgroups within a population remedies this. Second, we only asked a single respondent to fill in the survey. Future research could employ a matched-pair approach through which independent and dependent constructs are provided to different stakeholders within the organization. An alternative could also be to have multiple respondents per organization fill in the survey to gain a holistic view of the capabilities and environment of the organization. Third, our obtained survey data included various demographic variables (e.g., organization type, size). However, our empirical analyses did not take into account the possible differences among sub-groups of organizations. Also, comparing the strength of the relationships across the organization from different countries might well contribute to the generalizability of our findings. Finally, a more substantial sample space could then also contribute to more robust results.

CONCLUSION

To conclude, ITDCs are essential for the organization in the modern age. Our study tried to explain how organizations—that operate in turbulent environments—can differentiate to stay competitive, considering that they must evolve and reconfigure their processes to drive innovation. By considering the key antecedents and mechanisms through which innovation capabilities can foundationally be enhanced, we make valuable contributions to the literature. Our work also serves as a basis for future investigations.

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KEY TERMS AND DEFINITIONS

Environmental Complexity: The heterogeneity and range of industry and/or an organization's activities.

Incremental Innovation Capability: Organizations' potential to generate innovations that refine and reinforce existing products and services.

IT Capability: Firms' ability to mobilize and deploy IT-based resources in combination or co-present with other resources and capabilities in order to differentiate from the competition.

IT Flexibility: The degree of decomposition of an organization's IT portfolio into loosely coupled subsystems that communicate through standardized interfaces.

IT-Enabled Dynamic Capabilities (ITDCs): Firm's ability to leverage its IT resources and IT competencies, in combination with other organizational resources and capabilities, to address rapidly changing business environments.

Organizational Capabilities: An organization's ability to achieve specific business strategies and management objectives using focused deployment and are considered the building blocks on which firms compete within the business ecosystem.

Radical Innovation Capability: Organizations' the capability of an organization to generate innovations that substantially transform existing products, services, and technologies.

APPENDIX: SURVEY ITEMS

Table 3.

IT flexibility			
<i>To what extent do you agree with the following statements? (1-totally disagree, 7-totally agree)</i>			
Modularity		<i>Mean</i>	<i>S.D.</i>
$\alpha = .89$	KMO = .83		
[Mod 1]	Our information systems are highly modular.	4.28	1.580
[Mod 2]	The manner in which the components of our information systems are organized and integrated allows for rapid changes.	3.97	1.691
[Mod 3]	Functionality can be quickly added to critical applications based on end-user requests	4.22	1.720
[Mod 4]	Exchanging or modifying single components does not affect our IT infrastructure.	4.42	1.699
[Mod 5]	Organizational IT infrastructure and applications are developed on the basis of minimal unnecessary interdependencies	4.33	1.581
[Mod 6]	Organizational IT infrastructure and applications are loosely coupled.	4.23	1.544
Transparency		<i>Mean</i>	<i>S.D.</i>
$\alpha = .85$	KMO = .78		
[Trns 1]	Remote users can seamlessly access centralized data and processes	5.16	1.671
[Trns 2]	Our user interfaces provide transparent access to all platforms and applications	4.44	1.776
[Trns 3]	Software applications can be easily transported and used across multiple platforms	3.99	1.814
[Trns 4]	Data of one system can be easily used in other systems.	3.97	1.771
[Trns 5]	Our firm offers multiple interfaces or entry points (e.g., web access) to external users	4.62	1.772
Standardization		<i>Mean</i>	<i>S.D.</i>
$\alpha = .90$	KMO = .76		
[Stnd 1]	We have established corporate rules and standards for hardware and operating systems to ensure platform compatibility.	5.02	1.623
[Stnd 2]	We have identified and standardized data to be shared across systems and business units.	4.53	1.576
[Stnd 3]	Our systems are developed based on specifications that enable electronic links to external parties.	4.51	1.613
[Stnd 4]	Organizational IT infrastructure are developed based on compliance guidelines.	5.30	1.448
[Stnd 5]	Organizational IT applications are developed based on compliance guidelines.	5.20	1.469
Scalability		<i>Mean</i>	<i>S.D.</i>
$\alpha = .83$	KMO = .82		
[Scal 1]	Our IT infrastructure easily compensates peaks in transaction volumes.	5.00	1.460
[Scal 2]	Our information systems are scalable.	5.05	1.457
[Scal 3]	Our IT infrastructure offers sufficient capacity in order to fulfil additional orders.	5.32	1.424
[Scal 4]	The performance of our IT infrastructure completely fulfils our business needs regardless of usage magnitude.	4.68	1.519
ITDCs			
<i>Please indicate how effective your company is in using IT systems for the following purposes: (1-Not effective at all, 7-Highly effective)</i>			
Sensing		<i>Mean</i>	<i>S.D.</i>
$\alpha = .86$	KMO = .79		
[Sns 1]	Scanning the environment and identifying new business opportunities	3.95	1.609
[Sns 2]	Reviewing our product development efforts to ensure they are in line with what the customers want.	4.46	1.635

IT flexibility			
<i>To what extent do you agree with the following statements? (1-totally disagree, 7-totally agree)</i>			
[Sns 3]	Implementing ideas for new products and improving existing products or services.	4.60	1.573
[Sns 4]	Anticipating discontinuities arising in our business domain by developing greater reactive and proactive strength	4.07	1.544
<i>Integrating</i>			
$\alpha = .89$ KMO = .79		Mean	S.D.
[Int 1]	Easily accessing data and other valuable resources in real time from business partners	4.44	1.621
[Int 2]	Aggregating relevant information from business partners, suppliers and customers. (e.g. operating information, business customer performance)	4.25	1.695
[Int 3]	Collaborating in demand forecasting and planning between our firm and our business partners	4.14	1.599
[Int 4]	Streamlining business processes with suppliers, distributors, and customers	4.30	1.574
<i>Coordinating</i>			
$\alpha = .89$ KMO = .83		Mean	S.D.
[Crd 1]	Providing more effective coordination among different functional activities	4.41	1.463
[Crd 2]	Providing more effective coordination with customers, business partners and distributors	4.52	1.363
[Crd 3]	Ensuring that the output of work is synchronized with the work of other functional units or business partners.	4.40	1.443
[Crd 4]	Reducing redundant tasks, or overlapping activities performed by different operational units	4.05	1.618
<i>Reconfiguring</i>			
$\alpha = .86$ KMO = .79		Mean	S.D.
[Rec 1]	Adjusting for and responding to unexpected changes easily	4.14	1.543
[Rec 2]	Easily adding an eligible new partner that you want to do business with, or removing ones which you have terminated your partnership	4.21	1.744
[Rec 3]	Adjusting our business processes in response to shifts in our business priorities	3.98	1.472
[Rec 4]	Reconfiguring our business processes in order to come up with new productive assets	3.96	1.477
<i>Learning</i>			
$\alpha = .93$ KMO = .85		Mean	S.D.
[Lrn 1]	Identify, evaluate, and import new information and knowledge	4.33	1.576
[Lrn 2]	Transform existing information into new knowledge	4.33	1.534
[Lrn 3]	Assimilate new information and knowledge	4.30	1.535
[Lrn 4]	Use accumulated information and knowledge to assist decision making	4.25	1.495
Innovation capabilities			
<i>How would you rate your organizations capability to generate the following types of innovations in the products/ services you introduce (1-much weaker than competition; 7-much stronger than competition)?</i>			
<i>Incremental innovations.</i>			
$\alpha = .93$ KMO = .76		Mean	S.D.
[Inc 1]	Innovations that reinforce your prevailing product/service lines	4.59	1.206
[Inc 2]	Innovations that reinforce your existing expertise in prevailing products/services	4.70	1.144
[Inc 3]	Innovations that reinforce how you currently compete	4.56	1.172
<i>Radical innovations</i>			
$\alpha = .92$ KMO = .72		Mean	S.D.
[Rad 1]	Innovations that make your prevailing product/service lines obsolete	4.20	1.126
[Rad 2]	Innovations that fundamentally change your prevailing products/services	4.22	1.290
[Rad 3]	Innovations that make your existing expertise in prevailing products/services obsolete	4.20	1.164

How IT-Enabled Dynamic Capabilities Add Value to the Development of Innovation Capabilities

IT flexibility			
To what extent do you agree with the following statements? (1-totally disagree, 7-totally agree)			
Environmental complexity With respect to the uncertainty of your environment, please indicate how much you agree or disagree with the following statements (1-totally disagree, 7-totally agree)			
Environmental complexity In our industry, there is considerable diversity in:		Mean	S.D.
$\alpha = .78$	KMO = .69		
[Het 1]	Customer buying habits	4.00	1.751
[Het 2]	Nature of competition	3.86	1.777
[Het 3]	Product lines	4.07	1.766

Toward a Fitness Landscape Model of Firms' IT-Enabled Dynamic Capabilities

6

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INTRODUCTION

Scholars posit that information systems and information technology (IS/IT) are capable of revolutionizing the way firms operate, and hence drive a firm's performance under rapidly changing conditions (Agarwal & Selen, 2009; El Sawy, Malhotra, Park, & Pavlou, 2010; Kohli & Grover, 2008; R. Van de Wetering, Mikalef, & Pateli, 2017b). In understanding this particular role of IS/IT within the turbulent business ecosystem and landscape, previous studies have emphasized the importance of IS/IT in enabling organizational capabilities (Kohli & Grover, 2008). Organizational capabilities represent firms' potential to achieve specific business strategies and management objectives using focused deployment and are considered the building blocks on which firms compete within the business ecosystem (Barney, 1991). Firms that are capable of targeting and deploying IS/IT initiatives in support of these organizational capabilities are more likely to realize business value from their IT resource and IT competencies inventory (Sambamurthy, Bharadwaj, & Grover, 2003; R. Van de Wetering, Mikalef, & Pateli, 2017a). The extant literature refers to this specific capacity to effectively use IT functionalities to support IT-related activities as an IT leveraging competence (Pavlou & El Sawy, 2010).

The core principle of examining the particular value of IS/IT in enterprise processes it is embedded, i.e., IT-enabled capabilities is also highly encouraged in contemporary IS literature (Grover & Kohli, 2012; Kohli & Grover, 2008; Mikalef, Pateli, & van de Wetering, 2016). IT-enabled capabilities gained considerable as they collectively create business value and drive a firm's competitive edge (El Sawy & Pavlou, 2008; Mithas, Tafti, Bardhan, & Goh, 2012; Roberts, Galluch, Dinger, & Grover, 2012).

The capabilities we address in this current study constitute the dimensions of IT-enabled dynamic capabilities (ITDC). We define ITDCs as a firm's ability to leverage its IT resources and IT competencies, in combination with other organizational resources and capabilities, to address rapidly changing business environments (Mikalef et al., 2016). Based on the notion that firms must be able to be stable enough to continue to deliver value in their distinctive way, and agile and adaptive enough to restructure their value proposition when circumstances demand it, there is a well-documented distinction between ordinary (operational or zero-order) and these ITDCs (Drnevich & Kriauciunas, 2011; Mikalef et al., 2016; Pavlou & El Sawy, 2011; Winter, 2003). Ordinary capabilities enable a firm to make a living in the present, while ITDCs act as a continuous driver of evolution to changing business requirements (Winter, 2003). Thus, ITDCs help firms decision-makers in practice by extending, modifying, and reconfiguring existing operational capabilities into new ones that better match the environmental conditions.

There is overwhelming evidence concerning the impact of ITDCs on firm performance at an aggregate level (Mikalef & Pateli, 2017; Rai & Tang, 2010). However, there is still little consensus on how

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specific interrelations (e.g., too many or too little epistatic links and interdependency among individual capabilities) result in the achievement toward higher levels of performance and evolutionary fitness. Moreover, the extant literature has predominantly focused on the aggregate construct level of ITDCs.

Consequently, there is no clear overview of what constitutes useful configurations of the underlying interdependencies. A better understanding of the nature and role of ITDCs may have profound implications for theory and practice. In doing so, this study builds on the science of complexity recently become a significant focus of interdisciplinary research, also within the IS field (Benbya & McKelvey, 2006; Merali, Papadopoulos, & Nadkarni, 2012; R. Van de Wetering & Bos, 2016; Rogier Van de Wetering, Mikalef, & Helms, 2017; Walraven, Van de Wetering, Helms, Versendaal, & Caniëls, 2018). This chapter adopts a prominent model for studies in theoretical biology and population genetics, i.e., the so-called NK-model (S. Kauffman & Levin, 1987; S. A. Kauffman, 1993), that evolved into a valuable model to understand the antecedents of efficient, flexible, innovative and IT-enabled firms (Celo, Nebus, & Wang, 2018; Onik, Fiel, & Gable, 2017; Vidgen & Wang, 2006; Yuan & Jiang, 2015).

This study aims to address the previously outlined limitations in the literature by drawing on complexity science while simultaneously building on the foundations of ITDC. In doing so, this current study makes four main contributions. First, this chapter positions the science of complexity and evolutionary (simulation) models as a suitable 'lens' to study the behavior of firms' ITDCs. This lens has also been advocated by recent studies (Kay, Leih, & Teece, 2018; Onik et al., 2017). Second, following Kauffman's work (S. Kauffman & Levin, 1987; S. A. Kauffman, 1993; S. A. Kauffman & Weinberger, 1989) this study designs the NK-model and stochastically generate fitness landscapes using the five ITDCs as core elements of the model, and 'K' complex interactions between those five, i.e., the interdependency (epistasis). Third, firms' effort is simulated to adaptively explore and walk through a generated fitness landscape of possible strategies of interrelated ITDCs to change and move toward higher levels of fitness of ITDCs. Finally, this chapter identifies which degree of epistasis on average leads to optimal fitness values and hence firms' competitive performance.

Outcomes of our work provide new empirical support for possible business strategies that can be employed considering a firm's current status and interdependency among its ITDCs¹. To our knowledge, no scholarship is available that identifies these specific interactions among the different ITDCs and uses the NK-model to do so.

The remainder of this chapter is structured as follows. First, this chapter reviews the fitness landscapes theory and Kauffman's NK-model. Next, our methods section is outlined including the simulation model parameters, and the outcomes follow this section. This chapter ends with a discussion, including inherent limitations of this study as well as future research opportunities, and concluding remarks.

THEORETICAL BACKGROUND

Complexity science addresses the summon of adopting a dynamic methodological approach, in which scholars and practitioners are equipped with adequate assessment tools and mechanisms for examining the processes when IT and associated capabilities add value (Rogier Van de Wetering et al., 2017). This paper draws upon foundational and empirical work and presents, extends and integrates a complex adaptive systems perspective and applies this to the firm's ITDCs.

The NK model from population genetics and theoretical biology (S. Kauffman & Levin, 1987; S. A. Kauffman, 1993; S. A. Kauffman & Weinberger, 1989) has become a particularly popular reference model for studying strategy, organizational, and innovation problems and challenges through the use

of fitness landscapes (Frenken, 2006; Ganco & Agarwal, 2009; Daniel A Levinthal, 1997; McKelvey, 1999; Rivkin & Siggelkow, 2007). The model (originally) simulates an organism's adaptation and self-evolvment processes in complex and turbulent environments. Recent literature advocated the use of the NK-model to simulate and examine, e.g., organizational structure, change, and adaption (Daniel A Levinthal, 1997; Daniel A. Levinthal & Warglien, 1999; McKelvey, 1999), system and technology architecture (Frenken, 2006), business strategies (McCarthy, 2004) and enterprise intellectual capital (Fan & Lee, 2012) under the complexity science 'lens.'

The NK-model consists of N elements (in our case ITDCs), and K represents the richness of epistatic linkages (term used to describe interacting genes) among those elements. Alternatively, as Kauffman (S. A. Kauffman & Johnsen, 1991) defines it: "*K corresponds to the number of other genes, or traits, which have a bearing on the fitness contribution of each gene or trait.*" This richness of epistatic interactions among sites makes it possible for, e.g., a population to evolve toward different combinations of alleles depending on its initial genetic composition (S. A. Kauffman & Weinberger, 1989). The possible alleles of a particular element of a system can formally be described. Each string x is described by $x_1x_2x_3\dots x_n$. These strings are part of a solution or possibility set X , so that for two allelic values, or a two-allele additive haploid genetic model, as Kauffman (S. A. Kauffman & Johnsen, 1991) favors it we have:

$$x = x_1x_2x_3\dots x_N \in X; x_i \in \{0,1\}$$

The N -dimensional possibility space X is called the design space of a system. It, therefore, includes all possible combinations of the alleles of the individual system elements (Frenken, 2001). If we, thus, assume that each element within a system has two possible values, the binary strings with $N = 3$ can take the form of 000, 010, 101.....111. These strings are part of the entire possibility space which we formalize as $X = 2^N$.

In general, the degree of interaction and interconnectedness between those N elements, i.e., K , ranges from $K = 0$ (the least complex) to $K = N - 1$ (having the most complex architecture), and influences the ruggedness of a fitness landscape. With $K = 0$ the system's elements are independent concerning the fitness of all other elements. When a system is fully interconnected, each element is connected to all other elements. With low levels of epistatic linkages among elements (e.g., $K = 0$) the fitness landscape tends to be smooth with a single performance or fitness peak.

The fitness contribution of each element or trait depends upon itself and thus epistatically on K other traits (Altenberg, 1997; S. Kauffman & Levin, 1987; S. A. Kauffman & Weinberger, 1989). Therefore, each particular element makes a fitness contribution which, in turn, also (partly) depend upon the specified combinations, among $2^{(K+1)}$ of the presence or absence of the $K+1$ traits which bear upon its fitness. Now, these fitness contributions have to be specified. This procedure is done through the implementation of a matrix of all possible combinations in the N -dimensional binary space and their corresponding fitness (Bocanet & Ponsiglione, 2012; S. A. Kauffman, 1993). So, the fitness landscape is then created by randomly assigning values to the $2^{(K+1)} \times N$ fitness values. Having assigned all the fitness values, we can define the fitness of an entire genotype and specified string of possible x_i within X . Kauffman's NK-model specifies the overall fitness value F of a string x with N loci as the mean of the fitness values f_i of each element with two (binary) possible alleles at each position i :

$$F(x) = \frac{1}{N} \sum_{i=1}^N f_i(x_i, x_{i_1}, x_{i_2}, \dots, x_{i_K}).$$

Where $\{i_1, \dots, i_k\} \in \{1, \dots, i-1, i+1, \dots, N\}$. x_i now is a value of bit i within solution x . Following this logic, fitness values f_i drawn from a uniform distribution ranging from 0 to 1 (S. Kauffman & Levin, 1987; S. A. Kauffman & Weinberger, 1989), thus, take on a different value when a particular element i changes or when another element changes and thereby epistatically affects element i (Altenberg, 1997).

Following the logic from Kauffman's NK-model, a strategic change is assumed to be a process of moving from one firm strategy to another in search of an improved fitness (Daniel A Levinthal, 1997; Daniel A. Levinthal & Warglien, 1999; McCarthy, 2004). An 'adaptive walk' performs this search (S. A. Kauffman, 1993). In essence, what this means, is that if you would (randomly) initially select a point in the landscape, e.g., 001, there are now in total three 1-mutant neighbors, thus directly connected to this particular point in the landscape design (S. A. Kauffman, 1993).

METHODS

Simulation Model and NK-Model Parameters

All included dimensions that comprise ITDCs are based on past empirical and validated work. Hence, this chapter adopts five elementary dimensions of ITDCs, i.e.: (1) sensing (SEN), (2) learning (LRN), (3) coordinating (CRD), (4) integrating (INT), and (5) reconfiguring (REC) (Mikalef & Pateli, 2017; Mikalef et al., 2016; Pavlou & El Sawy, 2011; Protogerou, Caloghirou, & Lioukas, 2012) with each capability having two allelic values, i.e., '0' or '1'. The respective weights of the ITDCs in their contribution to fitness have to be specified. In the original NK-model, Kauffman assumes that all elements of the system weigh equally in their fitness contribution. In practice, however, this does not necessarily have to be the case as specific levels of complementarity among the capabilities may be present under different circumstances. This view is also empirically supported by (Fan & Lee, 2012; Valente, 2008). In light of this shortcoming of the original NK-model, the model parameters are extended with 'unequal' known weighting factors (φ) based on validated empirical work that reports path or regression coefficients of the individual capabilities (Mikalef & Pateli, 2016, 2017), see Table 1.

Table 1. Path coefficients of the weighted model; *** $p < 0.001$

IT-enabled dynamic capabilities	SEN	LRN	CRD	INT	REC
Path weights (β_i)	0.226***	0.249***	0.212***	0.212***	0.245***

As suggested by (Fan & Lee, 2012), one can now assign the different weighting factors ($\varphi_1, \dots, \varphi_5$), as φ_i being equal to β_i divided by the sum of all path weights. Note that the φ_i are appropriately weighted relatively to all the other capabilities, although the weights do not differ significantly. The overall fitness formula is adjusted accordingly (note that the factor $1/N$ now is absent because the φ_i by definition already sum up to 1):

$$F(x) = \sum_{i=1}^N f_i(x_i, x_{i_1}, x_{i_2}, \dots, x_{i_k}).$$

As a final step, random fitness values, f_i within the NK-model need to be specified. f_i is dependent on $K + 1$ binary variables, so there are $2^{(K+1)}$ different inputs. This study determines the corresponding outputs by assigning a value from a random variable that is uniformly distributed on $[0,1]$. For this, the RAND() function is used in Microsoft Excel 2013, and we represent f_i in table form. Now, that this study includes five ITDCs, $2^{(K+1)} * N$ ($N = 5$) table entries have to be generated. This set-up works for all integer K -values and thus for the simulation runs for $K = 0, \dots, 4$ in this study. Once the fitness landscapes have been specified, they remain fixed.

Proposition Development

Firms achieve fitness gains through varying levels of interdependency among the different ITDCs. Synergies only arise among the capabilities when they exhibit a degree of mutual interdependence and thus not when they are completely independent (i.e., $K = 0$). In the case of a fully connected model, the associated fitness landscape is entirely random (S. A. Kauffman, 1993; Weinberger, 1991). Also, the expected fraction of fitter neighbors falls by half at each adaptive step (S. A. Kauffman & Weinberger, 1989). Thus, when the level of K increases, it seems that more and more conflicting constraints emerge and frustration sets in (S. A. Kauffman & Weinberger, 1989).

Research has shown that for intermediate levels of K , the fitness landscape usually contains several local optima, but less than in the case of a maximum complexity scenario, i.e., $K = N - 1$ (Frenken, Marengo, & Valente, 1999). Kauffman (S. A. Kauffman, 1993) in general showed that fitness values of local optima of low- K systems are highest on average. This outcome leads us to believe that the interdependencies between ITDCs are the strongest (and lead to the highest fitness values) if the number of epistatic relations is relatively small. Another striking insight from Kauffman's simulations is that in the case of $K = 2$ (with differing values of N), the highest optima on the fitness landscape are nearest to each other and on average obtained fitness values are the highest (S. A. Kauffman, 1993). Low K -valued configurations (or systems), therefore, enjoy at least two evolutionary advantages over systems with high K -values (Frenken et al., 1999; S. A. Kauffman, 1993). First, local optima obtain, on average, higher fitness values. Second, and even more important, is the fact that the (correlated) structure of their landscape and the large basins of attraction of good local optima make firms more likely attain high fitness levels in lower K -systems (Frenken et al., 1999). Therefore, a low K -value that epistatically connects ITDCs is expected to outperform higher K -value configurations. Hence, we postulate:

Proposition: *Too many ($K = N - 1$) and too little ($K = 0$) epistatic links and interdependency among the ITDCs will inhibit overall fitness in comparison to a simple, non-complex level of epistasis; In other words, a configuration of $K = 2$, on average, will outperform all other K -values in terms of fitness values.*

ANALYSES AND RESULTS OF NK-MODEL SIMULATIONS

Simulation Analyses

In comparison with other NK-studies in the field of management and IS, this study ran our model using various values for the specified parameters. While keeping N constant because of our construct, i.e., ITDCs contains five underlying capabilities, this study varied with values for K .

As our model is probabilistic and dynamic, many runs are needed to ensure significant results (Ganco & Agarwal, 2009). Therefore, we performed 5 runs of 10,000 simulations, i.e., 50,000 simulations, for

each value of K , i.e., $K = 0$, $K = 1$, $K = 2$, $K = 3$ and $K = 4$ to average out random effects (Ghemawat & Levinthal, 2000). The generated data points in the fitness landscapes need to be searched and analyzed to test our proposition. Adaptive walks vary dramatically as the ruggedness of the landscape varies (S. A. Kauffman & Weinberger, 1989).

This study employs a local search strategy² (Nickerson & Zenger, 2004) that aligns well with one's intuition of what in practice such a search process would look like. The search strategy explores the associated neighborhood which we define as those forms or IT-enabled dynamic capability combinations that vary from the firms' current one by only one attribute (Daniel A Levinthal, 1997).

Hence, considering now that N capabilities have been included, a firm now has N different solutions in its immediate neighborhood. When, by randomly picking one of these, a higher fitness level is encountered, the search comes to an end, taking for granted that, on average, a modest performance level might be acquired (Daniel A Levinthal, 1997). This limitation can be addressed by incorporating 'long jumps,' i.e., distant search efforts on the fitness landscape, although, this strategy does not adequately exploit past obtained experience. Therefore, this search strategy is likely to result in a deterioration of performance (Daniel A Levinthal, 1997).

Core Results

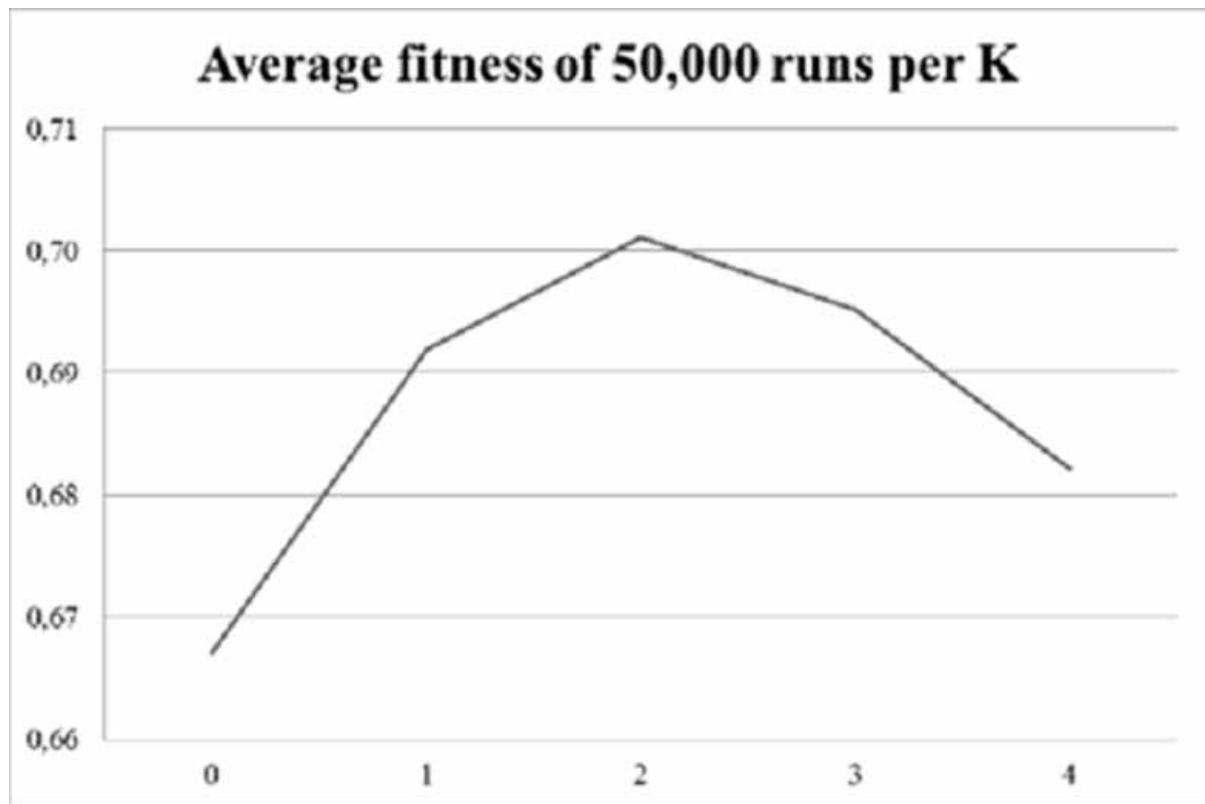
The main findings from our extensive simulation runs are now reported. Figure 1 shows the average fitness values for the 50,000 runs per K -value. Hence, fitness values range from 0.67 (for $K = 0$) toward 0.70 (for $K = 2$). An optimum can be seen at the predicted $K = 2$ level. This outcome confirms our proposition and supports the claim that, on average, an ITDC configuration of $K = 2$ will outperform all other K -values regarding fitness. This level of epistasis benefits firms in the process of obtaining higher fitness values and, of course, in such a configuration, the adaptive walk does not get caught in a local optimum.

The lowest obtained fitness values can be seen when looking at the extreme cases, i.e., $K = 0$ and $K = N - 1$. This particular outcome indeed suggests that having too many or too little epistatic links and interdependency among the capabilities will inhibit overall fitness in comparison to a more simple level of epistasis. Clearly, simulation outcomes show that higher fitness levels are obtained with the fully connected model, i.e., $K = N - 1$ instead of the $K = 0$ model. This results could be the effect of having a low N -parameter.

DISCUSSION

Most studies on ITDCs and the process of leveraging IT resources and competencies within firms, do not explicitly state their assumptions concerning the interdependency among the studied capabilities. This development, without a doubt, has contributed to seeming contradictions in IS and management scholarships. From the extant literature, we know that interdependent firm activities are critical sources of performance enhancements. This current research, however, shows that these levels and the degree of mutually reinforcing relationship between ITDCs are conditioned.

This study used a finite number of ' N ' elements, thus the five ITDCs (sensing, learning, coordinating, integrating, and reconfiguring), and a degree of ' K ' complex interactions between those capabilities. The science of complexity was then introduced as a fitting 'lens,' and this chapter highlighted the role the NK-model to study evolution on fitness landscapes on which actors or agents can tune their fitness base on available options and configurations. We departed our research with the knowledge that the avail-

Figure 1. Average fitness landscape values for different K -values

ability of new alternatives among ITDCs reflects a process of (re)combining multiple choices available. This chapter, therefore, extended this fundamental insight and simulated the degree of interconnectedness (K -value) among ITDCs to achieve optimal fitness and drive toward higher levels of competitive firm performance. Moreover, our fitness landscape model provides realistic scenarios with a nexus of possible strategies that can be employed considering a firm's current ITDCs status and interdependency among its capabilities.

Our findings have implications for business and IT managers. First, our simulations outcomes showed that having a non-complex level of epistasis among the capabilities, i.e., $K = 2$ is a crucial source of value through strategic options. Like (Celo et al., 2018; Ganco & Agarwal, 2009), this study highlights that certain levels of epistasis among ITDCs benefits firms considerably in a continuous process of obtaining higher fitness values and enhance firms' competitiveness. Second, the outcomes demonstrate the importance of investing in firms' ability to leverage its IT resources and IT competencies while simultaneously taking into account the diversity of processes and procedures that underlie the ITDCs. Hence, it is imperative for managers to pursue a pluralistic ITDC investment and development strategy. This outcome relates well to the claim made by Ghemawat and Levinthal (Ghemawat & Levinthal, 2000) that 'some choices condition other choices.' This study, thus, guides managers on allocating their firm resources across ITDCs and synchronize them with the degree of internal complexity and environmental turbulence. In doing so, decision-makers should focus capitalizing on substantial IT investments by focusing on maturing and enhancing core areas of the firm, as denoted by the underlying dimensions of ITDCs. This particular aspect raises the need for IT and business decision-makers to form multi-disciplinary teams

including IT and business experts. When executed harmoniously, IT and business representatives are committed and engaged in the process of sensing, seizing and reconfiguring internal and external IT and business competences and capabilities to address the rapidly changing business ecosystem. Third, the synthesis from this current study implies that next to a focus on one specific ITDC—where firms allocate their investments, resources, and assets to, depending on the specific conditions and state of the capability they wish to progress—firms also need to take into account the conditions and enhancement opportunities for two interrelated yet distinct ITDCs. In doing so, firms should follow a process-oriented perspective and focus on those particular activities that are closely related in the value chain. For instance, when a firm lacks competences and capabilities in effectively sensing the environment to spot, interpret, and pursue opportunities and threats, it only makes sense that resources are directed toward revamping existing operational capabilities with new knowledge (i.e., learning capability) and subsequently embed this new knowledge into operational capabilities (i.e., the integrating ITDC). In case a firm experiences difficulties in the deployment of resources, and activities in reconfigured operational capabilities, we suggest that firms first need to focus on synchronizing their assets, resources, and activities (i.e., integrating capability) next to maturing their coordinating ITDC. Also, firms need to direct their coordinating activities to create value to calibrate the requirements for change and to implement necessary business adjustments. There are many other configuration and patterns possible as there are reciprocal relationships among the distinct ITDCs (Pavlou & El Sawy, 2011).

FUTURE RESEARCH DIRECTIONS

Despite this study's contributions, there are several limitations that future work must seek to address. First, this study currently only applied a fixed structure model; that is, environmental factors were not included as well as the influence of collaborative partners/firms modern firms typically have. Current-day organizations need to be able to respond to operational and market adjustments in a swift manner (Tallon & Pinsonneault, 2011) and take external environmental factors into account within corporate IS/IT strategic planning (Newkirk & Lederer, 2006). It could, therefore, be possible that these factors influence the model's outcomes.

Second, our study currently did not extensively discuss the trade-off between short and possible longer adaptive walks leading to specific fitness values. This aspect could have significant implications for business strategies.

Third, an acknowledged limitation of the NK-model (S. Kauffman & Levin, 1987; S. A. Kauffman, 1993), however, is that it uses a binary measure for the interdependency parameter between two components, i.e., K (Fan & Lee, 2012; Li et al., 2006; Valente, 2008). So, an interaction between capabilities is either present or absent. While, in practice, one could argue that interaction between organizational components or entities, and thus also ITDCs, can be reflected by a specific degree of interaction, and is based on the characteristic of the particular organization under study (Fan & Lee, 2012). Therefore, an argument can be made for the additional inclusion of a simulation with a continuous and fractional value in $[0,1]$ as a measure for K .

Finally, our study included only a limited amount of elements ' N ' into our simulation model. In comparison to other NK-model investigations (S. A. Kauffman, 1993; Daniel A. Levinthal & Warglien, 1999; Rivkin & Siggelkow, 2007; Siggelkow & Levinthal, 2003), this amount of interconnected elements is rather small. Avenues for future research could expand the scope and reach of ITDCs and related (op-

erational or zero-order capabilities) and inter-organizational collaboration capabilities and help identify a comprehensive set of business strategies based on the simulation outcomes.

CONCLUSION

Our study is the first to present a fitness landscape model of firms' ITDCs. In this process, statistical survey data were leveraged and used as parameters for a simulation using an extended NK-model. Our contribution, therefore, differs from prior scholarships that use common statistical tools and test the direct or indirect, but isolated impact of ITDCs on competitive performance (Mikalef et al., 2016; Pavlou & El Sawy, 2006, 2011). These results of this study offer several contributions that improve our theoretical understanding of the role of ITDCs and their role in the process of driving toward superior firm performance and extends conceptual and variance based studies on organizational capabilities and ITDCs in particular (McCarthy, 2004; Mikalef et al., 2016). This chapter also demonstrates that the NK-model can indeed be applied toward more general representation problems, as suggested by Altenberg (Altenberg, 1997).

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ADDITIONAL READING

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KEY TERMS AND DEFINITIONS

Complexity Science: A scientific umbrella that studies complex adaptive systems (CAS) and has become the de facto standard and holistic ‘lens’ for the analysis and evaluation of complex and nonlinear relations between constituent entities under continuous change.

Fitness Landscapes: Can be considered a model that can be used to describe the particular evolutionary fitness of a system within a particular environment.

IT-Enabled Dynamic Capabilities (ITDCs): Firm’s ability to leverage its IT resources and IT competencies, in combination with other organizational resources and capabilities, to address rapidly changing business environments.

‘K’: K represents the richness of epistatic linkages (term used to describe interacting genes) among N elements.

‘N’: The number of elements that represent the system under study.

NK Model: Provides a comprehensive framework to evaluate the effects of relationships between (N) components of systems and their respective epistatic linkages or relationships (K).

Organizational Capabilities: Firms' potential to achieve specific business strategies and management objectives using focused deployment and are considered the building blocks on which firms compete within the business ecosystem.

ENDNOTES

- ¹ For this research we are satisfied with assuming that firm performance is positively influenced by the level of ITDCs fitness.
- ² Obviously, more advanced and complex search strategies are possible, e.g., long-jumps, directional search and other forms of adaptive walks.

Vertical Integration in Content Provisioning With Cloud Migration

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INTRODUCTION

The continuous growth of Internet traffic is significantly pushed by emerging high bandwidth demanding contents. All participants in the content provisioning process including content providers, service providers, Content Delivery Networks (CDN) and customers are influenced by bandwidth requirements. Appropriate bandwidth demand estimation and consequently network dimensioning, are of great importance for addressing resource investment. However, peak bandwidth demand varies during the day. Provisioning of self-owned resources that satisfy peak bandwidth demand leads to network underutilization in the periods of low or normal traffic load. Hence, the over-provisioning is cost ineffective. On the other hand, under-provisioning of network resources leads to rejection of customers' requests for service provisioning. Considering all aforementioned, providers in content provisioning process need to consider cloud migration in order to minimize costs and improve Quality of Service (QoS) and hence Quality of Experience (QoE) of their customers. Cloud providers maintain large-scale data centers to offer storage and computational resources in the form of Virtual Machines instances at a relatively low cost. Depending on the characteristics, cloud instances are available at different prices. In general, cloud providers offer three different pricing plans, such as reservation, on-demand and spot pricing.

In order to provide content to the customers, the vertical interconnection between involved providers is necessary. Larger undertakings in content provisioning process often perform vertical integration, thus ensuring a higher control over different segments of the process. Involvement of cloud providers into a content provisioning process introduces additional complexity for choosing appropriate interconnection contract between providers. The vertically integrated content provider's incentives for cloud migration can induce significant changes in interconnection contracts, and consequently in costs and requests' rejection rate. With the aim of obtaining optimal integration charging strategy, concepts like Revenue Sharing, Cost Sharing, and Wholesale Price etc. are applied frequently.

In this chapter different methods of vertical interconnection charging among vertically integrated providers are analyzed and compared. With the aim of QoS and QoE improvement, providers can perform cloud migration. Cloud resources utilization concepts like reservation, on demand, and spot-pricing are analyzed.

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BACKGROUND

Interconnection refers to physical and logical connecting between involved providers with the aim of provisioning the access to contents, applications or services. Intrinsically, interconnection enables customers connected to one network to communicate with customers of the same or different network. More precisely, vertical interconnection represents interconnection between undertakings on different network's levels. It is a set of legal rules, technical and operational arrangements which providers use to connect their equipment, networks and services. The actors in the content provisioning process often perform vertical integration that is the process of regrouping several segments of the content provisioning process under the control of a single undertaking. Vertical integration can internalize costs for big actors in the content provisioning process, such as global content providers, but also for service providers, which also can benefit from offering their own contents, applications or services. In addition, vertical integration is economical, efficient and it enables achievement of economies of scale (Dai & Tang, 2009). Vertical integration eliminates double marginalization (the effects of market power at consecutive vertical layers) which occurs when undertakings at consecutive layers have monopoly power and each undertaking reduces the output from the competitive level to the monopoly level, leading to overall losses. Also, vertical integration provides better adjustment of supply and demand. Therefore, it improves efficiency, provides more opportunities for profit maximization, and makes innovations more relevant (Maille & Tuffin, 2014).

Vertical integration is a common practice in telecommunications (often form is bundling content and access into a single service). Google is one of the most well-known examples of vertical integration. Initially, Google offered its search-engine service, generating revenues through advertizing. Afterwards, Google expanded the range of services, offering e-mail services, Google Calendar, Google Earth, the browser Chrome, and the operating system Android. The aim was to incorporate Google search tools into the services in order to generate more advertizing revenues, to increase competition at those service levels, and to reduce costs for customers. Another prominent example of vertical integration is Microsoft, which provides operating systems, but also commercializes software included in the Windows Office suite, search engine Bing, and other hardware devices. Apple also performs vertical integration, combining hardware (computers, iPhone, iPad, iPod) and software services (operating systems, Apple Store).

Content providers may perform vertical integration along the process of content provisioning. Big content providers may establish their own hosting capabilities, deploy their own network infrastructures or may provide CDN services themselves (BEREC Report BoR (12) 130, 2012). If a content provider is large enough, vertical integration is an economically viable solution. Additional costs from the establishment of vertical integration are compensated by enhanced economies of scope. Also, the QoS and QoE of the content provisioning process are improved. Some issues of the vertically integrated content provider in content provisioning process are analyzed by Mikavica & Kostic-Ljubisavljevic (2016), Mikavica, Kostic-Ljubisavljevic & Radonjic Djogatovic (2017) and Mikavica & Kostic-Ljubisavljevic (2018a). Often applied contracts of vertical interconnection between vertically integrated content providers and service providers are Revenue Sharing, Cost Sharing and Wholesale Price.

Instead of explicitly defined interconnection tariffs, operators often apply Revenue Sharing, which establishes a fixed revenue share among providers. This type of contract is characterized by operational simplicity, and it can rebalance providers' returns when retail prices are distorted for any reason. Some of the greatest challenges that providers are dealing with are increasing the profitability of the offered services, assuring higher charges for improved services and obtaining a fair share of the increased revenues. A fair Revenue Sharing contract based on the weighted proportional fairness criterion is proposed

by He & Warland, (2006). They also show that non-cooperative strategies between providers may lead to unfair distribution of profit and may even discourage future upgrades to the network. Modeling of non-cooperative interaction between service providers and content provider as a Stackelberg game is performed by Wu, Kim, Hande, Chiang & Tsang (2011). These authors propose Revenue Sharing contract between service providers that jointly provide network connectivity between the content provider and customers. They introduce profit division factor into the contract with the aim of social profit's maximization. Revenue Sharing contract between the content provider and two service providers under network neutrality debate is observed by Coucheney, Maille, & Tuffin (2014). In this model, service providers enable direct connectivity to a fixed proportion of the content and compete in terms of price for customers. Relations between service providers are established using Revenue Sharing contract in order to maximize customers' welfare.

Revenue Sharing and Cost Sharing contracts are often formulated using Shapley value (Lee, Jang, Yi & Cho, 2013; Bogomolnaia, Holzman & Moulin, 2010). This mathematical method allocates resources according to the contributions of each party in a fair manner. Application of Shapley value in order to obtain a proper revenue distribution between content and service provider with elastic and inelastic demand is proposed by Ma, Chiu, Lui, Misra & Rubenstein (2008). The following formulations of Cost Sharing contract in backbone networks: volume-device, 95th percentile-device, 95th percentile-customer, customer peak-device, aggregate peak-device and Shapley-device, are analyzed and compared by Gyarmati, Sirivianos, & Laoutaris, (2012). The results show that Shapley-device contract better reflects the costs of the customers and improves fairness compared to other observed contracts. The key characteristic of Cost Sharing contract is enabling compensation for the costs that the provider incurs in carrying traffic generated by other providers.

Under the Wholesale Price contract, the service provider's payment to the content provider for content provisioning depends on the established wholesale unit price and the traffic volume. The process of determining wholesale prices for mobile virtual networks operators and relations among vertically integrated incumbents when downstream entries are present under the Wholesale Price contract is described by Song (2010). It appears that the wholesale price can be the lower limit of the retail price and determines the competitiveness of mobile virtual networks operators. Related regulatory issues have also been considered and it emphasizes the fact that regulators should have a long-term perspective for the market.

In order to improve content provisioning process and assure satisfactory QoS and QoE, bandwidth demand estimation is essential. Content requires a certain minimum bandwidth which assures that customers' experience in content provisioning is satisfactory. Also, the content has assigned content popularity factor, addressing the probability of access to certain content. In bandwidth demand estimation, parameter depicting content popularity is an important parameter and has to be included in the network dimensioning process. Contents' differentiation according to its' assigned popularity is of great importance for load balancing, as well (Janaszka, Bursztynowski, & Dzida, 2012). Several observations on the suitable content popularity distribution can be found in the literature: Zipf (Zipf, 1932), Zipf-Mandelbrot (Tang, Fu, Cherkasova, & Vahdat, 2007), stretched exponential (Guo, Tan, Chen, Xiao, & Zhang, 2008), Zipf with exponential cut-off tail (Cha, Kwak, Rodriguez, Ahn, & Moon, 2007), etc.

In general, demand has stochastic characteristics. However, it appears that Internet traffic exhibits similar daily patterns and similar peak values every day. Demand attains the highest value in the evening hours, whereas the lowest demand occurs in the early morning hours. Provisioning capacity that satisfies total bandwidth demand is not economically efficient. Hence, the content provider's resources would be idle most of the time. In order to avoid over-provisioning, servers' capacity might be constrained

by parameter determining the portion of the peak bandwidth demand. The adequate bandwidth of the content provider's resources is from 40% up to 60% of the peak bandwidth demand (Li et al., 2011). Intuitively, the less capacity provisioned, the fewer resources are underutilized. However, this situation leads to greater rejection of customers' requests for content provisioning and hence, it must be taken into consideration. A promising solution for this challenge is cloud migration. Providers' incentives for partial cloud migration are analyzed by Li, Zhong, Liu, Li, & Xu (2011). A generic framework that facilitates cost-effective cloud migration of live streaming applications is provided by Wang, Liu, Chen, & Wang (2016). Cost-minimizing framework for migration of content distribution services into the cloud is presented by Qiu, Li, Wu, Li, & Lau, (2012). Costs for partial cloud migration and providers' profits obtained under different vertical interconnection contracts between the vertically integrated content provider and service provider are analyzed by Mikavica & Kostic-Ljubisavljevic (2016).

Cloud resources are organized in the form of different types of Virtual Machine instances. Instances are available at different prices, depending on the applied cloud pricing plan. Two cloud pricing plans that are widely implemented among cloud providers are on-demand and reservation. On-demand pricing plan considers payment only for utilized resources, charging a fixed rate per billing cycle, usually on an hourly basis. Cloud instances are available for an indefinite time. However, the cloud provider retains the right to terminate a cloud instance. Unused time (less than an hour) whether end user or another provider terminated connection, charges as a full hour. If the instance is terminated by the cloud provider, particular unused time is free of charge. Reservation cloud pricing plan enables reservation of cloud resources for a certain period of time, usually a year or three years. Beside upfront fee for resource reservation, cloud provider's customer pays discounted hourly resource usage price. Reserved resources are available at any time on request. Cloud pricing plans' classification is presented by Kansal, Singh, Kumar, & Kaushal, (2014). Spot pricing has emerged as a promising solution for the enhancement of the cloud provider's resources utilization and decreasing prices for cloud customers. Even with resources reservation and on-demand instances' utilization, some cloud resources remain in an idle state. Thus, cloud provider offers its available resources, namely spot instances, in cloud market at a lower price with the ability to terminate instances when needed. Spot pricing presents a dynamic pricing mechanism based on auctions (Toosi, Vanmechelen, Khodadadi, & Buyya, 2016) and reverse auctions (Roovers, Vanmechelen, & Broeckhove, 2012). Different auction-based pricing and allocation mechanisms for cloud resources are proposed (Kumar, Baranwal, Raza & Vidyarthi, 2017; Baranwal, Kumar, Raza & Vidyarthi, 2018; Lu, Yu, Zhu, Li, 2018). Cloud customer creates a bid, representing maximum price willing to pay for a specific instance. The access to spot instance is enabled as long as the bid exceeds the cloud provider's last computed market clearing price. A variant of spot instances, spot block instances can run continuously for a finite duration up to 6 hours. Pricing of spot block instances depends on the requested duration (full hours, up to 6) and the available resources. Prices for spot block instances are usually 30% to 45% less than prices for an equivalent on-demand instance (Amazon, 2018). When cloud customer submits a bid, it is necessary to specify the maximum price willing to pay per hour along with the duration (the number of hours that spot block instance will run uninterrupted). If there are enough available resources for the requested duration, spot block instance will be initiated and run continuously, without termination, for a flat hourly price. This cloud pricing plan is a cost-effective solution for occasional workloads requiring an uninterrupted run in duration up to 6 hours (Mikavica & Kostic-Ljubisavljevic, 2018b). Resource allocation and cloud pricing plans are closely related (Pal & Hui, 2013). Revenue maximization along with optimization of capacity allocation under different cloud pricing plans may be achieved by means of admission control (Toosi, Vanmechelen, Ramamohanarao, & Buya, 2015). Dependence of costs of a vertically integrated content provider from applied cloud pricing plans in content provisioning process

with partial cloud migration is addressed by Mikavica, Kostic-Ljubisavljevic & Radonjic Djogatovic (2017). Optimal placement of contents into the data centers of the vertically integrated content provider and cloud provider is analyzed by Mikavica, Markovic & Kostic-Ljubisavljevic (2018a).

RELATIONS BETWEEN VERTICALLY INTEGRATED PROVIDERS IN CONTENT PROVISIONING

The comprehensive growth of Internet traffic is caused by emerging high bandwidth demanding contents such as video on demand, High Definition Television (HDTV), real-time video, online gaming, file sharing and cloud computing. Participants in the content provisioning process include content providers, service providers, Content Delivery Network (CDN) and customers. Generally, these participants may perform different combinations of functionalities depending on whether or to what degree an operator's business model implies vertical integration (BEREC Report BoR (12) 130, 2012).

Content providers' main functionality is content creation and aggregation. In addition, content providers establish their own hosting capabilities or deploy their own network infrastructure. Content providers encompass various players such as: platforms enabling transactions (e.g. Amazon, eBay, etc.), social platforms (e.g. Facebook), search engines (e.g. Google, Bing), live and on-demand radio and video services (e.g. broadcasters), entertainment services (e.g. Youtube, Dailymotion, etc.), application providers (e.g. Skype), video on demand (e.g. Netflix).

Generally, term service provider refers to operators selling broadband access and connectivity to the Internet at the retail level and at the wholesale level through transit and other forms of integration. These providers enable connectivity for different types of customers, whether it is end customer of content provider.

CDNs serve as aggregators of content on behalf of content providers. Their function is delivering content closer to the terminating network. CDN is a system of servers, placed at various locations at the network edges in order to enable efficient access from any customers' location. Customers' requests are redirected to the servers nearest to them. Different services provided by CDNs are targeted at the different types of content, such as video services, game services, software distribution updates, which content providers distribute. Each type of content has its own characteristics, such as data volume, upstream and/or downstream traffic, peak traffic, for which different CDNs can provide added value.

Term customer refers to both residential and business customers of broadband access in their function of passively consuming content. Generally, customers form downstream traffic volume in consuming the content provided by the content providers. Overlapping between customers and content providers is possible. Players that predominantly act as customers may, in certain situations, act as content providers and provide content and services or applications, e.g. Youtube videos, Internet blogs, etc. Retail customers are private households whereas business customers may range from small to large business and industry customers.

If partial cloud migration is performed, vertically integrated content provider stores all original contents in self-owned servers and serves a major part of the customers' requests for content provisioning. A certain part of the content provider's contents is migrated to the cloud resources provided by the cloud provider. Cloud provider is a party which provides cloud services and performs activities necessary to ensure delivery to the cloud customers as well as cloud service maintenance. Term cloud service refers to one or more capabilities (application, infrastructure or platform capabilities type) offered via cloud computing invoked using a defined interface (ITU-T Recommendation Y.3500, 2014). In order to ensure

satisfactory QoE, cloud provider delivers contents to the cloud CDN. Subsequently, cloud CDN delivers contents to the service provider using a global network. In the periods of low traffic load, the content provider's resources can satisfy overall demand so data transfer through cloud CDN is not significant. However, in the periods of high traffic load, cloud CDN serves meaningful data volume. In order to assure access to the most popular contents, content provider occupies cloud storage capacity according to an appropriate cloud pricing plan. When demand exceeds the capacity of the vertically integrated content provider's resources, customer's request for content provisioning will be accomplished if required content is being stored into the cloud. Otherwise, the customer's request for content provisioning is being rejected. Therefore, determination of the portion of the contents' replication on the cloud has a direct impact on requests' rejection, especially in the periods of high traffic load. In order to minimize the risk of content unavailability, it is recommendable that cloud migrations occur in the period of low traffic load, so the content uploading to the cloud would not additionally load the system. Content replication during cloud migration assures that most popular contents are available even in the periods of high traffic load and it lowers the number of rejected requests for content provisioning. The least rejection rate attains for the greatest content provider's capacity and the greatest portion of cloud migration.

Each provider aims to obtain the highest profit along with satisfactory QoS and QoE which, in the long term, assures customers' loyalty. In general, providers' profits can be obtained by deducting corresponding costs from revenues. Service provider's revenue generated from the customers depends on the retail price and number of customers. Their costs largely depend on the selected integration contract. Prerequisite for selecting optimal vertical interconnection contract between the vertically integrated content provider and service provider is appropriate bandwidth demand estimation. In the context of partial cloud migration, vertical interconnection is being established among vertically integrated content provider and service provider. Relations among content and cloud provider are in accordance with the cloud pricing plans. Which cloud pricing plan will be chosen depends on the costs' prediction, demand, content provider's self-owned capacities and tolerance for requests' rejection rate. Vertical interconnection contracts that are often applied between providers are Revenue Sharing, Cost Sharing and Wholesale Price. Formulations of previously mentioned contracts used in this chapter are provided by Yoon, Yoo & Choi (2010).

In order to enable their customer's access to certain contents under the Revenue Sharing contract, the service provider shares its revenue with the vertically integrated content provider. Hence, the content provider's revenue under Revenue Sharing vertical interconnection contract depends on the service provider's revenue and on the parameter determining revenue share among them. The parameter depicting revenue share among providers is a predefined constant value in the range $(0, 1)$. Greater revenue share assures greater revenue for the content provider. The opposite state is valid for service providers.

Similarly to the Revenue Sharing contract which defines how revenues of content and service provider are shared, Cost Sharing contract defines how costs in content provisioning process should be shared among providers. Extensive analysis of content and service provider's costs in the content provisioning process will be presented later. The parameter defining cost share is a constant value in the range $(0, 1)$. A higher value of this parameter provides greater revenue for the vertically integrated content provider. In addition, content provider's revenue under Cost Sharing contract depends also on profit margin which indicates a provider's profitability and takes values in the range $(0, 1)$.

The parameter profit margin coexists in the Wholesale Price contract with the same characteristics as in the Cost Sharing contract, as well. Hence, greater values for profit margin implicate greater vertically integrated content provider's revenue. Considering the fact that the same parameter coexists in Cost Sharing and Wholesale Price contracts, these contracts are easy to compare.

Content and service provider's costs are highly influenced by a selection of proper vertical interconnection contract. Service provider's costs can be divided into the cost for customers' requests provisioning and vertical interconnection payment to the vertically integrated content provider. The number of the customers' requests provisioned through cloud CDN depends on the portion of contents' replication on the cloud. Hence, partial cloud migration introduces additional costs. However, cloud migration has numerous short-term benefits including lower requests' rejection rate and long-term benefits which consist of customer's loyalty improvement. Analysis of vertically integrated content provider's costs indicates that enhancement of self-owned resources increases costs, which is the primary motivation for cloud migration. The appropriate combination of the vertically integrated content provider's self-owned resources and the amount of cloud migration should be selected in accordance with the realized profits depending on interconnection contracts between content and service provider. Vertically integrated content provider's costs in content provisioning with partial cloud migration can be divided into costs for serving part of requests for content provisioning from self-owned resources and costs for cloud assistance. Cloud instances are being occupied depending on the following factors: estimated future demand, necessary storage capacity for the desired portion of the most popular contents on the cloud and offered cloud pricing plans. Hence, content provider's costs for renting cloud resources consist of: cost for reservation, if resource reservation is enabled; costs for resource utilizing, expressed as a fixed rate per billing cycle if on-demand or spot instances are being utilized and costs for data transfer from cloud CDN to the customers. Cost for content provisioning from cloud CDN to the service provider's network is based on the transferred data volume.

Vertically integrated content provider's profits under Revenue Sharing vertical interconnection contract increases with revenue share enhancement. Greater content replication on cloud increase costs. Self-owned capacities enhancement increase costs, as well. Profit margin assures a certain amount of content provider's revenue. In addition, cost share has a considerable impact on profits. Greater profit margin provides greater profits. Likewise, greater cost share leads to greater profits. However, under Cost Sharing and Wholesale Price contracts, unlike Revenue Sharing, increasing of self-owned resources and content replication to the cloud has a minor impact on profits (Mikavica & Kostic-Ljubisavljevic, 2016). Considering the service provider's profits under different vertical integration contracts and different levels of cloud migration it is notable that higher values of revenue share, cost share or profit margin decrease profit.

Analyzing requests' rejection rate, costs and occupied resources under vertical interconnection with the vertically integrated providers, it is notable that cloud migration is preferable. However, vertically integrated content provider is imposed on additional costs. Considering that less popular contents are not likely to be requested, complete contents' replication on the cloud would be cost ineffective. Hence, partial cloud migration which involves storing the most popular contents on the cloud is a promising solution. In order to achieve the greatest cost savings, appropriate determination of content popularity and demand estimation is essential. Cloud pricing plans in cloud migration may significantly affect vertically integrated content provider's costs, which in turn, may affect the proper selection of vertical interconnection contract with the service provider. Costs of the vertically integrated content provider in content provisioning, with partial cloud migration, depends on the following cloud pricing plans: on-demand, reservation and hybrid pricing plan, as addressed by Mikavica, Kostic-Ljubisavljevic & Radonjic Djogatovic (2017). If a vertically integrated content provider occupies cloud instances on request and without a long-term commitment, the on-demand cloud pricing plan is applied. The costs of this vertically integrated content provider depend on the marginal cost per request for content provisioning serviced by the observed content provider, the total number of billing cycles (hours) during

which certain on-demand cloud instance is utilized and its on-demand price, and the cost for content delivery from cloud CDN to service provider's network. When vertically integrated content provider only reserves cloud resources through reservation cloud pricing plan, costs depend on the marginal cost per request for content provisioning serviced by observed content provider, the reservation fee and the cost for content delivery from cloud CDN to service provider's network. The hybrid pricing plan, proposed by Mikavica, Kostic-Ljubisavljevic & Radonjic Djogatovic (2017), involves the combination of reservation and on-demand renting of cloud resources in order to minimize costs and requests' rejection rate. Vertically integrated content provider occupies a specific number of cloud instances for a contractual period and occasionally rents more on-demand instances. On-demand instances are requested only if reserved capacity is insufficient to support provisioning of the chosen portion of the most popular contents for cloud migration. In that case, costs of vertically integrated content provider depend on the marginal cost per request for content provisioning serviced by observed content provider, the upfront reservation fee, the number of reserved cloud instances, the total number of billing cycles (hours) during which certain on-demand cloud instance is utilized and its on-demand price and the number of utilized on-demand instances.

In general, when vertically integrated content provider assures greater self-owned resources, costs are higher. However, requests' rejection rate in all cloud pricing plans is below 5% (Mikavica, Kostic-Ljubisavljevic & Radonjic Djogatovic, 2017). More occupied cloud instances induce costs, but also considerably lowers requests' rejection rate. On-demand pricing plan provides the lowest costs and the highest requests' rejection rate. Reservation pricing plan includes long-term commitment and, in general, provides higher costs compared to the on-demand pricing plan. It can be noticed that the reservation pricing plan assures lower requests' rejection rate. Costs under hybrid pricing plan are similar to those in the reservation pricing plan. In addition, it provides the most appropriate requests' rejection rates, which values are below 5% even for a lower capacity of content provider's self-owned resources. Thus, hybrid pricing plan improves customers' satisfaction, with acceptable costs.

SOLUTIONS AND RECOMMENDATIONS

One of the most important issues in content provisioning process with cloud assistance that content provider should carefully perceive is the dynamics of customers' demand for access to contents. As a solution, a specific model for the determination of customers' behavior in the video on demand system and necessary upload capacity by cloud providers is introduced by Wu, Wu, Li, Qiu & Lau (2011). In addition, the satisfaction of bandwidth requirements is crucial for bandwidth-intensive applications. Optimal bandwidth provisioning strategy, considering both the operational costs and customers' experience, is derived using the Nash bargaining solution by He, Wu, Zeng, Hei & Wen (2013). Along with bandwidth requirements, storage demand and efficient migration of contents across different geo-distributed cloud resources is another important challenge. Wu, Wu, Li, Zhang, Li & Lau (2015) proposed an online algorithm for the accommodation of dynamic demand for access to cloud storage resources.

Moving the whole content provisioning to the cloud is highly challenging due to security requirements, flexibility, potential performance and control issues. However, cloud computing can provide enough elastic resources even for large-scale contents. Netflix, a major video on demand provider in North America is a typical example, which migrates its streaming services, encoding software, search engines, and huge data stores to cloud provider Amazon (Fan, Yin, Min, Yang, Luo, Lyu, Huang & Jiao, 2018).

Vertical integration in the Internet ecosystem may raise several discriminatory concerns. For example, third parties may have uneven conditions on market compared to the vertically integrated content provider and an online platform, since vertically integrated providers may gain an advantage due to superior visibility to customers, or better integration functionalities (Kramer & Schnurr, 2018). Discriminatory issues are also noticed in app stores, e-commerce and search engines since vertically integrated providers often have higher prominence. Therefore, rival providers have a critical impediment for successful competition. However, giving prominence to the vertically integrated provider's own services doesn't have to decrease social welfare. The prioritization of integrated content can likely be justified ex-post since it motivates the integrated provider to undertake higher investments (Kramer & Schnurr, 2018).

FUTURE RESEARCH DIRECTIONS

Revenue Sharing vertical integration contract has proved to be preferable among Cost Sharing and Wholesale Price contracts when partial cloud migration is performed (Mikavica & Kostić-Ljubisavljević, 2016). However, only reservation cloud pricing plan has been observed. Hybrid pricing plan which involves partial resources' reservation and on-demand instances provisioning may decrease costs and reduce requests' for content provisioning rejection, concurrently. The impact of these pricing plans on selection appropriate vertical interconnection contract between the vertically integrated content provider and service provides is subject of further research. Another promising solution for achieving goals of cloud provider's customers, i.e. providers and customers is spot pricing. However, there are some challenges related to spot pricing, including resources' availability and allocation, complexity for customer's understanding, optimal bidding in auctions etc. Migration to Superclouds allows relocation contents from terminating spot instance into the instance in another availability zone, or even on another cloud provider. This can enhance content provisioning process performances. Content placement into data centers of the vertically integrated content provider and cloud provider is an essential issue in content provisioning process with cloud migration. Optimal placement of contents and associated costs need to be carefully considered in future research. In addition to the observation of different vertical interconnection contracts between integrated providers and their comparison, the aforementioned issues will be addressed in future.

CONCLUSION

The aim of this chapter is to present the complex issue of vertical interconnection between vertically integrated providers involved in content provisioning process with possible cloud migration. Undertakings that are concerned include content provider, service provider and cloud provider with the corresponding CDN along with partial cloud migration. It has to be observed in different aspects. Primarily, appropriate bandwidth demand estimation is of crucial importance. The main reason for this estimation is to mitigate all the disadvantages of under-provisioning or over-provisioning of resources. Requests' for content provisioning rejection rate is another relevant parameter since it significantly affects customers' experience in the content provisioning process. Cost allocation and predicted profits are decisive factors in investment for partial cloud migration and selection of appropriate vertical interconnection contract between integrated providers. Considering the fact that providers' main business goal is achieving the highest possible profits, selection of proper vertical interconnection contract is essential. In this chapter,

Revenue Sharing, Cost Sharing and Wholesale Price contracts between the vertically integrated content provider and service provider have been analyzed and compared. Introducing cloud provider in content provisioning process increases complexity in vertical integration issues, but it may offer (some) different optimal solutions in that process. Different cloud pricing plans are compared in terms of costs and rejection of requests for content provisioning. It appears that partial cloud migration can be a cost-effective solution for providing contents with satisfactory QoS and QoE along with minimization of costs of vertically integrated content provider.

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KEY TERMS AND DEFINITIONS

Cloud Migration: Storing a portion of the most popular content provider's contents into the cloud resources with the aim of enabling access to those contents whenever capacity of the self-owned servers is occupied.

Cost Sharing: Integration contract which allocates costs to all undertakings in a fair manner. Cost share among providers is defined in accordance with contribution in total costs of each provider in content provisioning process.

On-Demand: Pricing plan which enables cloud providers' customers to pay only for utilized resources per time unit, usually on the hourly basis. Cloud instances are retained for indefinite time.

Reservation: Cloud providers' customers pay an upfront reservation fee in order to reserve cloud resources for a specific period of time. In return, they receive a significant discount on the hourly resource usage price.

Revenue Sharing: Integration contract which defines modality of revenue shares between providers involved in all forms of provider's integration. It is characterized with operational simplicity and possibility of rebalancing the returns of the providers when retail prices are distorted.

Spot Pricing: An auction-like mechanism where cloud providers' customers submit bids, i.e. maximum price they are willing to pay for specific cloud instance. The access to cloud instances is enabled as long as submitted bid exceeds cloud provider's last computed market clearing price.

Vertical Integration: The process of regrouping several segments of the content provisioning process under the control of a single undertaking.

Vertical Interconnection: Physical and logical connecting between undertakings involved in content provisioning process on different network levels, with the aim of providing the access to contents.

Wholesale Price: Integration contract among providers based on the determination of the unit wholesale price for a given service. Demand and traffic volume are highly dependent on defined wholesale price.

Impact of Management Automation on the Processing of Business Information

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INTRODUCTION

Presently, the importance of information in companies is increasingly relevant. Information is a necessary and important resource which is generated, through each of the company's processes. The technologies acquired by companies have evolved over time, to become more sophisticated and necessary to achieve competitive advantages. Information systems have progressively become essential in any organisation, because, with regards to them, coordination is made easier among the people involved in it. Therefore, it is understood that the information system of an organisation is the set of people and material means, which allow the information to be available to whoever needs it, when it is needed and in the recognised format (Solana, 2014). An information system will perform the activities of data capture, storage, processing and distribution of the resulting information. It can be said that the main functions performed by these systems according to Arjonila and Medina (2009), will be to: provide information to the top management, collaborate in the achievement of objectives and achieve competitive advantages. They are essential to help managers keep their company in order, analyse everything that goes through it and create new products that place the organisation in a good place. Therefore, companies that use information systems will have a greater component of adaptability to changes and will be prone to the identification of niches in the market and improvements to processes (Laudon and Laudon, 1996).

Managers are responsible for designing the information system in the company and for users to adapt and use it in their work in the best possible way (Ewout and Per, 2018). One of the specific information systems that companies use generally is integrated software such as Enterprise Resource Planning (ERP) systems, which is responsible for planning resources and managing information, whose structured form can meet the demand of the management needs of the company (Benvenuto, 2006).

With this study, we seek to understand the extent to which new information and communication technologies aid the productivity of the company, while on the other hand, to see the great impact that it provokes in industrial relations. To this end, a process of implementation and the use of an ERP in a company has been observed. In addition to this, the study has focused on knowing the satisfaction and utility perceived by users of this system. Specifically, the study was carried out in a company in the winemaker sector located in Jerez de la Frontera (Cádiz, Spain).

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In order to achieve the proposed objectives, the work was divided into different sections. First, it will explain the importance of information and the basis upon which information systems are based, as well as how they have evolved and the strategic role they play in companies. On the other hand, we delved into a specific information system, the ERP, carrying out a theoretical course on the concept of ERP, as it has evolved throughout history, the process of implementation and the reason for which the company decided to harness it and the advantages of using this type of system. Moreover, observing how its implementation benefits or affects the operation of the company and its employees.

BACKGROUND

The ERP

In the 60s and 70s of the last century, computer systems were introduced in organisations and companies dedicated to software development were founded. One of the biggest impacts carried out by the information systems was in the management of inventories and in the planning of production, specifically in the area of logistics, because thanks to these systems and the appearance of the computer, the management of sales and order distribution activities were facilitated (Orlicky, 1975). The provision of computers and systems capable of handling volumes of information at a speed that had never existed before, gave rise to companies' acquisition of systems such as Material Requirements Planning (MRP) as they were introduced. Companies began to acquire these types of systems to keep track of their activities in a precise manner. According to Cooper and Zmumd (1990), the objective with which the MRP methodology was developed was to replace the traditional information systems of production planning and control.

At the end of the 70s, the concept of MRPII (Manufacturing Resource Planning) was born, considering new processes associated with production, which were; the forecast of the demand, supply and the logistics of delivery. MRP systems evolved to help companies reduce the inventory levels of the materials they used because when planning their production requirements, premium is placed on only on what is demanded, resulting to reduced costs because they bought only what was necessary (Kapp, Latham and Ford-Latham, 2001).

Generally, the company that integrates an information system, seeks to improve its competitiveness, complete its decision-making process with increased productivity, as well as reduce its operating costs and delivery times. Menezes and González (2010) explain that in order to gain competitive advantage through ERP, a period of several years is usually necessary for implementation, which includes: The integration of existing information systems, the adjustment of the organisation with the ERP system, realisation of re-engineering and capacity of system configuration and its integration capacity.

Benvenuto (2006) defines ERP systems, as a global system of resource planning and information management, which in a structured way, can meet the demand of the company's management needs. Its optimisation leverages a firm's absorptive and adaptive capabilities (Groenewald and Okanga, 2019). ERPs are formed by modules that create workflows among different users which avoids repetitive tasks and improves real-time communication between all areas of the company. ERPs are information systems that employ Information Technology associated with business process engineering, for the redesign and integration of business processes and support operations within the framework of company strategy (Menezes and González, 2010). The ERP software plans and automates many processes, with the purpose of integrating information in the company and is responsible for eliminating the complexity of linking the different areas of the business (Hernández, 2006; Groenewald and Okanga, 2019). The article "The

ABCs of ERP” highlights a number of advantages that companies have with an ERP system. First of all, the ERPs offer a follow-up from the client’s request to the delivery of the product and service, thus, providing an advantage in the integration of the information of the clients’ orders.

On the other hand, the financial area requires information that is as appropriate as possible, which becomes difficult when there are different departments with this information. In this case, the ERP systems become useful, integrating the information in a single source and keeping it unified, so that the necessary information can be extracted for each department. In the manufacturing area, ERP systems make it easier for manufacturing processes to integrate the stages by standardising and streamlining manufacturing processes, which shows a significant reduction in time and increased productivity. Another advantage offered by ERP systems is that it minimises the company’s inventory, in order to comply with sales orders and improve the order delivery process. Finally, it is worth mentioning the standardisation of human resources information. Companies with a large number of employees will benefit from this type of system since they require the handling of varied information that allows the correct application of the economic benefits, as well as the benefits of their personnel.

To implement an ERP correctly it is necessary to define the strategic objectives, the commitment of the management and the willingness to structural and cultural change. More so, taking into consideration the information obtained on the account of the customers, suppliers and competitors. That is why it is considered a challenge, for the implementation of ERP, to build an implementation team that knows the needs of the organisation from the perspective of its business processes, to develop projects that take into account the end users of the system (Malhotra and Temponi, 2010). Benvenuto (2006) highlights a series of objectives to carry out the implementation of an ERP system, these are: decision making, optimise the reduction of time and cost and improve customer service. At the time of implementation, we must consider the extent to which the ERP system needs to adapt to the demands of the company. Many companies find it difficult to implement an ERP due to the rigidity it presents and this can cause the organisation to have to adapt to the software rather than the software to the organisation (Arjonilla and Medina, 2009).

The implementation methodology is constituted by a series of phases that must be developed consecutively. The three phases are as follows: (1) First phase: basic ERP, where the company can obtain substantial results, and usually involves between 9 and 12 months, (2) Second phase: it consists of integration with the supply chain, requires between 3 to 6 months and includes the processes that extend the ERP to the width of the supply chain and, (3) Third phase: the corporate integration in which the accounting and financial elements, applications of human resources, sales, logistics, etc. will be implemented. The required time can be from several months to a year. On the other hand, these systems present a series of characteristics in companies which implement them: High-risk complexity, the scope of application, technological infrastructure, changes in organisational processes and the involvement of end users (Díaz et al., 2005).

Small and Medium Enterprises (SMEs) are organisations with less than 250 workers and they present great importance in the world economy. They are the main economic agents and are a global source of growth of the national resource of the economy in any country. Iglesias and Rodríguez (2009) indicate that the flexibility of this type of company is what makes them compete in such a changing environment as the current one, with segmented demand and technological change that enables flexible production. When SMEs decide to implement ERP systems, they expect to achieve a series of operational benefits as a result of the creation and maintenance of a central database in which all the information of the company is stored, since it decreases the redundancy and unconsciousness of data (Khaleel and Alkhaldi, 2017). In implementing an ERP system in SMEs, the team in charge of the implementation should be taking into

proper cognisance. It is considered, essentially, that the team must consist of: director, project manager, project team, users, quality group and consultant.

On the other hand, Duplaga and Astani (2003) point out that large organisations implement ERP systems by modules, while small organisations usually carry out implementations of complete ERP systems. At the same time, in small organisations, the experience of the implementation is valued and the duration of the implementation is shorter, which could imply that the duration depends on the size and complexity of the company (Adam and O'Doherty, 2000; Lecerf and Omrani, 2019). For large, medium and small companies, it is usual to implement standard ERP solutions, marketed by business management software providers. The company can choose to buy ERP modules that it needs from a single supplier, which has the advantages of integration and data exchange between the applications or buy each module from the supplier that offers the best product (Stancu, 2019).

ERP and Recent Technologies

Cloud computing has acquired great importance in the last decade, so there is a huge trend integrating this technology with ERP, emerging what is known as Cloud enterprise resource planning (cloud ERP) (Shivam et al., 2018). Cloud ERP offers benefits such as (1) faster execution, (2) lower costs, (3) greater agility, (4) real-time integration of business processes, (5) less human resource involvement, and (6) helps to manage effective cross-functional operations in a business organization (Maestrini et al., 2017; Meghana, Asish & Rodrigues, 2018). All of this enables companies to compete in changing markets. The global cloud ERP market has grown significantly in the last decade and is expected to continue to do so in the coming years

On the other hand, working in a mobile technology environment has allowed organizations to considerably improve their processes, this results in greater efficiency, increased benefits, faster access to information, improved planning or reduced errors. Working without cabling –with smartphones or tablets- allows more flexibility and mobility. This is what is currently called the third generation of ERP. It becomes an open system with web-based tools, integrated into social networks and using mobile devices that give them greater agility (Mazur, Rakauskas, & Rosa). The use of an ERP in a mobile environment allows users greater mobility, becoming a part of the daily life of employees, streamlining and simplifying processes. In the same way, it becomes an advantage for organizations because mobile technology is easily integrated with ERP, the development of applications is relatively simple and it has a lower cost (Monteiro & Costa, 2016).

ERP in Agriculture Area

Decision-makers in the agricultural sector are constantly confronted with different variables and risks, such as warehouse management, transport cost or weather. The implementation of ERP systems can minimize the risk in decision making in this environment (Haberli, Oliveira & Yanaze, 2017).

In the agricultural sector, one of the greatest challenge is the distribution of products. Crop yields are difficult to predict, and inventories are very difficult to manage due to the heterogeneity of production. In this context, the introduction of efficient systems is necessary. The implementation of an ERP is very effective because: (1) allows the standardization of business processes, (2) improves the accuracy of information by centralizing it in real time, increasing the ability to exchange such information, making it easier to make decisions, (3) allows accurate accounting of stored products, very useful due to the perishable nature of the products, (4) the operational is more efficient and allows traceability, and (5)

improves delivery times due to the exchange of information in real time, as well as show exactly the quality of products (Kim, Jung & Young, 2015).

Although it is true that implementing an ERP in the agricultural area allows companies to generate value (Ruivo, Oliveira & Neto, 2012), it is necessary to know that it is not easy to find ERP specialists. This is a challenge for companies as they must train their employees in the use of the tool (Esteves, 2014). The incorporation of the ERP offers good results; however, it is important to know that there are also some companies that do not reach their objectives mainly due to a bad use of the software (Chou, Lin, Lu, Cahng & Chou, 2014).

The Resistance to Change

To consider the change in an organisation is to refer basically to the human being because if there is no change in the individuals there will be no change in the organisations (Hernández, 2006). Quinn (1997) emphasises that a person can change the system or the company if he uses the systems at his disposal appropriately. The word change can have different meanings, depending on the people involved in it. In the case of organisations, we can differentiate between employees and managers or suppliers and customers. For example, for the suppliers and customers, the change will mean better service. Managers, on the other hand, will take it as an option to reinvent the organisation, and in employees, there could be resistance to change, thus implementing new information systems is considered a problem for them (Mekadmi, and Louati, 2018).

Resistance to change is a very common symptom in individuals when faced with new systems or simply when they do not know what is necessary to successfully carry out the change. Hernández (2006) states that ignorance is often caused by a series of circumstances in individuals, such as lack of dialogue, or having too much information, which generates some rejection by the thought of not being able to change (Ewout and Per, 2018). Among the economic aspects that companies suffer when implementing an ERP system, the training costs of the staff (employees must learn new business processes), the costs derived from the personalisation of the application when it is not adapted to some business process, the integration costs (integrate the ERP with other applications of the company and check its correct operation), cost of passing registered information of customers and suppliers to the new system.

Hong Kim (2002) stressed that the success of the implementation decreases when a certain level of organisational adaptation is exceeded, because, the ERP and the adaptation of the processes are more effective in smaller measures. That is why the management of change could be considered indispensable for implementing processes. Since, as Laguna (2004) posits that the management of change is the knowledge used to ensure that major changes in the system obtain the correct results, in time and costs. The resistance to change can be minimised. As affirmed by Maristany (1998) there are a series of steps to reduce it. These are; verify if the change will get the resources expected, develop a plan, inform the individuals of the change, etc.

ERP SAP AND WINERY COMPANY

SAP is a software provider founded in 1972, a leader in business solutions for all types of industry. It is the most important software company and the third independent software provider in the world. It commercialises a standard and modular solution which boosts supply to different activities or departments within the company, such as; accounting, sales, relationship with customers and suppliers, warehouse

management or production management, amongst others. The company in this study implemented the ERP of SAP with the goal of benefitting, having information support and thus all employees at the time of working have access to the information. This entity dedicated to the production of wines and other alcoholic beverages such as gin and whisky is a large winemaking company of the Marco de Jerez region.

For the company, it turned out to be an important economic strength, likewise the effort in preparing the employees to avoid the greatest possible risk. At the beginning of the implementation, the company carried out a quality test to begin teaching the workers the use of the system. Once the quality of the system improved, the development test was generated, which is useful for the development of the system to make it as suitable as possible for the company. Finally, it is called a productive software, this is the definitive one the company will use as it is the most adapted for its operation, providing ease of work to its employees. To know the satisfaction of SAP users, a field study of the tool the company implemented was carried out as described in the following sections.

METHODOLOGY

To achieve the main objective of this work, a case study was developed in a winery focusing on SAP, since, it is the system the company implemented. To this end, a satisfaction questionnaire was made to the end users of the system, to gather quantitative information to augment the collection of relevant data on the subject of study of the work, as well as an informal interview to managers and users. In this particular case, information was gathered through the following sources: (1) Survey of 50 end users of the system, (2) Informal interview, (3) Participant observation, that is, the researcher was working in the company during the year 2017.

The questionnaire was designed in two parts, in the first place, sociodemographic questions were asked, such as the sex and age of the user. The questionnaire follows with a series of specific questions about the subject of study, specifically, those related to the training they received, the use they put the system to in the performance of their work, ease of use of the system and user satisfaction with the system. The following questions are directly related to the satisfaction of the users; if it was easy for them to face the system from the start and if they received the necessary training for its use. These questions were resolved according to greater or lesser satisfaction, that is, the participants answered 1 = Never and 7 = Always.

To obtain the answers of the users, the online questionnaire was created through Google, which was subsequently disseminated by sending a link through the internal e-mail of the company. Those consulted were chosen with the motive of being workers at intermediate levels of the company, in order to observe their opinion and not only that of managers, it was also sent to all the departments to which they had access to, so as to obtain a greater diversity of answers.

ANALYSIS OF RESULTS

Description of the Sample

In total 55 questionnaires was obtained, with the number of valid responses of 43. A response ratio of 78.19% was obtained, the high rate is attributable to the fact that it is a direct questionnaire. From the answers to these questions, we find that 55.8% of the respondents were women, that is, 24 of the total and

the rest men. The age group with the highest representation in the sample is between the range of 25 and 40 years old (52%), followed by the 41 and 55 years old age (22%). The answers are concentrated in these sections since the representation of workers in the company was included in these ages. Between them, a total of 32 individuals was added. 57% of the respondents were undergraduates and 31% graduates. Users were also classified according to their departments, to obtain a plurality of opinions according to the area which each respondent belongs. Noting that the majority of responses were obtained from departments such as production, accounting, international and operations. Also, the users' experience with the system was consulted, in order to check for any relationship between the months (time) the user had been using the system and the user's behaviour. Due to the fact that the system was implemented in the company in December 2016, it was observed that the experience expressed in months of the participants is approximately 72% of the cases, between 6 and 8 months.

Satisfaction Analysis

28% of users agreed that the system was not easy to learn and only 2 of the respondents, that is, 5% thought the system accessible. Although no respondent declared that it cannot be learned or that the difficulty of the system was very high, it was observed that users think that SAP is a difficult system to implement by themselves and that more training is needed by the workers of a company for them to efficiently work with it. It is for this reason that they were subsequently asked about the training provided by the SAP provider. It should be pointed out that 44% of the participants, together with 16% and 9%, consider that they need more training when a system of complex characteristics is implemented in the company, that is, courses, manuals and specialised people are required within the company, all to help workers through the process of changing the system they are used to for a new one, since it's tough working with a new system.

The next set of the questionnaire consists of 5 questions related to what the system provides users to do their work. First, participants are consulted to find out if they have sufficient access to the information provided by the system, from their respective jobs. In this case, more than 70% of the respondents believe they can access this information easily and are satisfied with the use of this information, as it enables them to perform their work in a simpler way. Next, we wanted to know if the information that the workers use is kept in the system without being lost, as well as, whether participants feel satisfied with the speed the system provides. So users who recognise that they have sufficient access to information, consider that the information with which they work is maintained in the system without being lost. Most participants say they feel satisfied and that the system provides security since the information and work they do is not lost. On the other hand, users of the system feel satisfied with the speed it provides, since, 35% of the participants give a score of 5 and 37.2% score with 6, on a scale of 1-7 are considered high scores. Next, it was asked if the system allowed users to enter the data in a clear and understandable way, with enough windows, menus, fields, etc. To which the participants responded in 45.5% of the cases that they feel satisfied with the explicit manner of the system. As a result of this question, we wanted to know in a more specific way if the system gave the possibility to use it combined with other useful tools in the daily work like Word, Excel or E-mail. Approximately 70% of the participants responded with scores between 4 and 5, considering that they can use other tools in connection with the system for their daily work. Likewise, 11 of the participants are very satisfied with this question, responding that they always use the system in coordination with different tools. Once you know what SAP users think about what it offers in a practical way, you want to find out the use and knowledge the system provides them. For this, two specific questions were asked, we want to know the level of knowledge or information provided by

the system, to understand what users are accessing and if they can easily apply this knowledge in their work. The respondents answered with more than 34%, positively assessing that the system provides them with sufficient knowledge and information, which they will subsequently apply to their respective jobs.

Subsequently, the frequency with which users access the system to communicate the knowledge and information provided by them was asked. So, users who recognise that the system provides them with information, also believe that this knowledge is communicated to their peers through the system, with more than 45% of the participants in favour of this question acknowledge using the information almost always. Noting that 30 of the 44 consulted are those that consider it useful to communicate information to the rest of the company's workers.

To complete the research, users were consulted on their level of satisfaction with the effectiveness of the system, as well as whether the system increases their quality of working life. In the first case, 64% of the participants responded that they almost always or always felt satisfied with the system and that it was useful to them in achieving their objectives. In the second case, the last issue directly related to the satisfaction of the users, which is to know their assessment of the service offered by SAP. In 36% of cases, users recognise that the quality of work life increases when they use the system in their work. In this question, the answers given are equally distributed. Data obtained showed 7% of the respondents never observed an increase in their quality of work, in contrast, 9% of the cases indicated workers who saw a growing increase in the quality of their work with the use of the system.

SOLUTIONS AND RECOMMENDATIONS

ERP systems are consolidated in companies of different sizes and sectors, thus making it possible for their real benefits to be definitely evaluated. However, choosing the right ERP is essential as, on one hand, the adaptations of the software can compromise the advantages of integration and, on the other, it requires having in perspective the needs derived from the strategy (information obtained from customers, suppliers and competitors) (Menezes and González, 2010). Also, for an ERP to facilitate the re-engineering of business processes, it must possess characteristics such as; the scope, configuration capacity of the system and its integration capacity; Different combinations of ERP perspectives can be applied with a view to achieving the required integration in inter-functional processes.

In this context, in order to guarantee the transition from an old system to the new one, it is important to carry out the following actions: a) hardware, software and database test; b) functional test with applied business processes; and c) the start-up in the real environment with specified technical and business performance criteria (Ugrin, 2009). One of the challenges of this phase is to build an implementation team that knows the needs of the organisation from the perspective of its business processes, to develop a project that takes into account the end users of the system (Menezes and González, 2010).

From an organisational point of view, it is important to identify unbalanced structures that tend to force customised adaptation, increasing the cost of modifications and the risk of the project (Soh and Sia, 2004). To avoid the voluntary mismatches between the users it is important to make a proactive management of the change, educating the users in alternative ways of working, hence, make the new system possible.

FUTURE RESEARCH DIRECTIONS

The investigation of how technologies and information systems support organisations to achieve their strategic goals is a huge field for the development of studies for business areas. In this context, the investigation of a specific technology such as the ERP opens a wide range of possibilities. For this reason, it seems important to carry out in-depth studies, using the case method, of the development of the background factors of the success of the ERP implementation, which together with the ERP system, are sources of sustainable competitive advantages. In particular, more studies are proposed to understand in detail: the role of organisational aspects, the impact of change management and how knowledge and learning exchanges lead to better results.

CONCLUSION

The results obtained from the study, as well as the theoretical development of this work, makes it possible to extract several conclusions about the satisfaction and usefulness perceived by the users of ERP systems and how it influences the quality of working life. The importance of an adequate administration of the information resource is increasingly considered in companies. Companies need technical and economic skills to design and develop information systems, which will permanently connect the company with the external information sources they need. Additionally, companies must design an adequate management of internal information, for which they advance studies that deepen the development and implementation of information systems which will lead them to achieve functions such as planning, controlling and supervising operational tasks, and data processing, as well as identify strategic and tactical information of the management level. The managers of companies must take into account the importance of the use of Information Systems and Information and Communication Technologies, in order to improve competitiveness, enabling them to act efficiently in current markets and achieve permanence in the marketplace.

Although it is a global phenomenon, Spanish companies are not unaware of this expansion, as a large number of them in recent times have implemented information systems such as ERP. They have benefited from the reduction and elimination of tasks due to the integration and automation of functions, as well as the reduction of circulation of documents and information on paper, all being registered in a database. The information is registered in the company and all users of the system have access to it, achieving a global vision of the operation of the company and obtaining available and immediate information for decision making. For all the aforementioned, a Spanish company which recently implemented the ERP software was studied for the observation of the reality of the benefits these systems present to users.

The present work analyses the effects of the implementation of ERP systems on the daily work of a group of users. While studying the satisfaction and usefulness of the system, it is observed that the users are affected by the change caused by the implementation of a new system in their work which they find difficult to manage. On the other hand, they have benefited, since the system has given them new knowledge and information in their work and the possibility of communicating it with the rest of the workers easily, without losing the recorded information. Also, the system provides the advantage of using it in combination with other computer tools that allow them to carry out their work. Furthermore, the importance of the time the software has been implemented is reached, since the effects on the productivity are not immediate, so it has been necessary to observe the improvement in the quality of work of users with the use of software over the months. It is worth noting that the people who are less resistant to change in the system and who have greater satisfaction by increasing their level of work

quality are those of the middle-age, with a higher education level. As a result, university education has a positive effect on the implementation of systems, therefore, companies whose managers have more training are most prone to better implementation. It was discovered that managers and employees with more training are less likely to oppose the change of system and are also more positive concerning the implementation in the company. It is concluded that the need for courses and manuals for the end users is fundamental, that is, proper training on the use of the software is important to make their use easier.

With all this, it is clear companies find advantages in the implementation of ERP systems, hence, different sectors now include them, in spite of the economic cost and time required, they look forward to its long-term benefits. Conclusively, the importance of information for companies is evident, therefore, information systems provide them with a strong advantage when it comes to attaining benefits and competitiveness. Companies should encourage the promotion of a culture in which individuals communicate with each other, as well as increase their skills and knowledge and share them with the organisation. Information technologies have become an acceptable resource which helps in the creation and internal accumulation of knowledge in companies.

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KEY TERMS AND DEFINITIONS

Competitive Advantage: A company's ability to obtain a better position in the market in which it operates, to defend itself against its competitors and also maintain its customers. It is the quality possessed by the company and its products so that in the same context, consumers or customers decide to select this company among the other potential options.

ERP (Enterprise Resource Planning): Information Systems that automate processes and allow access to the information generated at any point in the organisation. They integrate all the databases and help save costs and time. During implementation, it is necessary to invest in training staff, integration with other applications and the migration and conversion of data.

Implementation of an Information System: Process in which the planned acquisitions and developments are made, putting resources, both technical and human, in operation in a coordinated manner. It is crucial for users to begin to own the system.

Information Systems Re-Engineering: It consists of structuring or transforming old systems into easier to maintain applications, with more pleasant environments and integration into new platforms whether hardware or software.

MRP (Material Requirements Planning): Material planning system, associated with software which programs production and collects inventories. It regulates the quantity and when to procure materials according to the needs of the company. The software can determine the quantity to be produced, the components needed and raw materials to be purchased, in order to satisfy market needs.

MRP II (Manufacturing Resource Planning): It is an evolution of the MRP system that integrates production resources (raw materials, components, supplies, labour, tools, machinery, capital) with other areas such as administration, sales or the commercial area. It is the software which governs work order and materials and it is oriented towards strategies related to the human resources of a company.

Process Engineering: It consists of designing, planning, and making decisions to achieve the most optimal results of the processes. It gathers knowledge, techniques, and strategies for the company to accomplish the best results. It must monitor and give effective solutions during the start-up of the process and operate continuously until the end of it.

Resistance to Change: Lack of adaptation to organisational changes. This happens when a human being refuses to change their habits or become involved in new situations. In an organisation, employees can resist changing ways of acting, methodologies, schedules, or customs, among others.

User Satisfaction: Feelings of like or dislike which a user has when interacting with an information system, towards the benefits that the system generates. These feelings depend on whether or not the system meets the aspirations of the user.

Winery: Construction or building for the production and storage of wine. In Jerez, they are located on high ground with northwest or southeast orientation to avoid insolation and preserve moisture. The soil is earthy, which helps the winery maintain its freshness in summer, being able to water as many times as necessary. The generous wines of Jerez are dry and according to their ageing are classified as Fino, Amontillados, Olorosos and Palo Cortado.

Management Support Systems Type Business Intelligence (BI) and Factors Determining Their Implementation

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INTRODUCTION

The article contains the concept and analysis of basic types of Business Intelligence (BI) systems and the analysis of critical success factors of BI implementation. It focuses on the analysis of factors determining the effectiveness of implementation and use of Business Intelligence (BI) tools in organizations, depending on the implementation method applied. A particular emphasis is put on the use of agile methods in BI implementation. This article will present a number of arguments to confirm the hypothesis: Agile methods, in contrast to traditional methods, trigger the synergy of factors determining the effectiveness of using Business Intelligence systems. List of determinants of BI implementation and their link to a selected method of implementation will help organizations to use BI systems efficiently at all levels of management: operational, tactical and strategical. Effectively implemented BI will help organizations to prepare a smooth entering to the Industrial Revolution 4.0 (Industry 4.0).

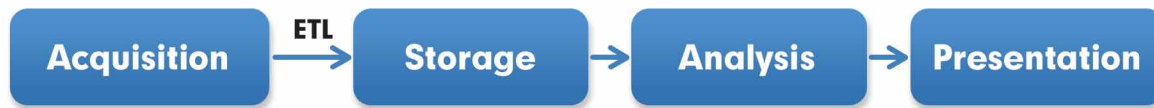
BACKGROUND

Nowadays, Business Intelligence (BI) systems are the most advanced approach to the application of information systems within an organization. There are many different reasons for this, such as: global economy, data growth, the increase in information significance - these force enterprises to focus on a better understanding of their environment and the inner circle of the organization, as well as on the reformulation of their strategies. Companies laboring under an overload of data, which they are unable to process, decide to implement BI systems or modify them. This solution is related to the need of identifying endogenous factors affecting the reception of new BI technology. This is required both by the shifting environmental conditions and the necessity to follow the environment. BI systems have become an indispensable element of the Industry 4.0 breakthrough. Industry 4.0 is related to the integration of the existing independent digital management systems and the creation of intelligent management support systems. The result is a new quality in the implementation of the management processes (Chen et al., 2018), which subsequently places new demands on supporting tools such as BI.

In view of the various features related to the implementation of the 4.0 concept, there are many technical problems associated with the transformation of traditional organizations. As BI can be used at various levels of strategic, tactical and operational management, it can help the organization on three

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Figure 1. Phases of BI (Eckerson, 2011)



levels of this transformation: identification and preparation, transformation process and implementation, continuous improvement within an already functioning smart organization. At the strategic level, top executives monitor, manage and analyze key organizational performance factors in accordance with the adopted strategy (Eckerson, 2011). Strategic goals supported by BI systems relate primarily to new sales markets, technological investments in production, as well as necessary modifications to the existing business model. The tactical and operational application of BI primarily assumes the enhancement of business processes (Fink et al., 2017). They are usually used to monitor and analyze operational processes in real time, such as production processes, for instance. Even though BI play such an important role, organisations do not use a real power of these systems. One of the reason behind is a weak implementation process which determines the actual usage of BI (Misiak, 2018). This article aims to list factors determining the effectiveness of using Business Intelligence systems and prove that agile methods trigger the synergy between them.

BUSINESS INTELLIGENCE STRUCTURE AND ITS TYPOLOGY

Business Intelligence (BI) covers a broad spectrum of issues such as practices, methodologies or tools related to data analysis. BIs transcribe data into information and knowledge (Olszak, Ziemia, 2012). Technologically, the BI system collects, integrates, analyzes data and then presents the obtained information in the decision-making process (Fink et al., 2017, Chen et al., 2018). The phases of BI performance, according to Eckerson's study (2011), are presented in Figure 1. Data is collected from various sources, then cleaned and unified with ETL tools (Extract, Transform, Load), transmitted to a data warehouse or virtual space, where they are analyzed by established algorithms, and finally the obtained information is presented in dedicated managerial tools.

These tools include reports, interactive dashboards, alerts and operational, graphical user interfaces, operational dashboards, etc. The benefits of BI are often indirect rather than direct. BI allows for a more effective, fact-based decision-making process and provides better quality information compared to those dispersed in various sources. An improved decision-making process based on good-quality information leads to enhanced business performance. Additionally, BI systems offer the possibilities of forecasting, access to real-time information and thus overall cost reduction (Eiskop et al., 2014).

BI systems can be an independent system, only integrated in the architecture of other systems operating in the organization, or they can be a module of Management Information Systems.

In recent years, the amount of data and the need for information has been increasing rapidly - the number of databases, repositories, files, websites and online stores, social media, etc. is growing. The concept of understanding BI remains unchanged, however, BI technology must adapt to changing needs. Therefore, new tools appear among BI solutions that extend the original BI functionalities. These include **Business Discovery**, intended for self-use by users, so-called BI self-service. This BI system allows you to create your own analyzes and reports without preparing OLAP cubes and data warehouses. Busi-

ness Discovery replaces the three layers of traditional BI: data warehouses, analytical tools and a data presentation layer. Nevertheless, any data warehouse can serve as a data source for Business Discovery. Thanks to this type of an analytical system, users can search for any information they need, not based solely on available pre-defined information structures.

Other tools that develop traditional BI are tools that support Big Data. According to the definition of Provost and Fawcett (2013) **Big Data** is a term referring to large, variable and diverse data sets, the processing and analysis of which is difficult and requires new technologies. In the report by Laney Douglas (Gartner, 2012), Big Data is described according to the 3V (volume, velocity, variety) model. Evolution of Big data brought the model 6V (Enterprise Management Associates, 2017):

- § large amount of data (volume),
- § high data variability (velocity),
- § large variety of data (variety),
- § ensuring the reliability and validity (veracity),
- § data proliferation (vulnerability),
- § data value (value).

Big Data in the technological sense concerns unstructured and process data from newly emerging sources (Devlin, 2013 and EMA, 2017). As emphasized by Power (2014), having Big Data is only useful when they are actually used in analyzes. In the further development of Big Data, *Hadoop* was created - distributed processing on the *open source* platform (managed by the Apache Software Foundation). Hadoop provides enterprises a new opportunity to process data more efficiently - primarily from the cost-side perspective (Rao and Vadapalli, 2016).

The development of tablets and smartphones has created a need to establish **Mobile BI** systems, which in a sense constitute additional functionality offered in BI packages. The availability of BI reports and analyzes on tablets and mobile phones allows access to company information from anywhere (Ronda et al., 2015).

The popularity of the concept of placing IT solutions in the cloud resulted in the creation of **Cloud-based BI**. These are BI systems offered in the Software as a Service (SaaS) model. For BI customers, it is a convenient way to use tools without the need to invest in infrastructure. Along with the development of the company, SaaS services enable the adaptation of BI infrastructure and software (Howson, 2013).

Rapid evolution of information technology and advanced production technology require the usage of BI systems. Production enterprises increasingly require support of Artificial Intelligence. Deterministic-digital models are replaced by heterogeneous models (Stochastic - deterministic). Due to the new challenges, the information needs of the traditional manufacturing industry have been gradually reduced. Decision systems are becoming more and more complex. BI systems, especially the ones of new generation, support integration processes of previously independent discrete systems and use more complex technologies. Intelligent production technology is one of the fields considered to be in the high technology class. Indeed, the industrialized countries pay more attention to it. Proposed by individual countries or organizations strategies such as “Europe 2020”, industrial revolution 4.0, US development programs accelerate the pace of reindustrialization and production flow. Intelligent manufacturing transformations supported by BI systems have an impact on future production worldwide.

In summary, BI systems are used to enhance the efficiency of the decision-making process. BI, transforming data into information, allows managers at all levels to better understand business and make wiser decisions. From the point of view of technological architecture, BI can download data from various

Table 1. BI Typology by data type analyzed (Chen et al., 2012)

	Characteristic	Feature
BI 1.0	Relational database in DWH § ETL (Extract, Transform, Load) - tools for data collection and OLAP (OnLine Analytical Processing) § Dashboards and score cards § Data mining	§ Database based on columns (DBMS) § In-memory processing (DBMS) § Real-time decision § Statistical analysis thanks to data mining
BI 2.0	BI 1.0 enriched with Web-based technology and unstructured content / data § Information (aggregated data) collected and extracted § Answers to inquiries § Analytics and web analytics and web intelligence § Analyzes and analysis of social media	§ Significant information processing § Opinion mining - BI allowing to download information about the mood of users / Internet users about a specific thing (e.g. product) § Answers to questions asked in natural language § Text and content analytics
BI 3.0	BI 2.0 enriched with mobile and sensor technology § Location-aware analyzes (identifying the geographical position) § Person-centered analysis § Context-relevant analysis § Mobile visualization	§ Ability to analyze BI 2.0 on mobile devices

sources - both systems inside and outside the company - and then, through defined algorithms, it presents them in the form of synthetic information. The number of possible data sources, type and amount of data increase, thus it leads to continuous development of new BI functionalities, tools and their new naming. The BI Industry 4.0 breakthrough will combine all the features described above. Technologically, BI will showcase much better performance in order to be able to provide information in real time from any data source and enterprise ecosystem devices.

Typology of BI systems changes dynamically and depends on technology level, the purpose of their use, or the type of data processed. The literature describes many different ranges of available BI systems and their typologies. The most popular is the typology according to Chen (2012), presented in Table 1.

In the era of Industry 4.0, BI systems should meet the features of BI 3.0 extended to learning technologies, real-time analysis of large data volumes (Big Data), and have forecasting functionality (Chen et al., 2018). It should be catalyzed by the evolution of trends like the Internet of things (IOT). From that perspective, BI systems focus less on creating reports that represent well-known situations in the past and more on discovering unknown insights and predictive outcomes about data in the future (Rodriguez, 2016).

THE ROLE OF BI SYSTEMS IN AN ORGANIZATION

BI systems allow making decisions based on information possessed by a company (Kisielnicki, Sobolewska, 2019). Thanks to them, decision-makers can take better and more effective actions and justify them (Davenport and Patil, 2012). The importance of BI has different dimensions depending on business areas in an organization. It can be used for financial reporting, marketing analyzes, management reporting, etc. BI provides managers the information on what is happening in their organization and ensures the easy access to information, often on-line (Williams and Williams, 2010.). For example, in the area of finance and controlling, these may be: analysis of financial statements (assessment of financial and property situation and profits by: index analyzes, causal research, regression and correlation analyzes, etc.), analysis of current assets (index analyzes in the scope of inventories, receivables, cash), analysis

of the capital structure (using the equity and foreign capital ratio), etc., in the area of sales: customer analysis in time (profitability of customers and groups of customers within a specified period of time based on purchases), analysis of deviations in sales of product-varied assortment (impact of the assortment change on the number of products sold and their price), etc., in the production area: analysis of production efficiency (analysis of productivity over time compared to standards depending on the production line, machinery, production operations, etc.), quality analysis (dependence of the quality of manufactured products and the used production lines and semi-finished products by suppliers). By analyzing indicators and deviations from the expected trend, enterprises can more effectively control decisions, accelerate development and increase their profits. Howson (2013) points out, however, that BI can bring an increase in the value of a company if users effectively use it. A wider and effective access to information does not guarantee a better performance of organizations, but rather show how available information is used by organizations. Howson (2007) indicates that BI alone does not introduce any value to a company. Therefore, BI implementation should not be a strategic goal, but a tool to implement management goals.

Business Intelligence can concern every level of management - operational, tactical and strategic. Operational and tactical management is always a consequence of the strategy. Therefore, the business strategy will be the basis for using Business Intelligence. A link between BI and a company's strategy can be presented in three dimensions:

1. BI as a support in creating an enterprise strategy;
2. BI used in the implementation of a company's strategy;
3. a need to implement BI as a result of a company's strategy.

Organizations, in order to set a good strategy, need to conduct a series of surveys in search of an answer to a question what factors and to what extent will affect their activities in the future. Implementation of a strategy requires continuous observation of the environment and analysis of micro- and macro-environment. Regardless of methods or tools used, the input data is required for this. These data will come from various sources, they will often be repeated or will appear in different formats. Thanks to the data warehouse or the logical layer of data processing (virtual warehouse), it is possible to combine data and thus obtain complete and cross-sectional information without the need to manually merge data generated in individual systems. Data warehouses store information about a long time horizon, which allows you to search for trends and use forecasting methods. Both current data analysis and forecasting may be useful in the case of budgets and their verification in various areas, e.g. labor costs, investments, sales revenue, product seasonality, but also competition activities and trends of its growth. Analytical applications often contain pre-defined solutions for a given company area with a standard set of reports and alert mechanisms. The **e-Business Intelligence extras** enable customers, suppliers and other partners to access information quickly. Acceleration of decision cycles has an impact on the efficiency increase, and it can be implemented when both parties have continuous access to information. **BI solutions for e-commerce** are used in advanced traffic flow analysis, tracking of user-customer traffic as well as accurate customer segmentation (Simon, Shaffer, 2003)

Business Intelligence systems support strategic management of organizations and allow them to achieve goals at every level. All levels of the organization base their actions on strategy. The need to implement BI should be the result of strategy - only then tactical and operational actions will lead to its effective implementation. Therefore, BI can allow defining a strategy and its implementation, while the decision to implement it must be the result of decisions at the highest level of a company.

BI IMPLEMENTATION METHODS

In the **traditional approach** to BI implementation, the stage project life cycle is intuitively mapped to cascading. It assumes that each stage of the project can start only if the previous stage is fully completed. Additionally, it is not possible to return to the previous stages after their completion, although there are variations of the model that allow returning to the previous stage in order to modify its partial products (change management in the project). For BI, this means that an organization will have to take into account the long waiting time for a final solution delivery.

This approach has many advantages, such as ease of planning, simplicity and linearity of a project. This method works well in projects where change is not recommended after delivery of certain products. However, using the cascade model in BI projects, numerous drawbacks and limitations should be taken into account. One of the disadvantages is maladjustment of the model to the changes occurring in the project. Changes are the everyday reality of every BI project (Cobb, 2012), especially in the case of systems created from the beginning or any information systems. In BI implementation projects, traditional methods work well for small organizations or limited substantive scope. This is directly related to a shorter implementation time and thus lower probability of changes in requirements. Thus, nowadays, agile approach has started to become popular.

Agile can be defined as a philosophy that focuses on principles, people, processes, products and practices, having a pragmatic approach to business needs (Cobb, 2012). Agile assumes that each project must be consistent with the strategic goals of the organization and focused on the early delivery of real business benefits. Business goals must be understandable for stakeholders who have an appropriate level of authority. A designed solution is delivered in time and in accordance with business priorities. All these assumptions do not differ from the traditional approach, however implementation of these assumptions is different. For this reason BI technology might be more easily accepted by users and lead to better views of information (Hughes, 2013).

There are many opponents of the agile approach, especially for Business Intelligence projects that have been conducted for many years in the traditional project management cycle (Lovell, 2014). In the case of such projects, it seems that many years of experience have allowed to fine-tune traditional methods almost to perfection, educating many project managers and developing many tools, both paid and free (*open source*). It is worth noting that the Agile philosophy has become part of the Industry 4.0 breakthrough. New technologies are implemented in agile way, and more often companies call themselves “agile” (Anderl, Fleischer, 2015).

In summary, agile methods require a change of approach and habits that are the result of running most BI projects in a cascade model. In traditional project management methods, the cost and schedule of a project determines its scope. Agile focuses on business values and uses them to determine a quality of the implemented BI system. Traditional methods are appropriate for a laid-out and predictable environment, while agile methods are ideally suited to the environment of frequent changes, uncertain and without a specific result. In case of BI projects, information requirements may change during a project, and often the information, which was very important, becomes useless at the end of the project. All models resulting from traditional methods adopt so-called *Rational Agent Model*, agile methods are based primarily on so-called *shared value approach* (Cobb, 2015). Traditional methods use and create structures based on control, while agile structures are flat, based on cooperation and so-called mutual inspection.

The choice of project management method will depend on many factors, such as an organization's ability to change, a type of BI project, as well as a size of the project. Table 2 presents main differences between traditional and agile approach.

Table 2. A comparison of Agile and traditional methods (Project Management & Agile Methodologies, 2012)

Approach	Agile	Waterfall
Emphasis	People	Process
Domain	Unpredictable/ Exploratory	Predictable
Documentation	Minimal-only as required	Comprehensive
Quality assurance	Customer centric	Process centric
Process style	Iterative	Linear
Organization	Self-organized	Managed
Upfront planning	Low	High
Perspective toward change	Adaptability	Sustainability
Prioritization of requirements	Based on business value and regularly updated	Fixed in the project plan
Management Style	Decentralized	Autocratic
Leadership	Collaborative, Servant Leadership	Command and control
Performance Measurement	Business value	Plan conformity
Return on Investment (ROI)	Early/throughout project life	End of project life

SOLUTIONS AND RECOMMENDATIONS

The complexity and diversity of BI systems means that the success of their implementation requires a methodical foundation and proven scientific theories. One theory is the theory of critical success factors that provides a good basis and a reference point to know what criteria should be used in BI implementation methods (Olszak and Ziemba, 2012, pp. 136-137). The idea to determine the factors that influence the organization's success appeared in 1961, presented by Daniel, and then developed by Rockart and Bullen (1981), in the context of the Management Information Systems (MIS) design. Noting that management boards of enterprises rarely use MIS systems, they stated that such systems should be structured in accordance with managers' information needs. In order to ensure that information needs of managers are known and included in the MIS management information system, they used the term "critical success factor".

In today's literature, critical success factors focus primarily on IT project management. Many consulting companies have developed their own lists of critical success factors and measures of project success, using them in their services of advisory.

Table 3 presents the critical success factors for projects, in particular BI, collected from four consulting groups. One of them is Deloitte, specializing in implementing IT solutions for business, in particular BI class systems, process and organizational consulting. The other two are McKinsey and Boston Consulting Group, the world's largest organizations specializing in strategic consulting.

The identification and use of factors influencing success is necessary for the proper preparation of selected projects. A precise measure of project activities is *efficiency*, most often directly referring to the financial or performance perspective of tasks carried out in an organization or a specific undertaking.

Efficiency measures can be divided into the following groups: measures of economic efficiency (quantitative) and measures of quality efficiency (Kisielnicki, 2017). Measures of economic efficiency (quantitative): Return on Investment, Payback period, Net Present Value, Net Present Value Ratio, Internal Rate of Return. Often, these measures are used for IT projects, by analogy to typical investment projects.

Table 3. Critical Success Factors of IT projects (especially BI projects) by Deloitte, McKinsey and Business Consulting Group (2016)

Deloitte	McKinsey	Boston Consulting Group
1. Project implements an organization's strategy and its needs 2. Sponsor of the project is the management board 3. Organization of the project - structure and management 4. Allocation of qualified resources to the project 5. Preparation for the project before it starts 6. Method of project management 7. Quality control	1. Sense of ownership and dedication to the implementation project 2. Prioritization 3. Recourses and their competences 4. Responsibility for tasks 5. Continuity in improving project implementation 6. Long-term planning from the first day 7. Effective method of project management	1. Full top management support 2. Project time: project implementation is shorter than 2 months or time between key controls is no longer than 2 months 3. Adequacy of participants' selection: run by a competent, motivated and well-coordinated team 4. Involvement of senior management 5. Commitment at lower levels: a project carried out by people with a positive approach to changes and changes are actually awaited by them 6. Additional effort: achieving, maintaining and consolidating does not require a lot of extra effort from project participants

It is difficult to assess the financial effects of projects with sufficient accuracy and refer them directly to the expenditures incurred. Quality performance measures are a group of measures which assessment is carried out in non-valuable units. They depend on the specific situation and can be divided into such groups as measures related to the organization's strategy in connection to BI implementation, BI project organization, the suitability of BI tool, technical and functional BI aspects translating into organizational benefits resulting from the BI implementation (Chen et al., 2018; Gaardboe and Svarre, 2017; Kisielnicki, 2008; Olszak and Ziemba, 2007). Many researchers have analyzed CSF of BI implementation. Delone and McLean (2003) demonstrated in their research critical factors of BI success: quality of information (obtained from the BI system), quality of the system (including its functionality and ease of use), quality of system maintenance. These factors might be directly translated into the intent of system's use and user satisfaction. As a consequence it leads to net benefits' achievement. In addition, as necessary success factors, they provided aspects of a schedule, budget and scope of the BI system implementation. It is a triangle that should be taken into account for every IT project. Ariyachandra and Watson (2006), on the basis of their research on the factors determining a success of BI implementation, divided them into three groups of CSF: organizational, efficiency of processes and infrastructure performance.

Similar observations have been found out in the research on critical success factors of the BI implementation process in small and medium-sized Silesian enterprises, carried out by Olszak and Ziemba (2012). The authors pointed out three perspectives of critical success factors: organizational, process and technological.

Nommesen and Macfie (2012) added a pragmatic test as a necessary factor for the success of the BI implementation. This applies to the quantitative check of data downloaded from source systems to a data warehouse.

Currently, organizations that decide to implement BI focus their attention on the method of system implementation. Agile methods are the most frequently selected. The Agile BI term is being used more and more often. **Agile Business Intelligence (BI)** refers to the use of the agile software development methodology for BI and helps in adapting to changing business needs. Agile BI enables the BI team and managers to make better business decisions. Agile method works on the iterative principle; it provides the best product. With Agile the requirements and design phases overlap with development, thus improving the development cycles for faster delivery. It promotes adaptive planning, evolutionary development

and delivery, and time-boxed iterative approach, and encourages rapid and flexible response to change. Agile BI encourages business users and IT specialists to think about low Total Cost of Change (TCC). With agile BI, the focus is not on the BI problem in the functionality of the cycle. Many companies fail to deliver the right business management (Loshin, 2019).

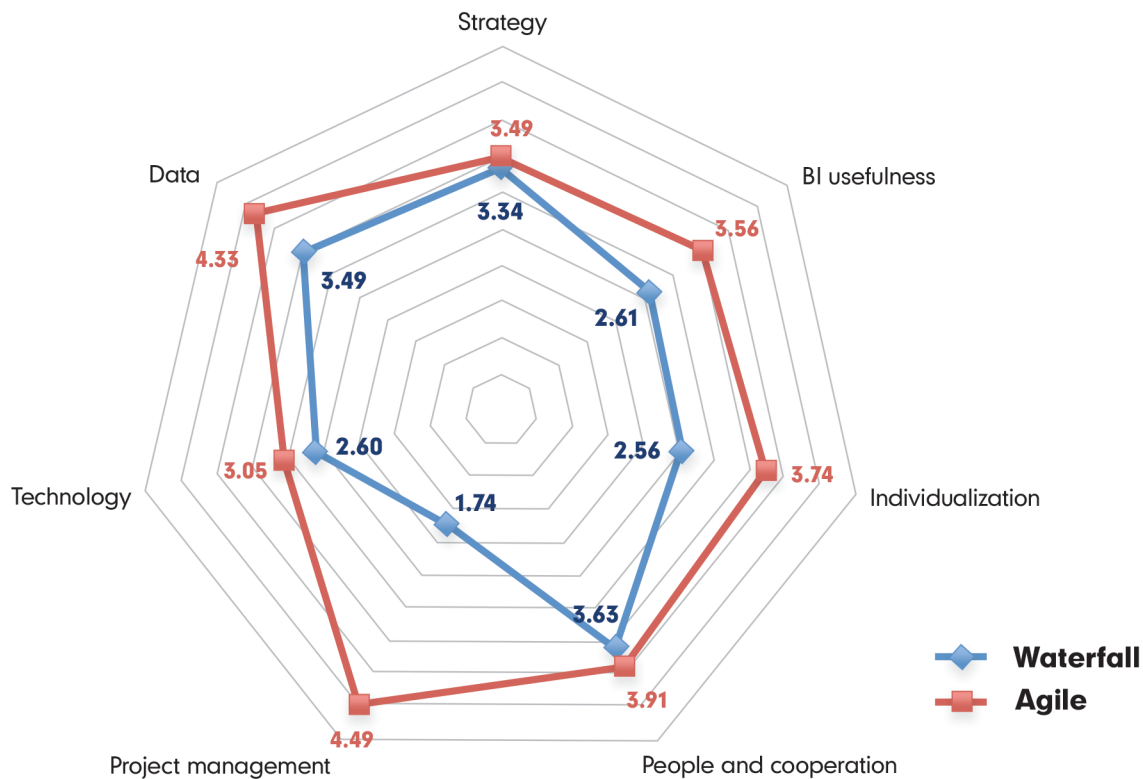
Research on determinants of BI implementation (Misiak, 2018), confirmed the results of research of predecessors in terms of both CSF and an impact of method on the effective use of BI in organizations:

- Regardless of the adopted implementation method, the factors of functionality and usability of BI are determinants of intention to use and actual use of BI;
- For project teams that have used a traditional implementation method, determinants of a practical use of BI in tasks at work and simple access to broad and detailed information are a quality of data in BI and simple tool handling. Determinants of the current use of BI are its practical usefulness and the possibility of simple access to detailed information.
- For project teams that have used agile implementation methods, determinants of a practical use of BI in tasks at work and simple access to broad and detailed information are the reporting speed and project management style of implementation, focused on cooperation. Determinants of current use are the suitability of BI system for tasks at work. Teams working with traditional methods also indicated this determinant.
- Very important determinants of BI implementation were also the need for BI implementation resulting from the organization's strategy and integration and mutual trust of team members. The functional aspects of BI were repeated several times in the analysis, these are: an easy access to detailed data (eg drill-down), an easy extension of access to wide information and a possibility of receiving individual content. It concludes that when BI implementation project is planned, in the first place the organization's strategy should be well recognized and understood. Based on the strategy, BI must be adjusted to its actual needs and implementation capabilities through the implementation of subsequent tactical and operational goals. At the same time, it is important to ensure the practical use of BI by future users, even if it involves a frequent change or extension of requirements during a project. At the same time, the manner of project organization and good relations in teams focused on cooperation may have an impact on the willingness to provide a high-quality BI product.

Additional interviews conducted by Misiak (2018) confirmed that for BI implementation projects, a use of elements of agile methods is more effective. The interviews were based on a number of questions that were based on the results of quantitative research and quality measures. The questions have been grouped thematically (Figure 2). Respondents used the Likert scale from 1-5 (where 1 means the lowest grade and 5 means the highest grade) and evaluated organizational issues, according to a current state of BI implemented in their organizations. The interviews' results showed that BI users participating in the agile project provided much better opinion on the implemented BI tool.

The users rated the highest a quality of BI data, indicating this factor as very important from the point of view of the usefulness of BI tool. Data was more complete and accurate when agile implementation methods were used. The usability of BI to work over other available tools was better assessed in organizations that used agile methods. Users associate the usability of BI with the individualization of content. The more the tool can be adapted to their needs, the more useful it becomes. Project management as a determinant of BI implementation was assessed by almost 3 points higher in the case of agile approach. According to the respondents' results, for this factor there is the biggest gap between the assessment of

Figure 2. Assessment of critical BI success factors depending on the applied implementation method according to the respondents' experience (Misiak, 2018)



the project carried out traditionally and agile. In the surveys, the need to implement BI resulting from the organization's strategy turned out to be the most important factor affecting the success of BI. During the interviews, managers indicated the essence of strategy in the BI implementation, at the same time confirming that it is independent from the applied implementation method.

FUTURE RESEARCH DIRECTIONS

The changes taking place are the result of new solutions in Management Information Systems (MIS). These are: Internet of Things (IoT), cloud computing, processing of big data sets (Big Data), blockchain technology, and all types of sensors and communication protocols. Most of these technologies are not exactly cutting-edge innovations. It is the combination of these technologies together with business processes and data processing that constitutes Industry 4.0 (Anderl et al., 2015). The value to be created by the breakthrough of Industry 4.0 will be achieved through innovative products along with the services, their individualization, growing competitiveness and more efficient operational processes. The ongoing progress in ICT (Information and Communication Technologies) enabled the functioning of intelligent, flexible organizations such as, among others, smart factories and smart cities (Schwab, 2016). In particular, Industry 4.0 is associated with a smart factory, where independent machines, systems and people become integrated and are communicating, leading to the creation of self-awareness and self-learning

devices (Lee et al., 2014). This allows for better control of production processes, thus increasing the quality of products (Bagheri et al., 2015), while also ensuring a more efficient acquisition, analysis and use of data, for the implementation of which the BI systems are a prerequisite. We can put forward the thesis that BI is a tool that significantly affects the functioning of an organization, which constitutes an implementation of the Industry 4.0 concept. These systems will have to feature the characteristics of the 4.0 breakthrough, i.e. processing of data from various systems and devices (internal systems, Internet, mobile devices, etc.), cloud processing of large data volumes (Big data), personalized visualizations, cooperativity, forecasting and reporting capabilities in real time and cognitive features. BI in Industry 4.0 will represent Artificial Intelligence (AI) functions or will be the main source of data for AI.

The BI operational capabilities are related to the creation of operational added value, which in turn leads to the creation of strategic added value (Fink et al., 2017). Therefore, it is advisable to measure strategic added value even if only operational BI applications have been implemented. The measurements carried out with the help of BI can be a contribution to the emergence of awareness of the need to implement Industry 4.0, and then to support the enterprise leading it towards the very transformation in the direction of Industry 4.0. The analysis of operational processes may allow to assess the readiness of individual areas for their introduction into the scope of technology 4.0. Furthermore, it can point out gaps and the needs for change prior to the existence of this technology. Data, information and knowledge are located in different places within the organization - they can come both from the inside or the outside, and they can take on various forms and be available on different media. This means that rendering the usefulness of collected information and knowledge in order to implement Industry 4.0 within an organization requires the introduction of its codification and the degree of abstraction - that is, a degree of generality - and the possibility of its use in various activities. Business Intelligence systems support both the registration of codification and the handling of algorithms and filters that allow obtaining knowledge and useful information (Cheng et al., 2019). Therefore, the BI system can be used for transformation by feeding data into a common denominator, and thus for connecting and communicating devices and employees within the network of smart factory operational processes. In a smart enterprise, intelligent logistics and objects, communication of mobile devices, etc., all work thanks to the efficient use of all the resources. Moreover, the goal is the production of smart items that can be further developed, even when they are already delivered to the customer, which can become an active element of the entire production process (Sendler, 2013). The vision thus described requires an independent order and organization of individual treatment of a single customer's order at each stage of the order's execution process (from the receipt of the order to its sending and continuous product modernization). In order to make it possible, Industry 4.0. must cover various forms of information exchange: exchange of information between humans (H2H), human-machine interaction (H2M) and exchange of information between machines (M2M) (Roblek, 2016). According to David et al. (2017), smart products can be characterized and improved by enhancing them with some input dimensions (e.g. sensors and download of relevant data), output dimensions (e.g. displays, including visual, audible or tactile signals), human-computer interfaces (e.g. control and interaction), interoperability (e.g. exchange of information between artefacts), integration (e.g. relevance or system utility on a larger scale) and resource efficiency (e.g. obtaining, generating and saving energy to provide their service) (Dawid et al., 2017). Thus, it can be stated that prior to implementing BI systems, one needs to focus on tasks related to the rapid transmission of heterogeneous information. At the same time, organizational procedures must be supported in the area of obtaining information in real time. Therefore, the effective use of BI in enterprises has become a key element of their strategy for transformation within Industry 4.0 and it will be a topic of next research.

CONCLUSION

Presented literature, analyzes of the researchers and trends in the BI market (Industry 4.0) confirm that agile methods trigger to a greater extent than the traditional methods of factors determining an effectiveness of Business Intelligence systems' usage.

The effective application of BI depends on the following groups of factors: 1) organizational (management support, clear vision, interactive cooperation, team composition, planning, etc.), 2) economic (budget, ROI, range), 3) technical (system quality, flexibility, scalability, data integration, data quality, ease of use, etc.), 4) sociological and psychological (leadership, motivation of the board and team, trust in the team, organizational culture) and 5) legal (aspects of financial and tax law). Among these determinants, there can be distinguished the following, affecting the efficiency of BI applications:

1. functionality of the system, including customization of content and access to more detailed and broader information as well as reporting speed,
2. data quality, their correctness and actual suitability for tasks,
3. usefulness of tools for tasks at work, so that the strategic, tactical and operational goals set by the organization can be realized,
4. method of implementation, especially the focus on cooperation and trust among project team members.

Essential topics discussed in the article introduce the elements of agile methods for BI implementation and an attitude of BI users to independent creation of individual content from large volumes of data coming from many sources. This indicates the need for further BI development in the direction of BI agile, BI self-service and Big Data, thus confirming that BI systems significantly affect the functioning of organizations implementing Industry 4.0. In addition to the many technical challenges that Industry 4.0 is facing, there is a need to identify the current state of business processes by mass reorganization of them so that enterprises and factories can become genuinely intelligent. The maintenance and further development of Industry 4.0 does not limit the need for BI systems. The emerging new data sources will introduce new opportunities to entrepreneurs, and hence they will need data analysis and tools that will provide guidance for new directions of development.

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KEY TERMS AND DEFINITIONS

Business Intelligence: Is a broad spectrum of issues such as practices, methods, or tools, with data analysis. BIs transcribe data into information and knowledge. BI can be an independent system integrated with other systems or exist as a Management Information System module.

Industry 4.0: These terms define the next, after the digital economy, stage of evolution of the economic management system. It is presented as integration of existing independent digital management systems and creation of intelligent management support systems.

Project Management Method: Comprehensive project management methods containing recommendations for conduct, pertaining to the entire complex of project management problems and processes.

REA–Semantic Teaching in the Accounting Information Systems (AIS) Courses

6

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INTRODUCTION

To meet the evident need for accountants that are familiar and understand Accounting Information Systems (AIS), many colleges added AIS courses or updated their current courses. Such a move was supported by accreditation bodies like the Association to Advance Collegiate Schools of Business (AACSB). But despite the agreement of the importance of AIS courses, the addition of AIS topics to the curriculum followed different approaches; some schools have only one AIS course while others may have two or more courses. Furthermore, most of the AIS courses were created with different topics and without any general agreement on the supplemental concepts (Fordham 2005), one may find some courses that focus on AIS security, audit and fraud while other courses give more emphasis on System Development Life Cycle (SDLC) and database design. Thus, textbook authors and publishers became more motivated to introduce textbooks that cover many of the needed skills, but in a format that exceeds what can be covered in one or even two AIS courses.

One of the important topics that most AIS course designs aim to cover is the REA (Resource-Event-Agent) framework that was designed by William McCarthy in 1982, it is widely adopted in AIS curriculum as a methodology to design a relational database, but despite its popularity the complexity of this topic and time limitations make it challenging to many AIS educators to cover such topic along with all the other learning outcomes that the academic programs and job market expect graduates to have. As a result, many AIS educators are facing a dilemma when they are creating or updating their AIS courses to achieve all the required learning outcomes within the allotted course meetings times. The easiest solution to solve this problem would be adding a second or a third AIS course, but that may not be possible nor practical in many cases. Consequently, some AIS educators ended up considering some topics as self-study material. Such an approach may work, but there is a price to be paid, greater preparation time, and student resistance to novel teaching approaches (Herreid and Schiller 2013).

Some attempts were made to address this issue; Seow and Pan (2017) designed an online self-study tutorial to teach REA at the undergraduate level, their online tutorial was designed to supplement class lectures by reinforcing the concept and incorporating practice to assess the student understanding. The online self-study tutorial helps in reducing the time required to teach REA data modeling, but it does not address how to deal with the theoretical part that will take place in the classroom. Textbooks that cover the REA data modeling topic in-depth offer several chapters in this area. For example, Romney and Steinbart (2018) cover REA data modeling in almost four chapters (4, 17, 18 and 19). Therefore, using a traditional approach by covering complete chapter materials may not be practical nor possible. This paper solves this problem by providing all the required knowledge to create an accounting relational

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database in one place. Furthermore, this paper provides a simplified example along each step to help to deploy the illustrated material.

FOCUS OF THE PAPER

This paper complements the Seow and Pan (2017) self-study online tutorial by providing a condensed version of the REA data modeling more from a theoretical perspective. It is designed to provide the basic knowledge required in each step in designing a relational database, accompanied by a simple example to show a possible outcome for that particular step. Furthermore, a clear methodology is provided on how to create a logical system design using a design approach that relies on business knowledge. This paper does not cover the remaining stages of the System Development Life Cycle (SDLC)¹. This paper can be used as a teaching aid for self-study material, a flipped classroom model or as supplementary material for an adopted textbook.

BACKGROUND

In this section, the basic required theoretical background for students to understand how to design a relational database using REA data modeling is provided. Furthermore, a simplified case study is being discussed along each step.

Preamble

Database design is the process of producing a detailed model of a database. This model contains all the needed parameters to generate a design in a data definition language, which can then be used to create a database at the beginning of its life cycle. The life cycle of any system, often called (SDLC), consists of the following stages:

- **System Analysis:** Represent collecting all the required information and defining the desired outcomes. This stage will produce a document generally known as System Requirements Analysis.
- **Logical design:** In this stage, a blueprint for the system is being created.
- **Physical design:** Translating the blueprint that was created in the previous stage into a software. This phase is also known as coding.
- **Implementation and Conversion:** In this stage, AIS will be deployed, and data will be transferred from the old system to the new system.
- **Operation and Maintenance:** The new system in this stage will be subject to routine testing and maintenance.

Database Design Approaches (Logical Design)

In logical database design, there are two different approaches. One approach is called Normalization, and this refers to the process of structuring data to minimize duplication and inconsistencies. It begins by storing all the data in one large table. After that, several rules will be used to split that large table into several interrelated and normalized tables as part of the database. The Normalization approach can be

similar to a paper writing style that starts by incorporating all the ideas and notes in one notebook; then, after that, the writer starts a refining process for the collection of notes to end up with a well-written and structured paper. The second approach is Semantic Data Modeling, in which the database designer uses business knowledge (technology) processes and information needs with respect to the semantic data modeling rules to create an efficient database. Using the writing analogy to illustrate this concept makes the semantic approach similar to when the writer starts by gathering all the required information and then placing such information in a well-defined paper structure and following a predefined plan (i.e., starts with the literature review, then define a problem, writing hypotheses ...etc.).

Semantic Database Design Using REA Modeling

The database design approach that this paper is following is a semantic approach called the REA framework that was designed by William McCarthy in 1982 (McCarthy 1982). In the spirit of the semantic approach design, the logical design that this paper illustrates follows these steps:

- **Acquire Business Knowledge:** This level covers the knowledge that must be acquired to identify the database users' needs and requirements. The semantic approach relies on the existence of such knowledge to create a well-designed database.
- **Design an REA diagram:** This is a diagram that provides an organization-wide view of the database and how the different elements interact with each other. One may think of the REA diagram as a general blueprint of a house, it gives the general layout of the house but does not provide specifics about each element (i.e., number of lights, outlets, trim specification in each room).
- **Internal level design:** In this level, using the REA diagram that was designed in the previous step, the database designer will create and describe the specifics of each data element. It is considered the lowest level of design and covers where and how data are stored, including the records layout, definition, and indexes. Using the above house blueprint analogy, the internal level design covers all house design specifics (i.e., number of lights, outlets, trim specification in each room).

In the following sections, the different steps in designing a database using a semantic approach that follows McCarthy's REA data modeling approach are described in more detail.

Acquire Business Knowledge (Step 1)

Using a semantic approach to design our database, the first step in the study will be acquiring business knowledge. This knowledge can be gained through the system analysis stage of the SDLC by utilizing different tools like questionnaires, surveys, interviews, and so forth. The quality of the information gathered could be affected by a data collection tool designer's overall industry knowledge and experience.

In this paper, a brief description of Green Goods Inc. sales operations is provided. The information provided may not be complete, and at a later stage, some assumptions need to be made by the users to complement the descriptions.

Case description ²

"Green Goods Inc. is a medium-sized company that sells small restaurant equipment. The sales representatives in Green Good Inc. receive customers' orders over the phone, or by email. After verifying the order information, the sales team creates a sales order and sends the information to the warehouse for

shipping. Also, they notify the accounting department to issue an invoice to customers. All invoices are due within 30 days; the company cashier will process any received payments and issue receipt voucher to the customer”.

REA diagram design (Step 2)

Data modeling is the process of defining a database, so it does represent all aspects of the organization, including its interaction with the external environment. This process happens during system analysis and conceptual design stages (Romney and Steinbart 2018). Data modeling can be executed through the **REA data model** that was specifically designed for AIS.

Generally speaking, the REA data model relies on identifying all the necessary information sources which we need to capture. Such information sources are called **Entities**. The REA data model target three types of entities, economic **Events** in each transaction cycle, the corresponding **Resources**, and the **Agents** who are participating in such events. The identified entities will be used in a modeling diagram called the REA diagram. To create an REA diagram, the below steps need to be followed:

Identify entities:

The REA data modeling focuses on the following three types of entities³:

- A. **Events:** Represent the events that the management would like to collect information about (i.e., purchase orders, sales, purchases, cash collection, etc.). There are two types of events: **economic events** that affect the company resources directly. They result from activities such as the sale of products to clients, receiving cash from customers. The second type of event is **commitment events**. This type does not affect resources directly but has other purposes, like planning and internal controls. A good example of this type is the purchase order; it does not decrease inventory directly, but it will provide a commitment for future purchases, which as a result, will decrease inventory. To identify events in any given case, one should assume that every event must be linked to at least another event. In other words, in each case, one should have at least two events. This assumption is withdrawn from the concept of “Economic Duality”, where a “give-get” relationship occurs. In typical business activities, a “give” event occurs when an organization must give up a resource to trigger a “get” event where they obtain another resource. For example, the event of a sale triggers a cash collection event or a purchase event triggers and linked to a cash payment event. Said that a database in a real-world scenario more likely will have more than two events.
- B. **Agents:** They are the individuals and departments that participate and support economic events. Agents can be both inside (internal agents) and outside the organization (external agents). Each event will be linked to at least two participating agents. For example, the event of a sale will be linked to a “Sales Representative” agent and “Customer” agent. Please keep in mind that there could be more than two agents linked to one event. Also, one agent may be participating in multiple events. For example, the “Customers” agent will participate in “Sales” and “Cash Collection” events.
- C. **Resources:** They are things of economic value to the organization and under its control. Resources are used in economic exchanges with trading partners are either increased or decreased by the exchange. Cash and inventory are examples of resources. To identify resources the recognized events are used to look for the resources that are linked to the events For example, if two events (Sales and Cash Collection) are identified, the user will be able to identify “Inventory” resource that is linked to “Sales”, and “Cash Accounts” resource that is linked to “Cash Collection” event. Each event will affect one resource with one exception to “Commitment Events,” which may not affect any resources directly. For example, “Sales Orders” is a commitment event that will not decrease

the “Inventory” resource directly but will lead to another event “Sales,” which, as a result, will reduce the “Inventory” resource.

Deploying the rules mentioned above on the Green Goods, Inc. case will generate the following entities presented in Table 1. Please note that the entities matrix was created by starting with Events followed by Agents and Resources.

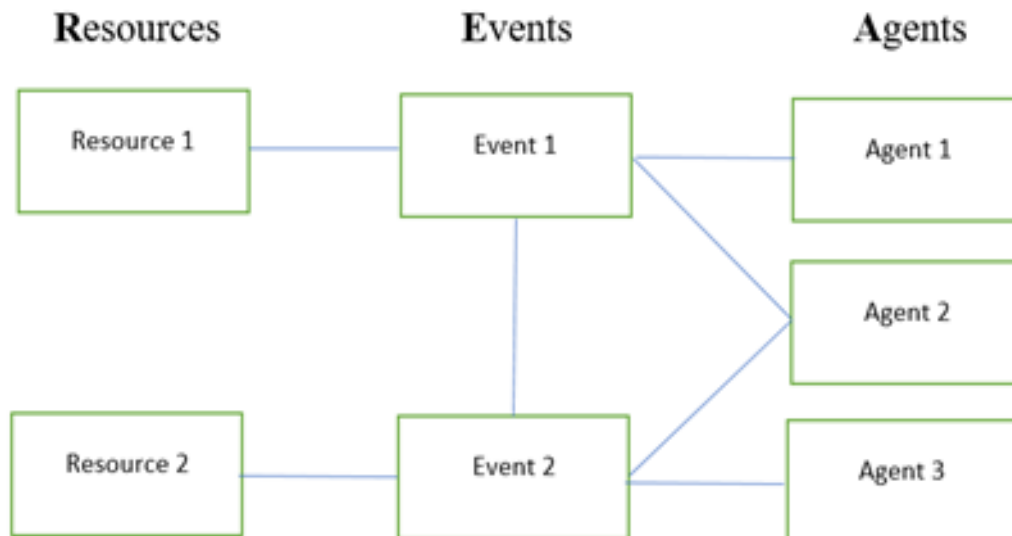
Table 1. Entities list in Green Goods Inc. Case

Events “Each event will be linked at least to another event.”	Agents “Each event will be linked at least to two agents.”	Resources “Each event will be linked with one resource. Commitment events are an exception.”
Sales order	Sales Representative	Inventory (indirect impact)
	Customer	
Sales/Invoicing	Customer	Inventory (decreased)
	AR officer	
Cash collection	Customer	Cash Accounts (Increased)
	Cashier	

Creating a Preliminary REA diagram:

REA diagram describes the pattern for how the three types of entities should relate. As a matter of fact, the diagram name (REA) represents the diagram structure. Events will be placed in the middle of the diagram, while Resources and Agents will be on the sides, as shown in Figure (1).

Figure 1. REA diagram template



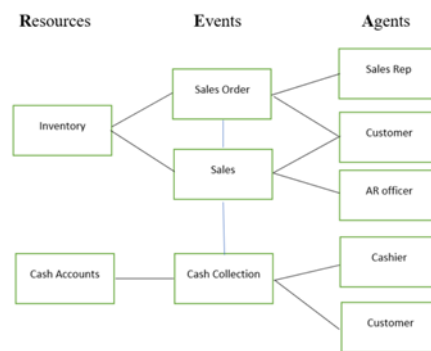
To create an REA diagram, one should:

- A. Place events in the middle of the diagram and list them in chronological order. In other words, we start with the oldest event and place it first, then follow it by the subsequent events. In the Green Goods, Inc. case, the first event will be Sales Order, followed by Sales and Cash Collection.
- B. Place the identified resources to the right (your left) of the related events. For example, one will place the “Inventory” resource beside the “Sales” event.
- C. Place the identified agents to the left (your right) of the related events. If an agent participates in two events, try to locate it to be close to both events. For example, “Customer” agents that participate in “Sales Order” and “Sales” events, is located to the left of the events and at equal distance from the events. If the agent participates in three events, you may create another symbol to avoid relationship overlaps.
- D. Connect the related entities using a straight line; the straight line represents a relationship.

These relationships described in step D can be one of the following types:

- **Economic duality (Give-Get) relationship** between events, where one event represents “Give” and the other represents the “Get”. For example, there is a relationship between “Sales” (Give event) and “Cash collection” (Get event).
- **The cause-effect relationship** between events. In this case, one event will cause or trigger the second event. This is very true for commitment events. For example, a “Sales order” event does not represent economic duality; nevertheless, it will cause the occurrence of a “Sales” event.
- **Stock flow relationships (inflow/outflow)**. This is a relationship that usually happens between events and resources. In this relationship, the event will either increase or decrease the related resource. For example, the “Sales” event will decrease the “Inventory” resource.
- **Accountability relationships**. This is a relationship that can be established between Events and Agents. Figure (2) shows the execution of this guideline on the Green Goods, Inc. case.

Figure 2. Step “D” in REA diagram development



Internal Level Design (Step 3)

As mentioned above, the REA diagram that was designed in the previous step will be used to create and describe the specifics of each data element. But before doing that, several concepts that are essential to this process are being explained below.

In database design, the focus is on **Entities**; they represent the point of interest and what the management would like to gather information about. After defining entities, one needs to identify each entity with its **Attributes** or characteristics that define the entity. All the data about the entity will be stored in a **Table**. Each row in that table represented one instance of that entity and called a **Record**.

Attributes are classified into three types. The first type is **Primary Key**, which is an attribute or combination of attributes that uniquely identify an item in a specific row. For example, a primary key for Green Goods inventory could be the “Item Number” or “SKU Number” attribute. The primary key is the first attribute that needs to be defined. The second type is **Foreign Key**; this key is an attribute that is a primary key in one table and used in other tables to execute a relationship. For example, the “Item Number” is a primary key in the “Inventory” table then used as a foreign key in the “Sales” table to identify the sold items. More discussion on this topic will take place in the following sections. Finally, **Non-Key** attributes are neither primary keys nor foreign keys; they are used to describe the entity and provide information that is essential for operations and/or reporting. For example, some non-key attributes for the “Inventory” entity are “Item Description,” “Item Location,” and the “MSRP.” For non-key attributes, a user must collect only enough information.

To create the internal design of a database, the following steps must be followed:

- 1- Create a table for each entity in the REA diagram.
- 2- Identify all the three types of attributes to each table.
- 3- Conduct completeness check

Create a table for each entity⁴

The ultimate goal of defining the entities of interest is to gather information about it; thus, one table will be created for each entity that was identified. For Green Goods, Inc. case and based on the REA diagram that was developed in Figure (2), nine (database) tables will be created, check Table 2 for further details.

Table 2. List of tables created in Green Goods

Tables / Attributes	Sales Order	Sales	Cash Collection	Inventory	Cash Acc.	Sales Rep.	Customers	AR officers	Cashiers
Primary Keys									
Foreign Keys									
Non-Keys									

Identify all the three types of attributes to each table.

As mentioned earlier, the **first type** of attributes that need to be defined is the primary key. A primary key is an attribute or combination of attributes that uniquely identify each incident of an entity; in other words, it can't be duplicated. Furthermore, one should keep in mind that the primary key cannot

be null (no value) for any incident. To choose a good primary key, the validation questions in Table 3 are recommended to avoid choosing the wrong attribute to represent the entity primary key.

The **second type** of attribute is foreign key, this key is an attribute that is a primary key in one table and used in other tables to execute a relationship. Foreign keys are created using the following rules. Please see **Different types of relationships** section to review the different types of relationships⁷.

- **The primary key of the first event will be used as a foreign key in the second event.** For example, “Invoice Number” as the primary key of the “Sales” event, will be used as a foreign key in the “Cash Collection” event. In this example, the foreign key will connect these entities and enable the database user to figure out which invoices are paid.
- The primary key of Agents will be used as a foreign key in the related Events.** For example, “Customer Number” as the primary key of the “Customers” agent is used as a foreign key in the “Sales” event.
- The primary key of Resources will be used as a foreign key in the related Events.** For example, “Item number” as the primary key of the “Inventory” resource is used as a foreign key in the “Sales” event.

Table 3. Primary key validation questions⁵

Question	Optimal answer
Does the proposed attribute differentiate one entity incident from another?	Yes
Is it possible for any duplicate attribute values?	No
Is it possible for the proposed attribute to have no value?	No

The **third type** is Non-key attributes, they are neither primary nor foreign keys. All Non-key attributes in a given table must describe the characteristics of the entity. For example, in the “Sales” event

Table 4. Database design checklist

#	Element	Verification
1	Number of entities	- At least two events. - At least two agents for each event. - At least one resource for each event with the exception of commitment events.
2	Number of tables	- At least one table for each entity we identified.
3	Primary keys	- One valid primary key for each table (see Table 3)
4	Foreign keys	- Each relationship will require a foreign key. In other words, if we have nine relationships, we should have nine foreign keys. - Generally speaking, all the foreign keys will be located in the “Events” tables; please check Table 4 as an example.
5	Non-Key attributes	- All non-key attributes must describe the entity that we are examining. - Tables that represent events (Transaction Tables) tend to use a non-key attribute that changes with every transaction (i.e., Sold quantity attribute in Sales table). While tables that represent agents and resources (Master Tables) tend to include a non-key attribute that does not change that often (i.e., MSRP in the inventory table).

Table 5. List of tables created in Green Goods and all the attributes

Tables / Attributes	Sales Order	Sales	Cash Collection	Inventory	Cash Acc.	Sales Rep.	Customers	AR officers	Cashiers
Step 1: Identify Primary Key(s)	-SR No.	- Invoice No	- Receipt No.	- SKU number	- Acc. No.	- Rep ID.	- Customer ID	-AR ID	- Cashier ID
Step 2: Foreign Keys	-SKU number -Rep ID -Customer ID	-SKU number* -Customer ID* -AR ID - SR No.	- Acc. No. -Customer ID* - Cashier ID - Invoice No.	N/A	N/A	N/A	N/A	N/A	N/A
Step 3: Non-Keys	- SR Date - SR Qt.	- Invoice Date - Qt. sold. - Unit price **	- Receipt date - Receipt amount. - RV notes.	- Item description. - MSRP - Warranty period.	- Account location. - Account Currency	- Rep Name. - Commission Rate	- Customer Name. - Enrolling date. - Shipping Address. - Billing address	- AR Name.	-Cashier Name

table, “Invoice Date” is a non-key attribute that describes the sales transaction. There are no specific requirements for defining Non-key attributes other than collecting all the information that is needed to describe the entity to fulfill any operation and/or reporting requirements.

Conduct a completeness check

In verifying the completeness of the logical database design, it is recommended to use the following checklist:

Cardinalities

Cardinalities define the nature of relationships between two entities by indicating how many instances of one entity can be linked to each instance in another entity (Romney and Steinbart 2018). The nature of the relationship between entities is defined by the norm followed (business logic) or a specific policy adopted by the organization. For example, cardinalities define how many invoices (instances of sales) can be linked to one receipt voucher (instance of cash collection): Issue one receipt voucher for each paid invoice? Or Issue one receipt for multiple paid invoices?

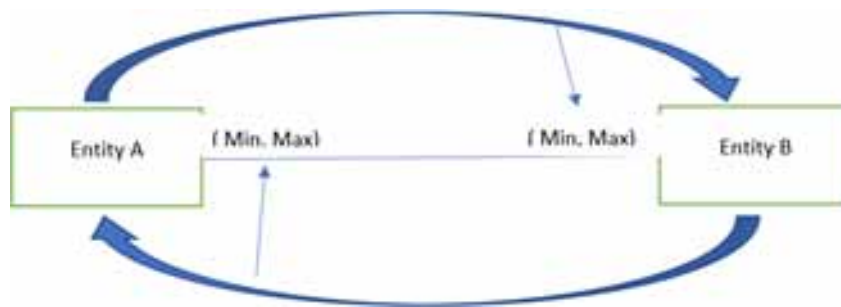
Defining cardinalities is usually done before creating tables; cardinalities may result in a specific type of relationship that will require creating new tables. Due to the potential complexity of this topic, it was elected to delay discussing cardinalities until a basic understanding of databases, the structure of tables is being established, and it also helps to realize the important role of foreign keys in representing relationships.

Cardinalities are used to represent the specifics of how entities are reacting with each other in the REA diagram. More specifically, how many instances of one entity can be linked to another entity? Thus, in any given relationship, two directions of relationship will be discussed. As explained in Figure (3), the first direction illustrates how many instances of Entity A could be linked to one instance of Entity B, while the second direction shows how many instances of Entity B could be linked to Entity A.

In each relationship direction, two values will be defined as one pair of cardinalities; the first is a **Minimum Cardinality** that represents the minimum number of times that the first entity must be linked to the second entity. The second value is a **Maximum Cardinality** that represents the maximum number

of times that the first entity could be linked to the second entity. Accordingly, each relationship will generate two pairs of cardinalities to represent both directions, as shown in Figure (3).

Figure 3. Pair Cardinalities in a relationship



Representing cardinalities for each direction can be done in different notation formats (symbols, numeric, etc.). In this paper, a numeric notation system will be used; this system can be found easier to explain and make more sense to accounting students. Using the numeric notation system will result in two possible values of Zero and One for a minimum cardinality, while the maximum cardinality has two possible values of One and Many. Table 6 shows a summary of the possible cardinalities' values and their symbols.

Table 6. Possible values for cardinalities

Cardinality type	Possible Values	Number/Symbol used
Minimum (The minimum number of times that the first entity must be linked to the second entity)	Zero	0
	One	1
Maximum (The maximum number of times that the first entity could be linked to the second entity)	One	1
	Many	"M" symbol is used. If two "Many" cardinalities exist in one relationship, the second cardinality will use the "N" symbol.

Cardinalities Interpretation and Implementation

In this section, cardinalities are explained. Followed with a proposed methodology to help to translate policies to cardinalities. The basics of cardinalities interpretation rely on understanding what each cardinality represents. The minimum cardinality basic interpretation reads

Each (*One instance of Entity A*) must be linked at least to (*enter the value of the minimum cardinality*) in (*the second entity instances*).

While the maximum cardinality basic interpretation will be

Each (*One instance of Entity A*) can be linked at most to (*enter the value of the minimum cardinality*) in (*the second entity instances*).

As an example, if the pair of cardinalities that represent the relationship between inventory and sales has a value of (0, M), the cardinalities interpretation structure will result in:

- Minimum cardinality (0): Each Inventory item must be linked at least to Zero invoices.
- Maximum cardinality (M): Each inventory item can be linked at most to Many invoices.

It worth noting “Inventory Item” was used as a representative of one instance of the “Inventory entity, while “Invoices” was used as a representative of the “Sales” entity multiple instances. The reader should keep in mind that cardinalities interpretation relies on the understanding of the business environment. Acquiring enough business knowledge is important to provide meaningful interpretation for any of the given cardinalities. Thus, the above basic interpretation can be transformed into the following statement.

“Each inventory item can be sold an unlimited number of times, but there may not any sell for a while.”

This statement does reflect normal business logic; no one knows if any inventory item the company acquired will ever sell (Minimum = zero), and, in a normal situation, one will sell the item several (Maximum = Many) times over the course of our inventory economic life.

Another example is the pair of cardinalities that have a value of (0, M) between the Sales entity and the Cash Collection entity.

The cardinalities basic interpretation for this pair of cardinalities is:

- Minimum cardinality (0): Each invoice must be linked at least to Zero cash collection receipt vouchers.
- Maximum cardinality (M): Each invoice can be linked at most to Many cash collection receipt vouchers.

The minimum cardinality indicates that each invoice created may not have any cash collection receipt vouchers linked to it. Using some basic understanding of business knowledge, it can be concluded that the minimum cardinality (Value of 0) implies no down payment will be required when upon selling. When examining the maximum cardinality (Value of M), it can be concluded that the company accepts multiple payments for each invoice; this is an indication of installment sales. Combining the two cardinalities in one statement will result in the following interpretation:

The company sales policy is installment sales with zero down payment

This is a company-specific policy. Other companies may have different requirements. For example:

- Cash only.
- Installment with a down payment.
- On account, but paid in full.

Now, after explaining how to read cardinalities, it is needed to explain how to translate any given policy to a pair of cardinalities. To do that, the following methodology is suggested:

1. Identify the pair of entities affected by this policy. In other words, which relationship in the REA diagram are being examined.
2. Identify the direction of the relationship. As explained earlier, each relationship has two pairs of cardinalities, and each pair represents one direction. Please check Figure (3).
3. Based on business knowledge, answer the following questions to define the minimum and maximum cardinalities.

Table 7. Cardinalities example for Green Goods, Inc.

Steps	
1- Identify the pair of entities affected by this policy. In other words, which relationship in your REA diagram you are examining?	We have two apparent entities: - Sales Orders - Sales Representatives
2- Identify the direction of the relationship.	We have two directions: - Sales Representatives to Sales Orders. - Sales Orders to Sales Representatives.
3 – Answer the following questions A- At least, how many times one instance of entity A must be linked to Entity B table? B- At most, how many times did one instance of Entity A have to be linked to the Entity B table? Min. Cardinalities has two options - Zero. - One. Max. Cardinalities have two options - One. - Many	<u>Sales Representatives to Sales Orders:</u> A – At least, how many times did one sales representative have to be linked to sales orders? Zero times; sales representatives spend three months in training and may not generate any sales orders during that period. B- At most, how many times did one sales representative have to be linked to sales orders? Many times; this is business logic, you hire the sales representatives to sell several times and not only one time. Pair of cardinalities for this direction is (0, M) <u>Sales Orders to Sales Representatives</u> A- At least, how many times one sales order must be linked to a sales representative? One time, the company policy states that each sales order must have one sales order. B- At least, how many times one sales order must be linked to a sales representative? Many times, the company allows for more than one sales representative to work on the same sales order. Pair of cardinalities for this direction is (1, N)

- A. At least, how many times one instance of Entity A must be linked to the Entity B table?
B. At most, how many times one instance of Entity A must be linked to the Entity B table?

This methodology relies on thin slicing any given policy to ease the process of identifying cardinalities in any given relationship. To illustrate this methodology, the following description to the Green Goods case is being added:

“Greens Goods hires sales representatives to market for the equipment that they sell. Sales representatives usually will generate sales orders after 3 months of a mentoring period. Green Goods sales orders only get generated through sales representatives. If any customer contacts the company directly, the customer will be referred to as one of the current sales representatives. In some cases, the company does allow more than one sales representative to work on the same sales order.”

Please check Table 7 for the solution to this case.

Different Types of Relationships

Identifying the pair of cardinalities in each relationship in an REA diagram will result in different types of relationships. Three basic types of relationships between entities are possible, depending on the maximum cardinalities in any given relationship (Romney and Steinbart 2018).

- 1- One-to-One relationship: Both of the maximum cardinalities in the relationship has a value of 1.
- 2- One-to-Many relationship: One maximum cardinality has a value of 1 while the other is Many. The order of values is irrelevant.

- 3- Many-to-Many relationship: Both of the maximum cardinalities values in a relationship have a value of “Many”.

Defining the different relationships in any database design is important. The first two types of relationships will not alter the database design that was created earlier in this paper. This is not the case for the third type, Many-to-Many relationships.

Many-to-Many relationships cannot be executed in databases, as a result, it is required to break them into two One-to-Many relationships by using a new third entity that is called a “Join Entity.” The primary key of the join entity table will be consistent with the primary key of the two entities that we are examining. Table 8 illustrates the join table concept between “Sales Rep” and “Sales Orders” Many-to-Many relationships.

Table 8. Join table between “Sales Rep.” and “Sales Orders”

Tables / Attributes	Sales Order	SalesOrder_Sales Rep (Join Table)	Sales Rep.
Step 1: Identify Primary Key(s)	-SR No.	- SR No. - Rep ID.	- Rep ID.
Step 2: Foreign Keys	-SKU number -Customer ID		N/A
Step 3: Non-Keys	- SR Date - SR Qt.		- Rep Name. - Commission Rate

SOLUTIONS AND RECOMMENDATIONS

The REA design process is hands-on and helps the students to:

- Understand the basics of SDLC.
- Differentiate between normalization and semantic database approaches.
- Create an REA diagram using REA data modeling.
- Ability to create an internal level design (Tables) using an REA diagram.
- Understand cardinalities and how they affect database design.

FUTURE RESEARCH DIRECTIONS

Entity Relationship or Enhanced-Entity-Relationship (EER) modeling is the de facto standard for relational database design in the broader field of Information Systems. The database design in AIS is considered to be a special case. However, it would be interesting to compare and contrast the REA modeling approach to database design in AIS over EER modeling. In our future works, we also intend to address this issue.

CONCLUSION

It is expected that the examples and the descriptions in the paper will complement the Seow and Pan (2017) self-study online tutorial and ease the burden both on the instructors and the students in designing a relational database. Contrary to traditional books that cover this topic using multiple chapters, this paper provides a comprehensive resource to design relational databases in accounting. This has been achieved by providing concise and simplified step by step guideline that covers the basic knowledge required in designing a relational database in AIS. Furthermore, this paper provides a simplified example along each step to help to deploy the illustrated material. Finally, we provided notes to instructors that cover possible discussion points with students, validation points, and any justification for a methodology we used in this paper. We believe this paper will help students to acquire all the required basic knowledge to create a relational database in a short period of time, which is becoming more and more important given the pressure to cover multiple topics in AIS courses to meet the market demand.

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ADDITIONAL READING

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KEY TERMS AND DEFINITIONS

Agents: A type of entity that represents individuals who participate and support the economic event.

Attributes: Characteristics that define the entity

Cardinalities: Graphical or numerical expression that define the nature of relationships between two entities by indicating how many instances of one entity can be linked to each instance in another entity.

Entities: A concept that represents the point of interest of what management would like to gather information about.

Events: A type of entity that represents an activity of interest.

Foreign Key: This key is an attribute that is a primary key in one table and used in other tables to execute a relationship.

Logical Design: Methodology of describing how information flows in a system regardless of which medium is actually used.

Primary Key: An attribute or combination of attributes that uniquely identify an item in a specific row.

REA Data Modeling: Methodology used to design databases in Accounting, it starts by defining the different types of entities then, using business knowledge, organize the relationship between these entities.

Resources: A type of entity that represents things of economic value to the organization and under its control.

Semantic Approach: Using business knowledge to create a database.

System Development Life Cycle (SDLC): A process that describes a system life cycle, this cycle starts with system analysis, conceptual design, physical design, implementation, and conversion and ending with operation and maintenance.

ENDNOTES

¹ Note to instructor: Please keep in mind that the above description of SDLC is a very brief illustration of what each stage entails. One can explain to the students that each stage will have more activities (i.e., feasibility studies, alternative analysis evaluation, etc.).

² Note to instructor: Providing a limited amount of information at this stage is intentional; it is designed to improve the students' analytical skills by asking them to be critical of the provided information and facilitate discussion.

- ³ Note to instructors: It will be beneficial to conduct a discussion about which entity should be identified first. The students will conclude that Events are the first type of entities that needs to be identified, followed by agents and resources. Students frequently ask about the inventory availability in the online sale environment and when a database system should update the available inventory. Does it happen after the customer place item in the cart or after they place actual order with valid payment? What are the pros and cons of each approach?
- ⁴ Note to instructors: One can ask the students to use the validation questions in the following problems: Is the “Invoice number” a good primary key for the “Sales” entity in Green Goods? Green Goods invoicing system uses a serial number for invoices that:
A-Alphanumeric invoice sequence (YYYY-Serial number), i.e., 2018-0001.
B-Simple serial number that we reset at the beginning of each year, i.e., 00001
- ⁵ Note to instructors: This is a good opportunity to remind students of the importance of obtaining sufficient business knowledge in database design using REA data modeling.

Embodied Conversation: A Personalized Conversational HCI Interface for Ambient Intelligence

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INTRODUCTION

Ambient Intelligence (AmI) and Smart Environments (SmE) are built on three foundations: Ubiquitous computing, ubiquitous communication, and personalized adaptive interfaces. One of the key requirements is the fact that interaction takes place through natural interfaces, in such a way that people can perceive the presence of smart objects and machines as little as possible, and only when the system cannot achieve its functionality without intervening for the user's attention. Namely, the use of physical, especially non-freeform, controllers (e.g. touch-screen, remote, mouse, keyboard) hinders natural interface and establishes a strong barrier between the user and computer. Moreover, speech and body language are part of the input/output Human-Computer Interface (HCI) modalities, which have the benefit of being a natural modality for communication between humans. The speech as input modality can be used in many scenarios, which are also reflected in the complexity of the automatic speech recognition system. Humans are social beings, who utilize all available signals, from linguistics, language, and speech, to paralinguistic and non-verbal in the perception, understanding, and production of information in face-to-face communication. Some of the paralinguistic and non-verbal audio events can be processed in parallel with the automatic speech recognition system, with the possibility to share some modules, such as feature extraction.

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Aggregation in (multimodal) understanding and use of natural language is especially supported through concepts of Conversational Interfaces (CIs) and Embodied Conversational Agents (ECA). In recent years, the CIs have become an important research and development topic in academia and the ICT industry. Smart environments utilize Artificial Intelligence (AI) increasingly and incorporate smart objects, such as: Devices, wearables, virtual agents, social robots, etc. Leading companies (e.g. Google, Amazon, Microsoft, Apple) have been making huge investments in the development of supporting technologies of Artificial Intelligence, such as Deep Learning and Natural Language Processing (NLP). The aim of these ventures is to create systems that will enable users of smart systems to obtain information and access services in a more natural, embodied conversational way. The classical vision of CIs incorporates dialog systems, and voice-enabled interfaces supported by Natural Language Processing. The multimodal vision of CIs, however, also aggregates embodiment and embodied cognition (as part of embodied language processing) in input (gesture-enabled user interfaces) and output (embodied conversational agents). Namely, CIs with virtual ECA capable of understanding verbal and non-verbal signals and capable of generating them, can engage with a human user on a more personal level. Particularly, through more conversation-like flow of the interaction, these Embodied Conversational Agents (supported by Natural Language Processing (NLP) and Embodied Language Processing (ELP)), may deliver new interaction models capable of adapting to the user's context and facilitating context of the conversational situation not only via modalities like speech, but also through visual interpretation and representation of information and social cues.

Despite all investment in this research area, an important amount of challenges still need to be solved. One barrier, which is connected with the users' desire to communicate in their native language, has to deal with the language questions. The languages outside the economic interest of leading companies are usually under-resourced, which presents an additional challenge for the intelligent ambient development process. A solution applied in the last few years is oriented toward collecting open and freely available language resources. In the case of such resources, some modalities, such as text, are available more frequently than others, as is speech combined with transcriptions. The availability of language resources is, thus, one of the key questions in the era of industry digitalization.

The intelligent ambient, and especially its manifestation in the form of the Embodied Conversational Agent, plays a crucial role in many areas of modern society. The application areas can range from general use in a smart home, to a dedicated use in a highly specialized e-Health environment. The common goal is to ease the user's interaction, with the objective to make it as natural as possible.

The background and literature review are presented first. The novel Ambient Intelligence embodied conversational model for HCI is proposed and the main modules, which are necessary to establish a natural communication, are described. The objective is to improve the quality of HCI in Ambient Intelligence, with the usage of advanced approaches. In addition, the services based on the proposed interaction model are presented. The chapter concludes with future research directions.

BACKGROUND AND LITERATURE REVIEW

A general overview of speech as the input modality is given in (Rabiner et al., 1993), where the authors addressed all different entities of an automatic speech recognition system. For more than two decades, Hidden Markov Models were used as basic acoustic models (Huang et al., 2010; Bilmes 2006) for different speech recognition scenarios that were applied in the research and industrial domains. Important progress was made in the area of robust speech processing, where noise reduction techniques and speech

enhancement algorithms were improved (Anusuya et al., 2011). The most advanced robust feature extraction techniques can enable the usage of spoken input in harsh conditions (Bagchi et al., 2015), but there are still many other factors which influence the performance of a speech recognition system (Benzeghiba et al., 2007).

The development of Graphical Processing Units with multiple cores and a large number of spoken language resources led to the success of various Deep Learning architectures (Zhang 2012). As a result, speech recognition accuracy improved for those languages where sufficient training material was available, but the group of under-resourced languages still presents a challenge for the research community (Besacier et al., 2014). When languages with complex characteristics (i.e. agglutinative, tonal, highly-inflected, free word order) are combined with spontaneous speech (Benzeghiba et al., 2007), which is frequently present in intelligent ambient, the speech recognition accuracy still decreases. These language issues also open the need to include linguistic knowledge, particularly in the domain of discourse (Verdonik 2015). The authors in (Christensen et al., 2015) and (Vacher et al., 2015), show that usage of advanced speech recognition techniques for communication in intelligent ambient can be beneficial for end users, as it eases the communication with the system and improves the naturalness of communication. An additional aspect that can be incorporated in spoken input modality is machine translation (Anastasiou 2015). Its role is to support the usage of intelligent ambient by foreign speakers, which can be a benefit in the case of a public environment (e.g. museums, exhibitions, transportation hubs...).

In addition, natural and multimodal co-verbal behavior is becoming one of the key methods of how machine responses should be represented to the users (Luger et al., 2016; Venkatesh et al., 2018), where the behavior is manifested through the Conversational Interfaces (CIs) and Conversational Agents (CAs). The idea behind CAs and CIs is that people could interact with (or speak to) smart objects, such as smartphones, social robots, and other gadgets, in more natural way in order to issue commands, or to engage in chats, etc. The CAs already serve in many different roles and within several Conversational Interfaces, such as: Tutors, guides, trainers and actors. The rise of personal assistants like Amazon Alexa, Cortana, and Siri, and other chat platforms with social bots, like Facebook Messenger and Google Allo, had also made accommodation to the CAs possible to the wider public. Thus, CAs have, become an indispensable tool in everyday scenarios (Graesser et al., 2017; Ciechanowski et al., 2018), where chatbots and 2D cartoon-like representations of talking heads are a good example of the facilitation of implementation consumer-oriented state-of-the-art AI that already simulates some aspects of human behavior (Firth, 2017; Kuhnke & Ostermann, 2017; Ochs et al., 2017). Nevertheless, chatbots are those type of CIs with no explicit goal other than engaging the other party in an interesting or enjoyable conversation (Hill et al., 2015; Fryer et al., 2017; Levesque, 2017). Therefore, in order to simplify understanding and tasks further, the CAs must also incorporate cognitive artefacts of conversation, through which the information (goal) is presented through a flexible representational medium that enables activation of communication channels, such as are utilized in face-to-face interaction. Embodied Conversational Agents (ECAs) are, therefore, developed for advanced HCI, that are capable of interacting with humans in face-to-face situations. These agents interact through utilization of chat (speech) and their articulated body placed in virtual worlds. Namely, in the field of Face-to-Face Conversation, it has been shown that the most natural way to interact is to visualize and emulate communication through synchronized verbal and co-verbal cues (Kacprzyk & Zadrozny, 2010). Therefore, the ECAs are showing potential, especially in scientific circles, and are on the verge of their integration within various conversational concepts and interfaces, including tutors, guides, trainers and actors (Veletsianos & Russell, 2014; Garrido et al., 2016; Kim & Baylor, 2016; Klopfenstein et al., 2017). In this way, ECAs represent a highly suitable concept for machine-based presentation of information. Nevertheless, the primary goal of an ECA, to

give an artificial entity the capacity to engage with the user in the form of a human-like conversation, nowadays, still represents an important research challenge, where face-to-face interaction itself is much more than just a speech accompanied by the repetitive movements of limbs and face, while interaction entails multiple variations that are correlated in dynamic and highly unpredictable settings and under dynamical and rapid changes (Kopp & Bergmann, 2017; Porcheron et al., 2017). Additionally, humans tend to incorporate social and interpersonal signals into multimodal responses, in order to ‘color’ the final outcome (Pelachaud, 2015; Porcheron et al., 2017; Krämer et al., 2018).

PERSONALIZED CONVERSATIONAL HUMAN-COMPUTER INTERFACE

In this encyclopedia article, a novel embodied conversational model applied to Ambient Intelligence is proposed. The core of the conversational model is Embodied Conversational Agent EVA, capable of capturing and processing multimodal input signals (e.g. Automatic Speech Recognition, gesture recognition), and of generating appropriate multimodal output signals in the form of synchronized verbal and co-verbal behavior. This architecture provides advanced solutions compared to methods presented in the literature review, with the objective of improving the natural way of HCI.

Human Spoken Interaction and Automatic Speech Recognition

Automatic Speech Recognition (ASR), as one of the multimodal inputs, is one of the already traditional solutions of how to capture the user’s uttered intention and prepare the information for further processing in the NLP chain in the form of text. A typical Automatic Speech Recognition system has to deal with the uttered information on two levels, where the first one addresses the acoustic characteristics of speech, and the second one considers the language characteristics of speech. A general Automatic Speech Recognition system has the following building blocks:

- Audio input,
- Robust feature extraction
- ASR decoder,
- Acoustic models,
- Language model,
- Grapheme to phoneme conversion,
- Text output.

The spoken audio signal can be captured with various types of microphones, from single-channel closed talking microphones, which can also be part of user terminal equipment, such as a smartphone, to multi-channel microphone arrays, as they can be found in a typical intelligent ambient solution. The quality of the capturing device plays a very important role in practical solutions, as its role is crucial for the overall accuracy of the system. Sometimes, a dedicated push-to-talk system can be applied to isolate the uttered speech better. The acquired speech signal is then preprocessed, with the goal to improve the signal and increase the robustness of Automatic Speech Recognition against noise and other background audio sources (e.g. music, other conversations), which are frequently present in intelligent ambient. In the next step, feature vectors are extracted from the speech signal, which represent the key characteristics of the uttered sentence. Different types of feature extraction algorithms can be used, which depends on

consecutive speech recognition steps. Two of the very frequently applied feature extraction algorithms are Mel-Frequency Cepstral Coefficients (MFCC) and Filter Bank Cepstral Coefficients (FBCC).

The objective of acoustic models is to represent the phonetic and acoustic characteristics of the human speech signal. Several different approaches were used in the past for completing the acoustic modeling task. The first widely deployable Automatic Speech Recognition systems for intelligent ambient were based on Hidden Markov Models. The Big Data perspective also influenced the ASR area. With the availability of various media and user-generated content (news shows, TED talks, audio books, parliamentary debates, conversations), the amount of data needed for acoustic models increased dramatically. In parallel, Graphic Processing Units (GPU) with a large number of cores become widely available. As a consequence, different Deep Learning approaches, like those based on Deep Neural Networks (DNN), were introduced to the area of Automatic Speech Recognition, with the result of improving the speech recognition accuracy and robustness. General acoustic models are speaker independent, but, according to the context and user scenarios, speaker adaptation can also be applied, to increase the speech recognition accuracy further. One of the methods used frequently to carry such speaker adaptation in intelligent ambient is iVectors. The main focus of language models is to represent the characteristics of text, encoded in the speech signal. One of the general approaches is to represent text in the form of n-grams, and then apply Artificial Intelligence approaches, such as Deep Learning, to model them. The grapheme-to-phoneme module is responsible for linking the acoustic and textual dimension. The general approach is to use manually produced phonetic vocabularies, but also automatic approaches carrying out on-line grapheme-to-phoneme conversion with the support of machine learning can be applied in intelligent ambient. In this case, support for new words and domains can be added. The Automatic Speech Recognition decoder is the main entity, which then combines the gathered knowledge from all three sources and estimates the best output results. The decoding phase can be performed in a single step, or in multiple steps, where results of previous phases are used to improve the end result. This approach is also applied in the case where different types of systems (e.g. DNN, CNN, HMM) are combined to produce improved speech recognition results.

In the intelligent ambient, various spoken scenarios can occur during the communication. The basic one is supporting only isolated or connected speech with limited pre-defined grammars. Such basic scenario has limited applicability in intelligent ambient, mainly for control and command scenarios, but it can prove robust speech recognition accuracy even in acoustically degraded environments. A more advanced scenario supports large vocabulary continuous speech, where the user utters sentences in a read or planned way. Such a system can be used to process different media or user-generated content, which can play an important role in the case of intelligent ambient, as a source of additional information for activity prediction. The most complex scenario is spontaneous speech recognition, which covers the human communication entirely, and provides successor modules access to the complete information uttered. With the increasing complexity of scenarios, the speech recognition system complexity also increases, which can present a challenge for intelligent ambient architecture.

One of the important aspects of Automatic Speech Recognition in intelligent ambient is the question, where is the computation taking place. The presented methods from the area of Digital Signal Processing and Artificial Intelligence need a high amount of computing power. In the case of mobile applications, virtual assistants and other similar ICT services, the Automatic Speech Recognition is carried out in the cloud or edge. User analyses have shown that an important portion of humans feel dissatisfied with the concept of transmitting their voice recordings to the cloud for processing. As a result, Automatic Speech Recognition approaches, which require low-power equipment, are gathering in importance for intelligent ambient.

An important aspect of Automatic Speech Recognition is also the question of language support. A prerequisite for developing Automatic Speech Recognition systems is the availability of large amounts of spoken language material, which needs to be entirely partly annotated, and/or transcribed by humans. An additional challenge is presented by language characteristics, as some of the languages (e.g. tonal, highly-inflected, agglutinative) are more complex from the Automatic Speech Recognition point of view than others. Currently, the commercial speech recognition systems are available for approx. 100 languages, where the commercial interest is present. In the case of other, under-resourced languages, approaches such as cross-lingual speech recognition can be applied, but the achieved results are usually applicable only for simple tasks.

In the case of Human-Computer Interaction in intelligent ambient, the uttered speech is not the only feasible information source which can be used beneficially for acquiring knowledge about the user and his activities. Additional information can be collected from paralinguistic and non-verbal audio events, such as breathing sounds, a laugh, snoring, eating-sounds... Other important information, which can be extracted from the captured audio, is dealing with the speaker's emotions and stress level. Both of them can be used further by an Embodied Conversational Agent, to be able to personalize the response to the user's verbal interaction better.

Image Recognition and Human Gestures

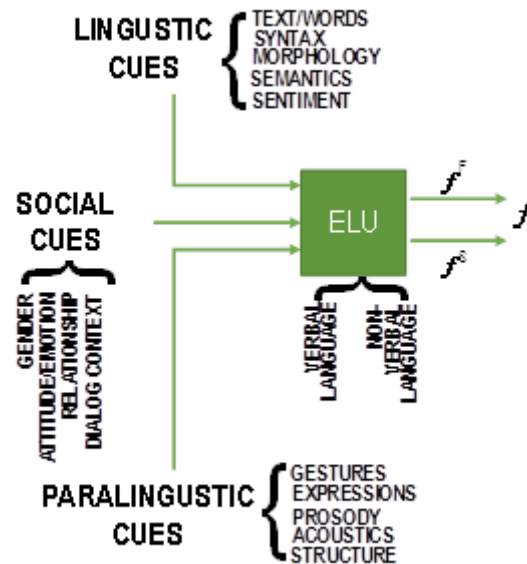
A crucial part of every human-machine interaction is mutual understanding. When dealing with gesture conversation, communication participants deal with visual information. Image recognition is a process of identifying objects, people and actions in images in the video stream, where a camera gathers the multimodal input visual information. This information is then processed by machine vision algorithms and Artificial Intelligence software. While human and animal brains recognize an object in an image with ease, this is still a difficult job for Artificial Intelligence. Namely, nowadays, computers, to solve such tasks, are trained with supervised learning techniques on large sets of annotated images. The best performing algorithms include convolutional neural networks, like SSD (Liu et al., 2016) to recognize objects in the video in real-time. In this case, in the first part of the network, convolutional layers are used to extract characteristic features of each object class, in the second part fully connected layers are used to classify extracted features into specified classes. When dealing with video, the temporal dimension is added to individual images, while sequential images are processed one by one. For recognized objects, object tracking algorithms are used to define gestures' trajectory, where, in the case of gesture recognition, image recognition algorithms have to distinguish between specific objects present in the intelligent ambient. Additionally, they need to segment the image into arms' parts in order to process their movement.

Multi-Modal Aspects of Communication in Intelligent Ambient

Embodied behavior (gesticulation), and being able to express information beyond words and even speech, is taking a significant role in human-machine interaction as a key method of how machine responses are represented to the users. Namely, in natural face-face interaction, the co-verbal signals conveyed together with spoken content, or even in the absence of it, are essential for establishing discourse cohesion. One could say that the verbal/linguistic parts of spoken language (e.g., words, grammar, syntax) carry symbolic/semantic interpretation of the message, while the co-verbal parts (e.g. gestures, expressions, prosody) carry the social component of each message, and serve as an orchestrator of communication.

Thus, co-verbal signals differentiate from general motor actions by representing what is articulated and recognized (e.g. scratching while thinking or waving goodbye), rather than simply expressing something through a different transducer (e.g. screen wipe). Overall, the co-verbal signals in machine responses actually enable users to react to these responses socially; more specifically, users start to exhibit social behaviors that are similar to those observed when engaged in interpersonal communication. However, aligned with the uncanny valley phenomenon (Mori, 1970), the more human-like the machine response, the greater the expectation and, more intense, the negative affect it causes, when dissynchrony occurs (e.g. less natural voice, flickers in animation, wrong gestures/expressions, non-synchronized power of co-verbal expressions, etc.) (Poria et al., 2017; Ciechanowski et al., 2018). The major source of possible discohension (negative perception) in the response is the lack of ‘conversational knowledge’. Such knowledge consists of communicative signals from linguistic, paralinguistic, and even social domains (Figure 1). Moreover, in contrast to language, there are no universal rules (e.g. grammar) that would create a finite set of causes and predict effects. In order to represent viable human-like responses, these signals must be fused into real human like responses, and various knowledge sources are required. As outlined in Figure 1, we propose to design a complex function f , which utilizes information fusion in order to combine Natural Language Processing (NLP) and Embodied Language Processing (ELP) into Embodied Language Understanding (ELU).

Figure 1. Multimodal fusion model of Embodied Language Understanding



The proposed model outlined in Figure 1 is built around the concept that a ‘multichannel’ representation of an idea via audio and visual signals, e.g. fusion function $\mathcal{F}$. It is first formulated on a cognitive level through symbolic fusion ($\mathcal{F}^S$), and on a representational level through fusion of form ($\mathcal{F}^F$). The global symbolic level fusion function is defined as

$$\mathcal{F}^S = f(L, P, S) \quad (1)$$

It establishes an overall symbolic link among various signals, which are represented in various domains of cognitive linguistics, such as pure linguistics L , para-linguistics P , and social context S . The nature of fusion function f and correlation of various individual signals and their individual contribution is, in many cases, already well described via the modern theories in cognitive linguistics and communicative behavior. However, we cannot simply ‘glue’ the narrower knowledge into a common strategy. Hence, we envisage that all conversational theories are relevant, and contribute to the ‘cohesive’ generation of human co-verbal behavior. Thus, any individual contributions must be observed under a common context, and any generated knowledge must reflect this complexity, induced due to convergence of signals. The nature of representational level fusion function is best described as

$$\mathcal{F}^G = g(\mathcal{F}^S, I, GS, t) \quad (2)$$

where g represents the fusion function for defining the physical nature of the ‘multichannel’ representation of the idea, with a clear reference to actual physical preferences. Thus, Equation 2 not only denotes the shape of expressions, but also the propagation of how the shapes are formed (e.g. movement phases, fluidity, power) in relation to the formulation of verbal counterparts (e.g. local pitches, prosody, and prosodic phrases). In the next chapter, we outline an example of the utilization of the proposed model, and omni-comprehensive expressive spoken dialog systems incorporating an Embodied Conversational Agent as an active participant.

Spoken Dialog System with Multi-Modal Functionalities

The final step in interaction is to react to the multimodal input in a human-like fashion. Thus, to generate a machine response incorporating an ECA, which can speak through voice and body (e.g. in the form of speech synchronized with embodied conversational behavior). This is usually achieved through a Spoken Dialog System (SDS) (Figure 2), enhanced with Automatic Speech Recognition (ASR) and Gesture Recognition (GR), which are observed as two primary input modalities. The expressive Embodied Conversational Agent delivering conversational responses is observed as the primary output modality. In between is an application driven, and task-oriented Dialog Manager (DM), used to understand conversational signals by facilitating multimodal sensing.

In the proposed HCI, the central component responsible for generating human-like conversational responses, e.g. the Natural Language Generator (NLG), is the expressive Text-To-Speech synthesis system (eTTS) called PLATOS. PLATOS is designed based on the EVA behavior generation model (Rojc et al., 2017), a practical implementation of the outlined multimodal fusion model (ELU in Figure 2). The EVA behavior generation model comprises of a Text-To-Speech synthesis processing que which is interlinked with the processing que responsible for planning and modeling of conversational behavior.

The EVA behavior generation engine converts context supplied by the DM (e.g. text to be spoken, domain and additional social cues) into speech accompanied by human-like synchronized gesticulation and lip movement. In general, sentences/statements can have multiple interpretations in various contexts, therefore, the interpretations of the communicative intent can overlap partly or fully, and introduce ambiguities and several inconsistencies. Thus, during the *Classification of the intent*, the Semiotic Grammar is used for classifying individual semantic and morpho-syntactic sequences in the text onto correspond-

Figure 2. Omni-comprehensive spoken dialog system capable of responding in a human-like conversational manner



ing parametric descriptions of the semiotic class (subclass) given the classified social cues (situation, dialog function and role, etc.). In the *Planning of the intent phase*, the inconsistencies and ambiguities are resolved by using integration, elimination, and selection. In order to do this, the prosodic information (prominence, stress, prosodic phrases), predicted by the TTS modules, is used in combination with further social cues (e.g. person, gender and emotion). In the *Planning of the Movement phase*, a movement model is generated which represents an animated sequence of shapes/poses that, together, represent the targeted visual part of conversational signals. For each model at least, a stroke movement phase must be defined, and aligned with the acoustic prosody information, as specified by the TTS engine. Finally, in the *Synchronization of the shape phase*, the planned models, which are aligned temporally with the temporal features of verbal information (durations of phonemes and pauses), are used for a lookup into Gesticon, in order to specify the best shapes V (or poses P), and trajectories T of the realization of the co-verbal behavior relevant to the entity generating them. In this phase, the algorithm moves from abstract/symbolic level to physical level, which has to take into account the motor capabilities of the virtual entities. When the behavior was aligned with the agent as well as the conversational context, a parameterization of the animation occurred (*Generation of the co-verbal behavior phase*). Each planned movement phrase is transformed into a symbolically, prosodically, and spatially coherent movement of an individual body part, described as a parametric configuration of agents' movement controllers propagating in defined time intervals. The description is specified in EVA-Script notation, which is understood by the EVA U-Realizer (Mlakar et al., 2018), interpreting and animating it.

Personalized HCI Entertainment System

The proposed HCI interface, with a novel embodied conversation model, has been applied within the UMB-SmartTV (Mlakar et al., 2014) that is a proprietary platform used for personalized HCI entertainment solutions in intelligent ambient. Namely, it is a multimodal IPTV platform that links IPTV services with the intelligent ambient. The architecture is developed on an IP Multimedia Subsystem (IMS) (Anis et al., 2012), and distributed DATA (Mlakar et al., 2013) distributed system extended with a cloud-enabling application framework. IMS is the core technology of the Next Generation Network (NGN) (Wilkinson, 2002), and is a platform of integrated multimedia application services to provide advanced, personalized functionality and content to the users. In a UMB-SmartTV, the IMS network provides basic communication functionalities like establishing audio and video calls. The IMS network is extended to provide additional functionalities, like network phonebook, presence and video conferencing (Jegade et al., 2010). For integration of IoT devices in intelligent ambient, a SIP application server provides gateway functionality between the IMS network and the IoT devices using an MQTT protocol. Environmental parameters are gathered from sensors, and relayed to the cloud-enabled DATA application framework. Its DM module makes an intelligent decision based on the data, and provides advanced user-centric adjusting of the environmental parameters. The DATA framework also provides ASR, TTS and gesture generation functionalities. They enable multi-modal enriched communication with the user. On the client side, DATA enabled client is used, implementing DATA protocol for multimedia content delivery.

Distributed Message-Oriented Core Server

From the system architecture point of view, many parts of the proposed HCI solution are very diverse, running from small embedded IoT systems on customer premises to applications and services running on HPC clusters located in the cloud. To be able to integrate these parts in a coherent entity, which is operating transparently for the user, a core server was implemented using a message-oriented queue middleware Gearman (Ewart, 2013). The three-tier design offers complete isolation and separation of functionalities into small logical entities that can be distributed over a large number of different machines. The core server's main objective is sorting received tasks from "clients" into queues, prioritizing them, and dispatching them to the appropriate processing server - called "worker" - without the implicit need for the client to know the final destination. High availability of the core server is achieved with clustering and persistent queues. Examples of clients include IPTV STBs and smart thermostats, which communicate with worker processes that are providing information and controlling the environment, heating, presence, lighting and other ambiance-related devices. In this way, the UMB-SmartTV merges IPTV services, intelligent-ambiance services, and a conversational agent flexibly into a personalized and embodied conversational interface.

ADVANCED SERVICES IN INTELLIGENT AMBIENT

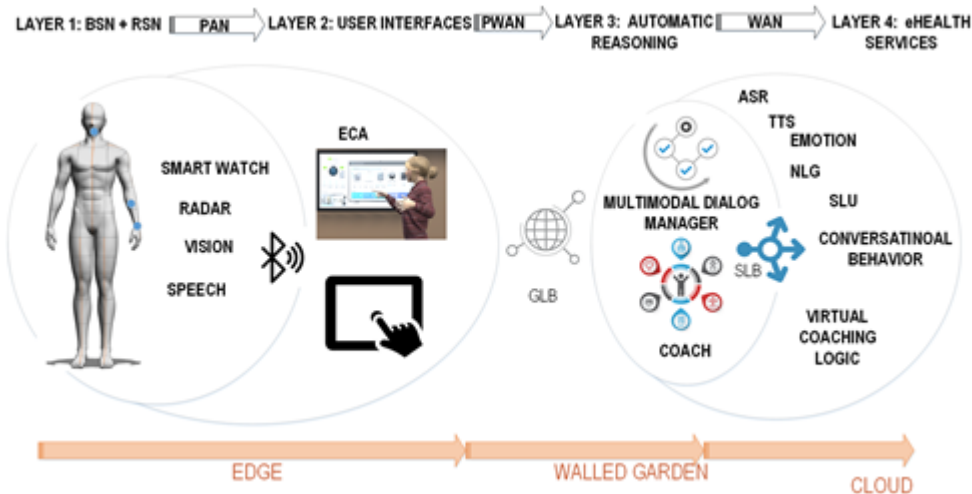
Thus, the traditional intelligent ambient services are enhanced with the state-of-the-art Human-Computer Interface technology, enabling them to process, drive and react in a human-like fashion by utilizing auditory and visual channels in embodied conversation.

An example of such advanced intelligent ambient service, which makes a profit from improved naturalness in the communication are e-Health services and ambient assisted living paradigm (AAL).

The intelligent ambient can be applied as an ambient assisted living environment, which can be used to ease and support the independent living style of elderly users. An example of such a platform, primarily targeting the well-being of a person, is outlined in Figure 3. The ELU, outlined in this paper is extended with a virtual coach and biomarkers indicating the user's health. In this way, the coaching can rely on causal models of machine-user interaction which applies emotionally-believable adaptive responses of the virtual coach, keep off loneliness, sustain informed health status, enhance quality-of-life and simplify access to telecare and medical services. Such an agent knows when to start an interaction with the user; it is able to give advice; explain and motivate behavioral change in user's everyday life. In the system, outlined in Figure 3, proposed system the virtual coach measures the index for the holistic health/wellness status an elderly person by fusing the available vital signs, biomarkers, behavioral information and other information sources. The coaching logic can then select and schedule appropriate personalized coaching programme aligned (e.g. exercises, nutrient, etc.) with the person's individual needs and available resources.

In order to implement human-like and conversation oriented interaction, the ELU is utilized to fuse audio-visual sensing along with word sequences generated by Automatic Speech Recognition into an idea/concept regarding user's request, emotional state, and even expectation, giving the system a more detailed psychological state of the person. The ELU is used to define textual, expressive and semantic components of the response and fed directly to the text-to-speech engine (TTS) to express the communicative goals via the auditory channel (e.g. what to say). The Visual articulation of spoken content incorporates the non-verbal complements defining the nature of non-verbal representation (e.g. how to say). Through these complements, the conversational concepts are transformed into gestures and expressions synchronized with speech. The human-like embodied entity (e.g. embodied conversational agent) can express the generated communicative signals in form of non-verbal signals (gestures, postures, gaze, facial expressions and emotions) symbolically and temporally aligned with speech. Thus, the virtual coach notifies the user about the necessary steps/actions and outlines the obtained results to him/her.

Figure 3. A three-layered architecture of an advanced AAL framework supporting causal models of machine-user interaction



Architecturally, as outlined in Figure 3, the first tier of the proposed system is the Edge environment. It is physically situated in the user's domestic environment. It is built around the body (BSN) and remote sensor networks (RSN) with the ECA supported UIs as a centerpiece. 'Coaching' and interaction goals will be conveyed via friendly, empathic embodied conversational agents (ECA). The second tier is the walled garden - a closed ecosystem with restricted convenient access to non-approved applications and content. This layer isolates each user environment and hosts the cloud-based Coaching Logic (Coach) Conversational Logic (dialogue manager – DM, spoken language understanding – SLU, and natural language generation – NLG). The SLU facilitates the understanding of conversational signals generated by the user and, the NLG generates human-like conversational signals for personalized persuasive communicative and non-communicative interaction. The final layer consists of a dedicated and secured cloud environment which hosts the Cloud-based System Data Analysis framework (SDA) with services making 'general' and anonymized decisions. Each 'garden' instance sends irreversibly anonymized data to the big-data analytics framework.

Another important aspect of AAL is also the support of rehabilitation. The last phase of rehabilitation is, typically, carried out in the patient's home environment. As the patient is not being monitored directly by medical professionals, a lack of motivation can occur, and reduce the effectiveness of the rehabilitation procedure. The proposed system, outlined in Figure 3 can be used in intelligent ambient to remind and notify the patient when the next rehabilitation session takes place. Moreover, the agent can be applied to increase the user's motivation, with approaches such as presenting the patient with the positive development of his condition, which can be attributed to the past rehabilitation sessions. The Human-Computer Interface input modalities can be used additionally to supervise the user's rehabilitation session, and estimate the effectiveness and output of the session directly. The success of such e-Health services is tightly connected with the usage of advanced communication interfaces, which can produce natural and personalized interaction.

FUTURE RESEARCH DIRECTIONS

Speech, as an input modality for intelligent ambient, has proved to be an efficient way of communication. There are currently different implementations of virtual agents, with support for Automatic Speech Recognition available on the market. They provide Automatic Speech Recognition successfully for typical every-day scenarios in major world languages. The achieved speech recognition accuracy is in the range between 90% and 95%, which gives enough accurate information to the next processing modules, like the Natural Language Processing system.

The future trends in the area of Automatic Speech Recognition for intelligent ambient will focus on those scenarios where robustness against the degradations present in the input speech signal plays an important role. One of such sources of degradation is ambient and background noise, which is frequently present in intelligent ambient. Another important direction for future work is the support for low-resourced languages, which is a crucial step to enable the usage of spoken input modality in intelligent ambient for unsupported languages and new markets. Two main research directions can be observed in the area of low-resourced languages. The first one is trying to reduce the amount of spoken language resources which is needed to be able to train the Automatic Speech Recognition system. The second research direction is devoted to crosslingual speech recognition, with the objective to transfer the Automatic Speech Recognition system or spoken language resources from the source language to the target language. Cur-

rent research approaches show promising results for similar languages belonging to the same language group, but further research work is needed for less similar languages.

Further, the multimodal user interfaces have to be simple, intuitive, natural, and should adapt to a user's abilities with regard to the processing of natural and cognitive information and presentations. In intelligent environments several devices and AI technologies are being designed at a rapid pace. Nevertheless, the progress results in bigger interactive complexities, and, therefore, influences the perceived added value of these new technologies. Therefore, human-machine interaction and personalized interfaces have to start to drive not only the user experience, but also the 'penetration' capabilities of these technologies as a whole. In order to engage with a human user on a more personal level, natural human-machine interaction has to start to virtualize itself, and to utilize the potential of entities resembling human collocutors in interaction.

CONCLUSION

This article presented an overview of Human-Computer Interfaces in an intelligent ambient, with the specific focus on embodied conversation, which also utilizes personalization of the main interaction functions. The general building blocks of such an interaction system were presented, and an embodied conversational model was proposed. The objective of the proposed system is to establish the most natural way of communication, which is feasible with current state-of-the-art algorithms and methods. The outcomes and future research directions show that this research field still presents some very challenging topics, which need to be addressed in the future.

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KEY TERMS AND DEFINITIONS

Automatic Speech Recognition: An approach of recognizing an uttered speech signal into a computer readable text.

Deep Learning: Part of Machine Learning, where methods of higher complexity are used for training data representation.

Emotion Recognition: An algorithm which recognizes human emotion automatically from various input signals.

Feature Extraction: A digital signal processing algorithm, which extracts distinctive values from the input signal.

Gesture Recognition: An approach to recognize gestures produced by a human during communication automatically.

Intelligent Ambient: An environment where various devices, algorithms and processes capture input signals and produce optimal environment conditions based on captured data and previous knowledge, applying Artificial Intelligence.

Multi-Modal: A procedure or algorithm which incorporates different types of modality and processes them to a single end result.

Personalized: An approach where parts or functions of a system get adapted to the particular end-user.

Text-to-Speech Synthesis: An approach where a system generates output audio signals from input text.

Integrated Electronic HEI Performance Management

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INTRODUCTION

Organization performance has traditionally been in the forefront of public and private enterprises on the rationale of strategic and operational process efficiencies and results effectiveness of value creations. Over the past decades, HEIs (Higher Education Institutions) as organizations offering educational values have slowly embraced the more business oriented management fundamentals to manage the HEIs professionally albeit profitably in its educational value creations to the students' effectiveness and employability. These managerial practices are more visible in the planning, quality assurance and accreditation pursuits and OBE (Outcome based Education) that forms the foundation of the HEIs assurance in meeting the market and societal needs of solid and quality education experiences and values to the students who represent the future of any society (Sousa, et.al., 2014; Hazelkorn, 2007).

All these managerial and quality endeavors are linked to the programs and institutional strategic and operational plans resting on huge disparate silos of data and information from academic-administrative units. Inadvertently colleges/programs/HEIs are asked the very basics of their outcome based accomplishments and achievements that encompass the performance management fundamentals. HEIs have harped on IR (Institutional Research) to holistically link educational quality assurances practices to planning underpinning students' performance and effectiveness through the wealth of data crunching and mining critical to the performance management for the colleges/programs/HEIs (Dawson, et.al., 2016; Hrabowski, Suess & Fritz, 2011a, 2011b; Picciano, 2012; Brudan and Zarnescu, 2015). These existing IR practices and performance management can be enhanced and expanded through an integrated electronic system that seamlessly extracts data from student, faculty, infrastructure and resources administrative and academic silos channeled towards the educational applications and colleges/programs/HEIs management and their re-invention (Clarke, Nelson & Stoodley, 2013; Hilbert, 2013).

While most HEIs have their customized Information System supporting planning, quality-accreditation- information-planning management in one form or another, these are exclusive within the HEIs context and needs. Of the research publications of these systems in support of informed decisions, there is a lack of in-sights into a holistic integration of the quality-planning-information systems that are used to prepare the operational course-program-self-study reports and performance metrics that links the planning-information duo from operational-tactical-strategic levels by faculty-program/college/institutional management based on data analytics. As such, it is posited in this chapter that the strategic triangularization of the QPIT (Quality-Information-Planning Troika) can lead to the development of an integrated electronic quality-planning-information system linking the IR (Institutional Research) goals to meet the faculty-program/college/institutional management needs and expectations based on data-performance analytics. This integrated electronic QPIT management system underscoring educational performance management is advocated to create and deliver on better value added education performance

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of educational value meeting stakeholders-society-students' needs, HEI basic accountability of its stated mission through the proposed integrated systematic electronic PMS (Performance Management system) that closes the theoretical and practicalities gaps an electronic education performance management system.

Based on the rational above, this chapter proposes an integrated electronic system that links the QPIT (quality-planning-information troika) which is the basic foundation of performance management in any organization or organizational units. A leading university in the Middle East case study is used to illustrate this integrated electronic performance management system (e-PMS). Since 2016, the Phase 1 of the e-QMS (Quality Management System) (Teay, 2017) has been applied to the institutional-programmatic quality-accreditation management. The Phase 2 encompassing the development of the full-fledged ITQAN 2020 PMS (Performance Management System) is aimed at linking the quality-accreditation-planning management via information management and the use of BI (business intelligence) tools for its data and its learning analytics and methods (Avella, et.al., 2018; Daniel, 2015; Elias, 2011; Dekker et al., 2009; Feng et al., 2009; Ming & Ming, 2012) to support better informed decisions (Educause, 2010; Baker, 2007; Teay, 2018).

BACKGROUND: PERFORMANCE MANAGEMENT IN ENTERPRISES AND HEIs

The world is facing digital disruptions that could potentially affect the redundant value-chain activities or repetitive manual work (Dawson, et.al., 2016) of not only operational work in enterprises but also administrative-academic work in HEIs. The operational mundane administrative works run from developing the semester course specifications and reports, annual program specifications and reports to the 5-years program self-study reports. At the tactical level, department heads need better understanding of the student effectiveness through performance analytics. These cover a wide range of administrative and operational data gathering processes aimed at assessing institutional/collegial/programmatic performance and progress in order to predict future performance and identify potential issues related to academic programming, research, teaching and learning (Hrabowski, Suess & Fritz, 2011a, 2011b; Picciano, 2012). The strategic level decision making covers fiscal sustenance and enrolment strategies, programs offers and closures, infrastructural and resources planning and management efficiencies and effectiveness.

"Data and information is power" mentality has always been key organizational barriers in performance analytics and management (Kellen, et.al., 2013). Additional issues include: (1) pulling "quality" data out from all legacy systems silos across an enterprise, breaking out of "we know mindset" by pulling and linking them together so that the management or staff can look at them in any one of 50 or 100 dimensions, and (2) having capabilities and transferrable skills when adopting new technology to bridge the technical and the business sides (Manuel et.al., 2016; Kellen, et.al., 2013). This highlighted a McKinsey survey of 519 executives representing the full range of regions, industries, and company sizes that indicated high performers attributing their data and analytics success to involved leaders, while low performers say their biggest challenge is designing the right organizational structure for analytics activities (Brown and Gottlieb, 2016). In a bid to improve performance, GE, the Gap and Adobe Systems (Vara, 2015) dropped ratings, rankings, and annual reviews practices. The focus shifted from accountability to "learning" and development, centrality of team working and agility (Cappelli and Tavis, 2016). This rethinking of performance management would mean collecting more objective performance data through systems that automate real-time analyses with a shift in emphasis from backward-looking evaluations to fact-based performance and development discussions (Ewenstein et.al., 2016).

In its 2015 Performance Management State of discipline report (Brudan and Zarnecu, 2015) the KPI Institute reported key trends and challenges as:

1. **Trend Towards Integration:** The trend is towards data visualization through graphics focusing on individual and organizational goals in a collaborative work environment. These goals need cascading to all levels to improve productivity, innovation and governance (Clarke, Nelson & Stoodley, 2013) and integrating data from different systems which are the zenith of effective planning through alignments of objectives across all levels regardless of private/public organizations.
2. **Challenges:** Key challenges include: (1) performance definitions, (2) setting appropriate goals, (3) creating and motivating compelling performance management by the people, (4) interconnected practical systems, (5) people engagement and commitment at all levels, (6) informed decisions based on ability to obtain, analyze and report specific data within acceptable time frame to arrive at improved outcomes through business intelligence (Educause, 2010; Baker, 2007), (7) providing visibility and clarifying accountability issues, (8) building action plans through initiatives with KPI measurements that are minimally invasive and inexpensive, and (9) managing data at the scale of the Internet (Avella, et.al., 2016; Baker & Siemens, 2013; Dean & Sanjay, 2008).

A HEI, like any other organization, has specific processes that support the achievement of its teaching-learning-research missions and contribution to academic and societal development of the community and stakeholders at large. These three key processes (Ashworth, 1999; Childe *et al.*, 1994; CIM-OSA Committee, 1989) as adapted to the HEI as a value creating organization are the:

1. Operational educational processes that create, produce and deliver on educational value,
2. Academic and administrative support processes that support the operational processes and provides added value to the basic educational value (Garvin, 1998; Porter, 1980), and
3. Administrative and management processes encompassing the goal setting, controlling and organizational behavior processes.

Verweire and Van den Berghe, (2003) argued that all these processes supporting integrated performance management needs both strategic and maturity alignment of appropriate managerial and operational processes for performance measurement and management. This underlies the imperatives that ethical performance management in the HEI must move from a monitoring stance to that of management focused on strategy (Cullen, *et al.*, 2003). It should support management through measurement (Bourne, *et al.*, 2005) that highlights the internal context factors that are interactive in nature and are much more complex than the existing simplistic physical and formal systems affecting performance. The performance model of Martz (2001) for a HEI setting had the principles to define performance expectations, create attainable but challenging goals, furnish clear measurements, encourage involvement and provide process clarity and feedback.

ANALYTICS IN HEIS

McKinsey Global Institute (2011) reported that Big Data is the next frontier for innovation, competition and productivity. Business intelligence and analytics (BI&A) data science means that enterprise data management and advanced data, text, and Web analytics are essential and critical for turning data into

actionable insights and intelligence (The Economist Intelligence Unit 2011; Russom 2011). Demand for BI&A has been demonstrated by a number of studies (LaValle et al. 2010, 2011).

Key issues facing accountable and transparent governance of the 21st century HEIs in this disruptive digital era include increasing enrollment, ensuring students effectiveness and employability of graduates, reducing tuition and costs (Thornton, 2013) through educational value re-creation and re-inventing learning experience and be an accountable and transparent corporate citizen (Sousa, et.al., 2014; Hazelkorn, 2007). This has compelled HEIs towards better understanding the strategic enrollment, student retention and learner engagement through course re-design from the applicants and students' context. This includes tracking enrollment trends and educational data mining research through psychometrics statistics, information visualization, and computational modelling in a forward thinking manner (Baker and Inventado, 2014; Baker, 2013; Romero and Ventura, 2010 and Baker & Yacef, 2009; Norris et al., 2008). Infrastructural support includes fiscal success through comprehensive data comparatives and analytics, efficiencies and effectiveness of IR (Institutional Research) and the HEI ICT (Information Communication Technology) ability to support the institution's data availability-access-analysis to transform management informed decisions (Boyd & Crawford, 2012). These call for the HEIs to seek to leverage their analytics capabilities and not in the technology per say but in the use of new technologies for data capture (Choudhury and Pentland, 2003) and advances in computation (Mayer, 2009). This calls for managing and making the most of opportunities that big data offers (Long and Siemen, 2011) that is "technologies and techniques that make capturing value from data at an extreme economical scale" (Yang, 2013) and the "three Vs" (Volume, Velocity and Variety) of big data (Douglas, 2001). The OECD (2013) report suggested that big data be more cost effective (Hilbert, 2013) to be the foundation where HEIs can reinvent their business model by bringing together the data analytics (Avella et al., 2016; Elias, 2011) for informed decision makings about educational outcomes.

These informed decisions are based on the INFORMS categories of analytics of "Three Big Data Analytical models in Higher Education" (Daniel, 2015). These three categories of analytics intersect each other to provide:

1. **Descriptive Analytics:** This covers describing and analyzing historical data collected on students, teaching, research, policies and other administrative processes (cf. Dekker et al., 2009; Feng et al., 2009; Ming & Ming, 2012). This can include analytics like course completion rates for a particular program over time or determining what were the attributes of the students who didn't complete successfully.
2. **Prescriptive Analytics:** This involves assessing their current situation and making informed choices on alternative course of events based on valid and consistent predictions to arrive at increasing student completion rates, reducing time to degree and minimizing excess credit hour accumulation. In essence, it is "using various technologies to uncover relationships and patterns within large volumes of data that can be used to predict behavior and events" (Educause, 2010) to "engineer positive changes throughout the student life cycle" (Eduventures, 2013).
3. **Predictive Analytics:-** This provide institutions/colleges/programs with better decisions and actionable insights based on data like predicting students who are exhibiting behaviors early in the semester which put them at risk for dropping or failing a course or the predicted course completion rate for a particular program and which students are currently at risk for failure.

Addressing these challenges, Kellen et.al., (2013) case study of HEI's big data analytics and architecture recommended: (1) open access to data and front-end neutrality through Big Data and other BI

(Business Intelligence) opportunities, (2) build architectures that promote copying and reuse, (3) engaging the community throughout the process to collect valuable feedback and build new designs quickly that the community needs (Dringus, 2012; Dyckhoff et al, 2012; Wagner and Ice, 2012). Long and Siemen (2011) and Avella et al. (2016) indicated, “Big Data is now well positioned to start addressing some of the key challenges currently facing higher education”.

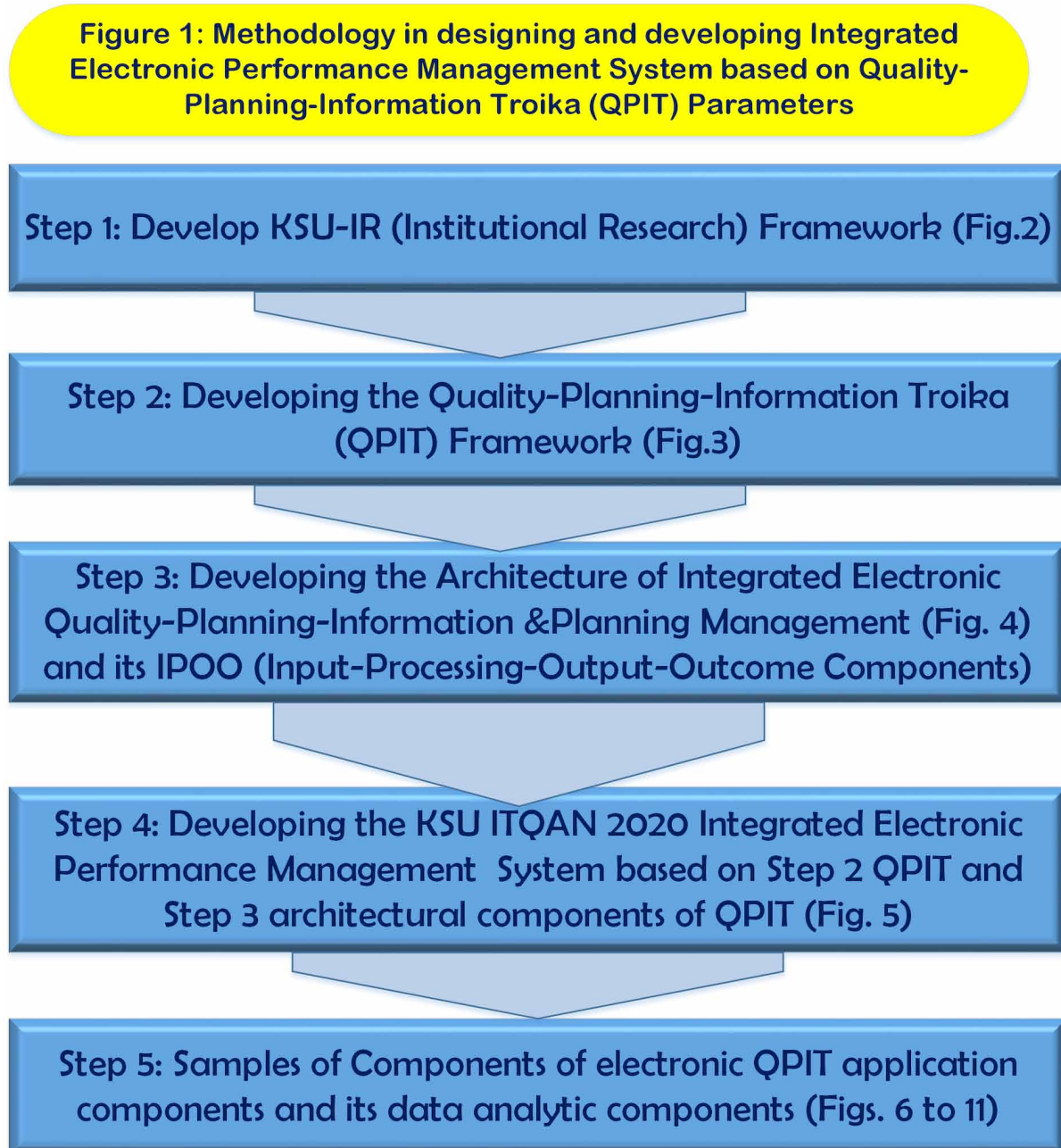
A UK Higher Education Commission Report highlighted that “Fluid data has the potential to provide an instant, accurate picture of how a student is performing” to be collected, linked and analyzed. Part of the 12 recommendations of this report include using learning analytics as the measurement, collection, analysis and reporting of data about learners for the purposes of understanding and optimizing learning and the environments in which it occurs. The Commission emphasized the need for institutions and leadership of achieving their strategic goals by ensuring that digital literacy, capability and good data management strategies being an integral part of the HEI strategic plans. They indicated that learning analytics provide huge benefits for their students by introducing appropriate learning analytics system to identify and foster excellent teaching, improve student support and institutional performance. The learning analytics definitions, processes and potential of Elias (2012) and the methods, benefits, and challenges in Higher Education by Avella et.al., (2011) discussed the state of art and their great and untapped potentials to benefit the HEI performance management and its use and understanding of data and learning analytics of its systems and schools to deliver on educational value greater process efficiencies and result effectiveness. These benefits include identifying target courses, curriculum improvement, student learning outcome, behavior, and process, personalized learning, improved instructor performance and post-educational employment. The challenges include data tracking, collection and analysis, evaluation process, learning sciences connection and environment optimization, emerging technology and ethical and privacy issues

METHODOLOGY IN DEVELOPING INTEGRATED E-PMS (ELECTRONIC PERFORMANCE MANAGEMENT SYSTEM)

While education excellence is an aim, this must be translated into functional and operational systems-mechanisms that drive performance excellence in education as enshrined in the education criteria of MBNQA (NIST, 2015). In aiming to close the theoretical and practicalities gaps of the design-development of an electronic education PMS (Performance Management System, a 5 step methodology is advocated:

- Step 1 **(Developing the KSU-IR Framework):** The KSU-IR Framework is the main foundation of a strong sustainable performance management system with use of planning-information-quality analytics for informed decision making. The data collations-extractions-processing-staging into information combines BI (Business Intelligence) and human heuristics-judgmental tactics to come up with educational knowledge and wisdom as opposed to subjectivity-emotional-political schemes dependencies.
- Step 2 **(Developing the QPIT Framework):** The KSU-IR defines the data-information-knowledge of the academic system requirements underlying the interdependencies and integration QPIT domains that should not be addressed independently as mostly effected by most HEI. The QPIT identifies the key requirements linkages across the quality/accreditation-planning-information domains-management systems that are critical to an integrated electronic education performance management system.

Figure 1.



Step 3 (Developing the IPOO Architectures): The QPIT is used to define the architecture and schematic electronic modules of the quality/accreditation-planning-information that includes the performance/statistical-data metrics, internal audit & assessment/scoring, learning outcomes design-development-teaching strategies-assessment, DBMS (database management system).

Step 4 (Integrated Electronic PMS): The QPIT & IPOO architecture culminates in the PMS data entity & applications processing management as a holistic electronic academic system applications working in tandem interactively to meet the performance management needs of the stakeholders.

Step 5 (**Sample Screenshots of actual PMS**): These depicts some of the main quality/accreditation-planning-information modules and the strategic-operational dashboards data analytics of the PMS.

STEP 1: DEVELOPING THE KSU-IR (KING SAUD UNIVERSITY INSTITUTIONAL RESEARCH) FRAMEWORK

It is important to note that the QPIT is the basis of operationalization of the KSU-IR framework (Figure 2) that links quality-accreditation-planning management via the information management of data analytics. Key contributions of IR to planning, decision-making, and policy formulation where IR can contribute to programmatic/collegial/institutional informed decision making through data analytics (Saupe, 2009; Sousa et. al., 2014) are:

- Determining how the institution's publics perceive its missions and goals by assessing institutional outcomes and accomplishments, pointing to areas where performance does not meet expectations and develop strategies for improvement; facilitating institutional self-study and accreditation-accountability-performance processes-mechanisms and resources utilization.
- Contributing to program planning-development by intensive programs-departments reviews; reviews and revisions of curricula based on students' course-selection behavior; faculty grade-giving behavior and students grade-earning behavior.
- Studying the faculty-students and administrators-management culture-values-norms diversity and extent to which the culture-values-norms effects on inform the planning-policy directions and understanding potential obstacles to moving in new directions.
- Improving process-procedures instruction and specific instruments used in the evaluation of instruction and instructional methods and media.
- identifying instructional activities and allocation of resources inefficiencies with data on class sizes, teaching loads and student-credit-hour productivity made available to academic administrators.
- Providing enrolment projections-analyses trends and relationships which guide enrolment policy and suggest enrolment planning assumptions-strategies through student body data, retention and attrition data, causes of attrition and on strategies for increasing retention that can contribute to maximizing society's investment in education.
- Supporting inclusive education to special types of students by assessing their preferences, predispositions and academic behavior like part-time/minority-group students, women/LGBT students, talented/handicapped students, older-others students who differ from the traditional student.
- Assisting access to the college/university educational opportunities by informing applicant's choice institution; developing/availing consumer information to prospective students; determining students' financial affairs used as consumer information as well as referents for the determination of financial aid programs and policies and determining program effectiveness of financial aid in achieving the program goals that can be evaluated with the evaluation leading to improved financial aid resources use.
- Evaluating and improving academic advising/counseling, career planning/placement, intercollegiate activities, health services and housing.
- Contributing to the institution's development program through institution information used in proposals for specific projects external funding; fund-raising campaigns; and designing information-based strategies for seeking donations from foundations, corporations, and individuals.

Figure 2.

Source: Adapted from AIR (Association for Institutional Research) 2017, *Development of Duties and Duties & Functions of Institutional Research*, FL, U.S.A., <https://airweb.org/>

Figure 2 : KSU-IR (Institutional Research) Framework		
	Duties	Responsibilities
	1. Identify information needs	- the iterative process of identifying relevant stakeholders and their decision support needs - assisting stakeholders in developing and refining research questions
	2. Collect, analyse, interpret, and report data and information	- provide data, information, and analysis for decision support - process of collecting and reporting required and requested data - incorporates applied research methods to analyse data to provide information for decision making, including appropriate interpretation of analysis results
	3. Plan and evaluate	- Planning may include operational, budgetary, and strategic planning - include program review, particularly for accreditation purposes - Formative and summative evaluation processes conducted at an institution use IR data and analysis for planning and <u>decision making purposes</u>
	4. Serve as stewards of data and information	- institutional research's role in ensuring an institution-wide data strategy (privacy and security and ethical issues) - data quality assurance activities - ensuring data are appropriately accessible and usable to those who need them to make decisions
	5. Educate information producers, users, and consumers	- training and coaching related to the use of data, analysis, and information to inform decision making - ensuring the ability to collect, access, analyse, and interpret information independently and in collaboration with other stakeholders - Scholarship to inform and improve data, information, and analysis for decision support

STEP 2: THE QPIT FRAMEWORK OF KSU ITQAN 2020 E-PMS CASE STUDY

The rationale of the QPIT underscoring the ITQAN 2020: KSU-PMS supports Andersen *et al.*'s (2006) holistic approach of harnessing the various tools and concepts into an overall framework where their inter-linkages are understood when responding to the internal and external challenges. While most of the frameworks look at the macro or big picture, Rouse and Putterill (2003) proposed a macro-micro linkage and moving from organizational to operational levels of: 1) interface between organization and stakeholders, 2) resources capacity-capability, 3) planning-evaluation and resource-achievement, and 4)

Figure 3. Quality, planning and information troika (QPIT) framework



input-activities-output core elements, are key determinants of success. This supports Franco-Santos *et al.*, (2007), Bernardin *et al.*, (1998), Kennerly and Neely (2002), Harrington (2005), Newkirk-Moore and Bracker (1998), Temporal, (1990), Bolt, (1993), Burach *et al.*, (1997), Tovey, (1991) and Mason, (1993) macro-micro organizational and management views that were not clearly nor specifically addressed.

The QPIT (Figure 3) demonstrates a seamless quality-planning-information management platform principal to the integrated inseparable and interdependent performance management that are the three key strategic pillars of KSU 2030 “Towards Excellence” Vision and Mission covering:

1. **Quality Management:** Addresses all aspects of continuous improvements of quality & accreditation management meeting academic & educational services & support requirements of national & international accreditation.
2. **Planning Management:** Addresses strategic and annual operational planning of all academic & administrative units inclusive of developmental planning from quality & accreditation management.
3. **Information Management:** Addresses academic-administrative data, documentaries and information inclusive of strategic/tactical/operational performance-statistical metrics, data analytics and dashboards needs for evidence-based performance management.

STEP 3: DEVELOPING THE IPOO ARCHITECTURE E-PMS

The QPIT links the KSU-IR to the architectural development of the KSU ITQAN (Arabic term for Excellence) 2013-2015 e-QMS (Quality Management System). It is the base system to support the data analytics that all HEIs aim for. The basic rationale for the integrated e-QMS system is a robust electronic workhorse to address the demanding documents heavy, tedious and repetitive statistical requirements for the EEC-NCAAA (Education Evaluation Commission – National Center for Academic Accreditation

and evaluation) quality management/accreditation system of KSA (Kingdom of Saudi Arabia) and the newly established SAQF (Saudi Arabia Qualification Framework) in 2018.

Figure 4. KSU ITQAN 2020 Integrated Electronic Performance Management System



The full-fledged ITQAN e-PMS (electronic-Performance Management System) architectural platform (Figure 4) has two main phases of:

1. **Phase 1 (2014-2016) e-QMS** of achieving efficient and effective institutional-collegial-programmatic quality/accreditation management and functional-operational course/program/ self-study specifications/reports by programs in all colleges.
2. **Phase 2 (2018-2020) e-Planning & e-Performance** constituting the integrated planning-performance management platform with e-QMS meeting critical performance needs and requirements of

academic/administrative planning-quality-accreditation assurance, data analytics and performance management.

Basically, the ITQAN e-PMS architecture has three main operating components of its Inputs/Processing/Outputs & Outputs-Users (Figure 4) as follows:

1. **INPUT Component** – Constitutes the common data sources for functional-operational data management in quality/accreditation/planning/performance management from the various data sources across the whole institution.
2. **PROCESSING Components** – Constitute the main processing system that houses two main components of:
 - a. **DBMS (Database Management System)** – This DBMS extracts-prepares-processes-stages all statistics & data from the data sources used in the quality-accreditation- planning-performance data-marts for the e-QMS and e-PMS applications software.
 - b. **E-(Electronic) E-Quality, E-Planning, E-Information and E-Performance Management Application software** – Covers all the existing e-QMS and new e-PMS functional-operational modules as follows:
 - c. **E-QMS:** Full functional aspect of e-QMS modules for institution-college-programs quality-accreditation management with updated modules of:
 - i. **E-Curriculum Mapping Module and E-Course/Program/Self-Study Modules:** Reflect and support both new EEC-NCAAA/EEC-SAQF in-depth system requirements. This brings about modifications to the templates and statistical data requirements of Course/Program/Self-study requirements.
 - ii. **E-Performance Metrics & KPIs:** A new set performance-statistical data metrics will bring about a new set of aligned quality-accreditation-planning-performance metrics and data analytics to support strategic/tactical/operational performance management and informed decision-making by all KSU units.
 - d. **E-Planning Management:** Addresses the Strategic/Annual operational-developmental planning for all academic-administrative units' functionality development and planning monitoring and management tied to quality management.
 - e. **E-Performance Management:** Addresses the Strategic/Tactical/Operational performance metrics of academic-administrative units' performance monitoring-management that are aligned across board in KSU with data analytics and dashboards supporting informed decision-making and actions.
 - f. **E-Academic Development & Course/Faculty Portfolios Management:** Addresses the Vice Rectorate of Academic Affairs needs of Program development-updates-monitoring-management that are inclusive of E-courses/faculty portfolios.
 - g. **E-Societal Responsibilities Management:** Addresses capturing-reporting of all societal responsibilities activities by all KSU units.
 - h. **E-INTERNATIONAL & E-ISO Accreditation:** Address the colleges/programs international accreditation & administrative units' ISO certification of quality assurances.
3. **Enhanced E-Supporting E-Modules:** The following (1) e-Performance Metrics; (2) e-SID - (Statistics, Information & Documents); (3) e-Statistics, (4) e-Surveys (5) e-Faculty Portfolio, (6) e-Business Intelligence Queries & Analytics and (7) e-Student Portfolio, are all enriched to meet the enhanced functional and operational needs of the e-PMS.

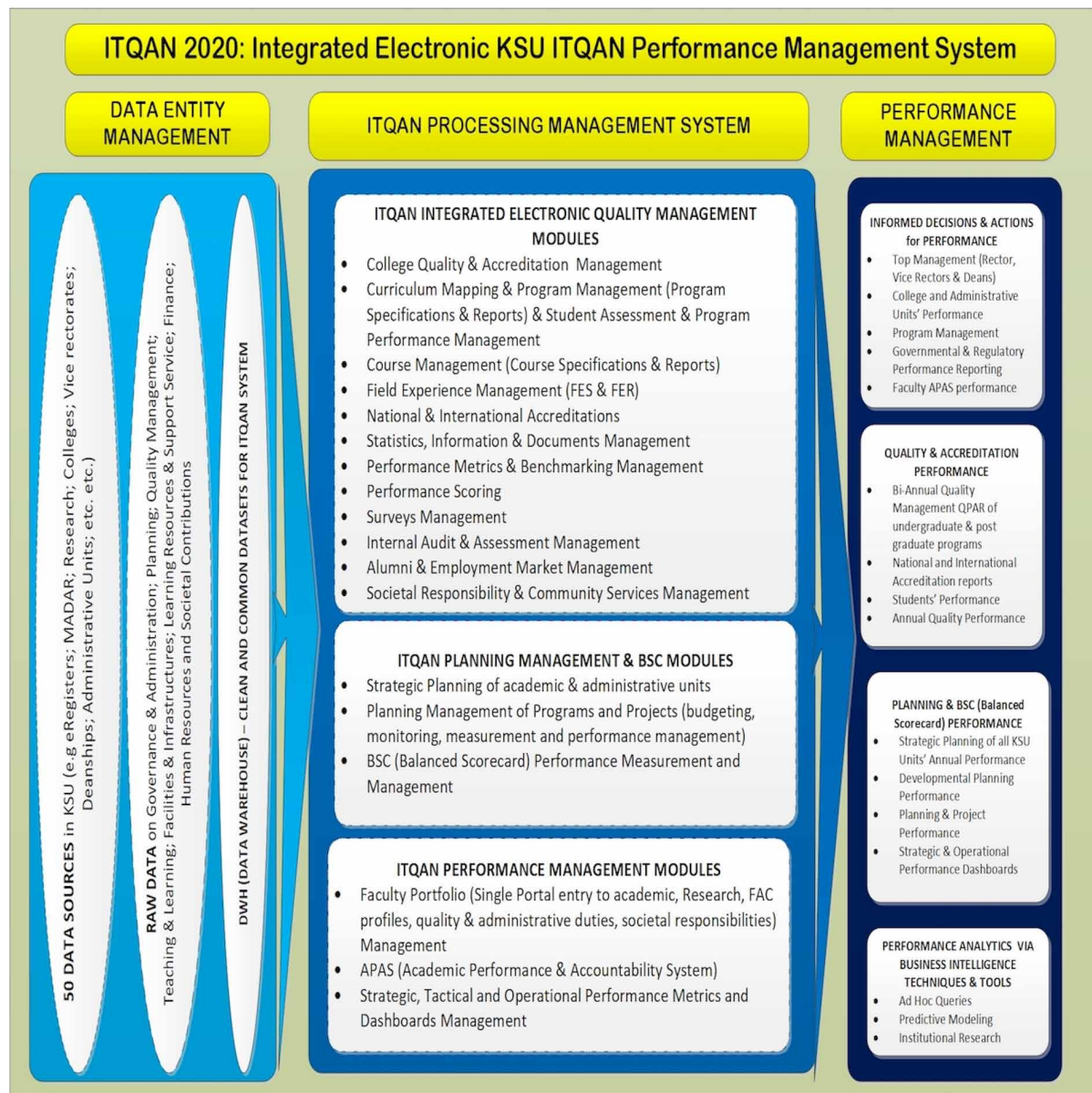
4. **E-OUTPUT & E-USERS Components** – This identifies the two main aspects of the key users-outputs of the e-PMS as:
 - a. **Users:** The 5 main users are: (a) Programmatic Self-Study Teams (b) Faculty (c) Program Committees (d) Board of Assessors and (e) academic-administrative decision makers. The integrated power of data queries-analytics is used by all administrators for informed decision making and actions underscoring the KSU-IR Framework.
 - b. **Key E-Outputs:** Main outputs from the e-PMS are used for: (a) quality-accreditation management of courses/programs and students' effectiveness-efficiencies and, (b) well planned and actioned performance accomplishments-achievements management to support informed decision making and actions with key outputs as follows:
 - i. E-Program Specifications-Reports (PS-PR)
 - ii. E-Course Specifications-Reports (CS-CR)
 - iii. E-SSRI and E-SSRP (Self-Study Report – Institution and Programs)
 - iv. E-SESRI and E-SESRP (Self-Evaluation Scale for Institution and Programs)
 - v. E-QPAR (Quality Performance Assessment Report)
 - vi. E-Quality-Accreditation and E-Planning-Performance monitoring-management performance reports
 - vii. E-Strategic-Operation-Developmental Plans
 - viii. E-Strategic-Tactical-Operational Performance Metrics & data analytics and E-Management queries, E-dashboards, routine and ad hoc E-reports.

STEP 4: DEVELOPING THE ITQAN PMS AND IMPLICATIONS AND DISCUSSION

In essence, the QPIT and architectural components is transformed into the integrated electronic platform of the ITQAN 2020 e-PMS architecture modular components and configurations (Figure 5) with 3 main sub-system components as follows:

1. **E-Data Entity Management:** The main purpose of this entity is to provide clean-correct common datasets in the DBMS used for the quality-accreditation-information and planning-performance management. These data are sourced, cleaned and validated as reliable/valid common datasets for the ITQAN processing management system. Basically this is a core critical data sourcing-capturing-cleansing operation for validity-reliability from data silos across the academic-administrative units. They are processed-computed-staged as datasets for application data marts in the ITQAN e-PMS applications.
2. **ITQAN e-PMS:** The e-PMS has two main processing mechanisms of: (a) the common datasets inputs from the data entity management data/statistics processing used for quality/accreditation/planning/performance management (b) the statistical data and performance metrics staging to the EEC-NCAAA and KSU-QMS templates and tables for Course/Program/Self-study/accreditation management, SID management, performance metrics & surveys, internal audit and assessment & performance scoring, and alumni/employment markets and societal responsibility and community services management applications. The components of the ITQAN processing management is comprised of:

Figure 5. KSU ITQAN 2020 Integrated Electronic Performance Management System



- 12 modules of the *ITQAN e-QMS & accreditation modules* (Figure 5) that are basically the heart of the system underscoring the main quality/accreditation development-monitoring-management of academic units processing components meeting EEC-NCAAA requirements;
- 3 modules of the *ITQAN e-Planning Management & BSC (Balanced Scorecard) module* for all academic-administrative units' strategic-operation-developmental planning-monitoring-management through the BSC approach; and
- 3 modules of the *ITQAN e-Performance Management module* for the academic- administrative units performance monitoring and management supporting informed decision making through data analytics.

3. **E-Performance Management:** This represents the main utilization of the data & performance analytics and information from the base systems (1) & (2) for data and learning analytics. As noted in the data analytics section above, the courses-programs, academic-administrative units data entities provide a huge pool for data and learning analytics applications as:
 - a. ***E-Informed decisions and actions for performance management*** by all levels of institutional/collegial/programmatic/individual users of data-statistics-information for objective informed decision making as opposed to subjective-heuristic behavioral-judgmental decisions. These cover the individual student/faculty performance and effectiveness analytics in support of increased curriculum development-design-implementation and infrastructure/resources management efficiencies and effectiveness. These include: (a) descriptive analytics of students, teaching, research, policies and other administrative processes (cf. Dekker et al., 2009; Feng et al., 2009; Ming & Ming, 2012); and (b) Prescriptive and Predictive analytics to uncover relationships and patterns within large volumes of student/faculty/program/resources data to predict behavior and events (Educause, 2010) for effective positive student/program change throughout their life cycle (Eduventures, 2013).
 - b. ***E-Quality and accreditation management*** that increases productive efficiencies and effectiveness levels by minimizing manual based quality fatigue and zeroed in on evidenced based performance management of its course/program & student/faculty analytics (Norton, Porter and Shacklock, 2016; Dringus, 2012; Dyckhoff et.al, 2012; Wagner and Ice, 2012; Elias, 2012 and Avella et.al. 2011).
 - c. ***E-Planning & E-BSC (Balanced Scorecard) management*** that brings about better development-implementation-management of the strategic/annual operation/developmental plans based on the recommendations of internal audit & assessment and accreditation. It highlights the imperative that the planning is linked to the quality and accreditation management as part of the QPIT and cause-effect data analytics and performance monitoring/management through the BSC framework aligning the performance across all levels.
 - d. ***E-Performance Analytics and business intelligence tools*** to support in-depth cost effective data analysis-modeling that forms the core of institutional research affecting informed decision making. This allows for drill-ups to institutional level or drill-downs to individual level to better customize program of studies based on better understanding of student/faculty performance (Yang, 2013; Douglas, 2001; Hilbert, 2013).

STEP 5 SAMPLES OF SCREENSHOTS SAMPLES OF ITQAN 2020 SYSTEM

Figure 6 shows the landing page of the two main e-PMS and the Performance dashboards that leads to: (1) the 12 modules of the ITQAN System on the left menu, and (2) the overall dashboard of the progress of institutional accreditation components and its drill downs (Figure 7).

Figure 8 shows the main sub-components of the administrative performance dashboard entry. These allows for drill-ups and drill downs, trend analysis across years or data points periods, or deep dive into a singular metric that needs more detailed analysis. Figure 9 illustrates a sample of the main summary of strategic performance metrics. These strategic level performance metrics can be customized based on key categorical areas of data analytics meeting different needs or requirements.

Figure 6. Landing page of the ITQAN Performance Management System

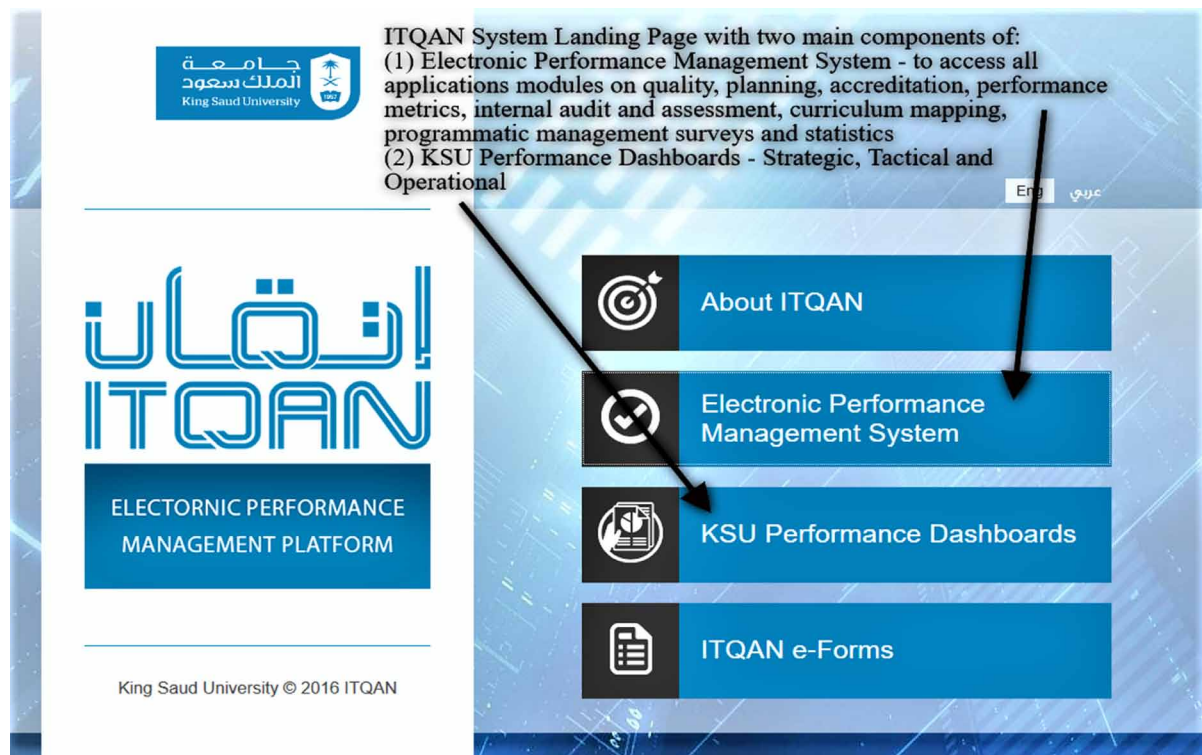


Figure 7. Dashboard for Institution drillable to programs and course levels activity status

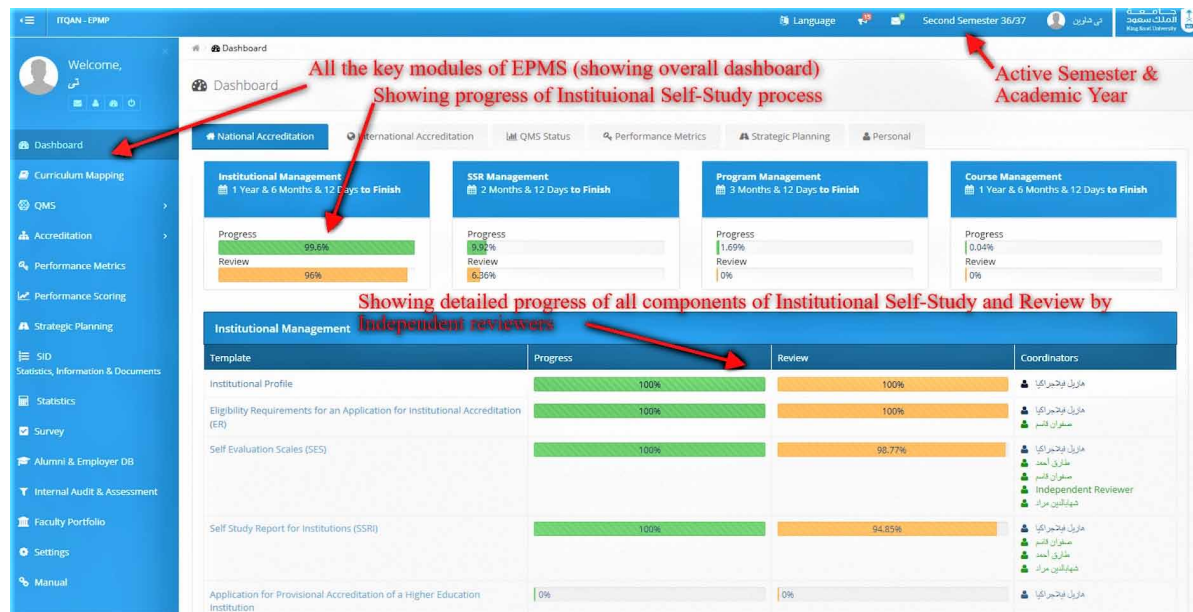


Figure 8. Landing page for all administrative units' dashboards



Figure 9. Dashboard of Strategic Performance Metrics



Figure 10. Strategic Planning Module of KSU 2030 Strategic Plan Mission, Vision, Values

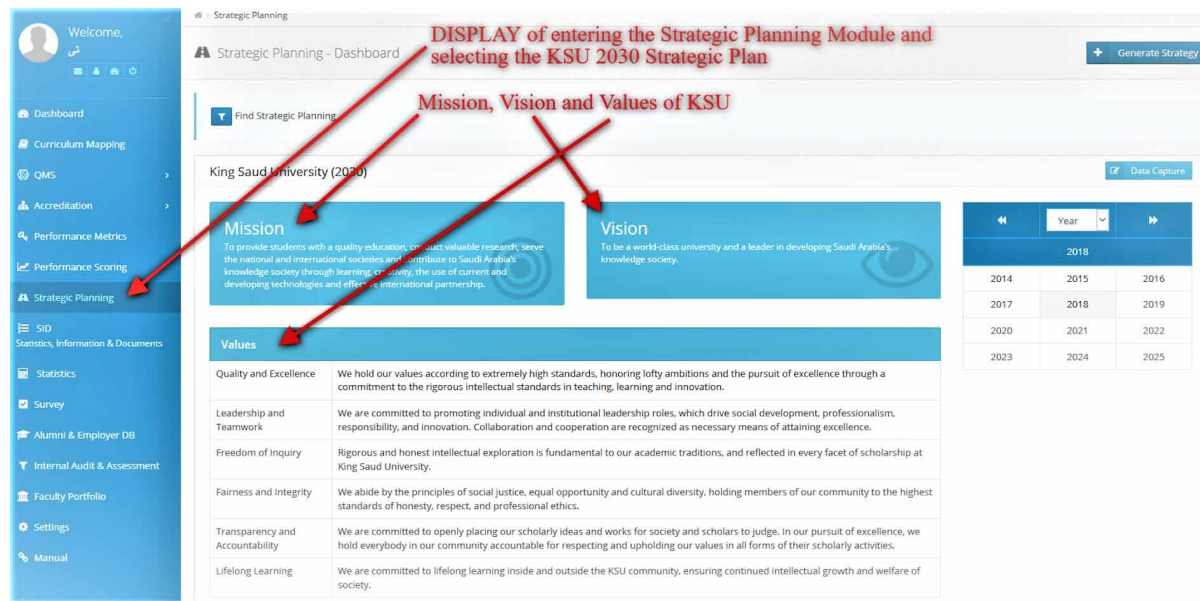


Figure 11. Dashboard of the main BSC (Balanced Scorecard) of Planning Module

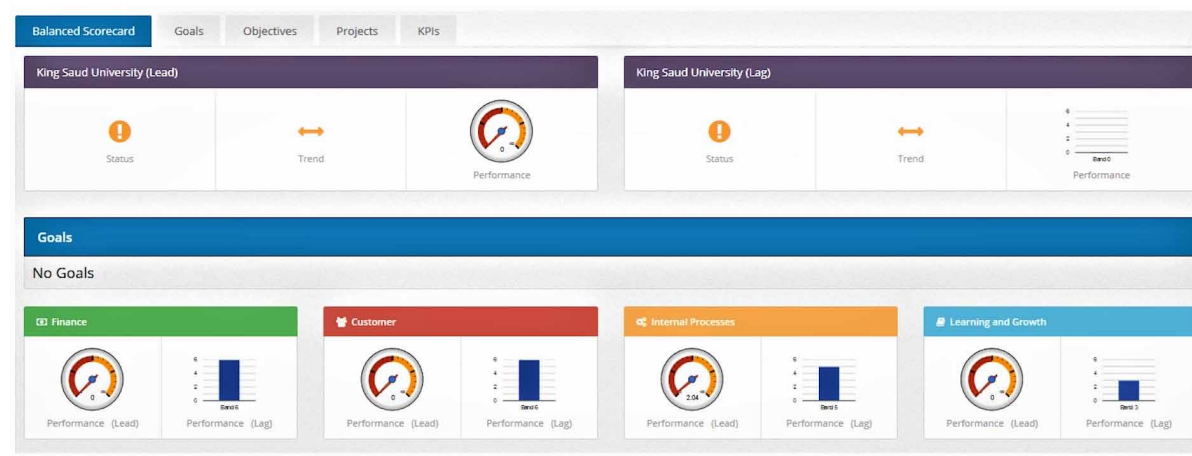


Figure 10 shows the entry to the BSC system for strategic planning where the key Vision, Mission, Values and the goals and objectives are displayed. Figure 11 shows samples of the dashboard of the planning module.

IMPLICATIONS AND LIMITATIONS OF E-PMS

As demonstrated by ITQAN KSU-PMS the key implication is the integrated bridging of the ICTs and HEI quality-accreditation-information-planning-performance management electronically data analytics of its planning-performance educational aims and mission accomplishments that underscores the KSU-IR Framework. Key implications of the QPIT based e-PMS are:

- Bringing about an interdisciplinary interdependencies of the strategic management, education management with the IS/IT management as the enabler for QPIT management, that are aligned, to bring about the convergence of 3 very different disciplines and practices. This is done through the expert knowledge of the champion or change agent who has practical and working knowledge and skills of the strategic needs of the HEI and the operationalization of the technicalities of ICTs, data analytics and details of the tedious-overwhelming quality management and accreditation operational requirements.
- Moving from the macro organizational strategic educational needs to the micro level operational or functional educational processes-procedural needs. This calls for a new mind-set, new capability-capacity sets; new individual-organizational learning as cohesive and consistent entities moving in the same unified holistic mutually aligned strategic directions-accomplishments-achievements. The key factor is aligning-matching the college-program-faculty micro aspect operationalization of the institution macro overview through re-engineered internal processes-procedures and human capital.
- The core educational teaching-learning-research processes is strategically linked via the quality management with the ICTs supporting enablers and a set of strategic-operational-developmental plans that form the integration and electronic triangularization of the QPIT managed as a holistic whole than as separated parts.

As evidenced in another book chapter, the key limitations are mainly human capacity-capabilities inclusive of leadership-management mindsets-philosophies-values-pragmatics and bureaucratic silo focused organizational strategies-policies-processes-procedures and lack luster collaboration-cooperation that persists and impedes the e-PMS strengths and sustainably.

FUTURE RESEARCH DIRECTIONS

While this e-PMS is a robust QPIT linkage of seemingly diverse and disjointed quality-accreditation, planning-performance and information-data analytics systems enabled by ICT, key future research directions exist for more in-depth and interdisciplinary research into:

- Enhancing the education knowledge economy through a set of integrated data-performance analytics that covers the scale and scope of the HEI strategic-tactical-operational educational management integrated requirements, as opposed to a silo-based approach that undermines societal-stakeholders-students' needs-expectations-accountabilities;
- Incorporating the power of enabling ICT and data-performance analytics into the HEI educational strategic-tactical-operational management integration to minimize quality-accreditation fatigue, increased faculty-program-collegial-institutional educational productivity and better informed decision making by all internal-external stakeholders;
- Incorporating interdisciplinary business tools-techniques, strategic-planning-performance management competencies, quality-accreditation diaspora, human-organizational behavioral-attitudinal-values, ICT tools-techniques to create and deliver the societal educational values-needs-expectations; and

- Determining the educational value creation-delivery and educational accountabilities-responsibilities framework of the educational PMS towards students-faculty-institutional efficiencies-effectiveness paradigms.

CONCLUSION

HEIs have established IR for integrative quality, planning and information optimization through data analytics. The IR has been realized through various manual-computerized based systems that are potentially integrated or disjointed separated quality-accreditation- information-planning-performance management systems. The KSU ITQAN e-PMS case study chapter intends to highlight that an integrative PMS framework can be made more powerful through the establishment of an e-PMS through the QPIT.

On the quality-accreditation front, the tedious mundane document heavy processes have improved by 50% quality fatigue reduction and improving program/faculty efficiencies leading to better support and student/faculty effectiveness management. On the planning-performance front, planning is linked to the strategic/operational performance metrics thus closing the consistently weak quality-planning link. In effect, the e-PMS forms the core foundation for performance analytics to support better institution/program/student/faculty/infrastructure management through the data and learning analytics using the BI tools. While this e-PMS does not claim to be the best integrated system, it does demonstrate that integration of the QPIT can better support performance management in the institution/colleges/programs/students/faculty/resources efficiencies and effectiveness through its rich vast data and information analytics.

In conclusion, even-though the integrated electronic ITQAN 2020: KSU-PMS emphasized on the strategic QPIT integration, this does not mean that other concepts and frameworks are irrelevant. On the contrary, as noted by Andersen *et al.* (2006), the quality-accreditation-information and planning-performance management, or for that matter, all aspects of the HEI commitment of educational value to society must be approached from a holistic integrated perspective with an appropriate set of plethora of tools and techniques depending on the situational needs.

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KEY TERMS AND DEFINITIONS

E-PMS: Performance Management is a process for establishing shared understanding about what is to be achieved and how it is to be achieved, and an approach to managing and developing people that improves individual, team and organizational performance (Armstrong M., 2006). e-PMS is the integrated electronic modular components of the HEI Quality-Accreditation- Information-Planning-Performance essential for student-faculty-programmatic-collegial-institutional efficiencies-effectiveness towards strategic-tactical-operational the mission-goals-objectives underscoring informed decision making.

E-QMS: e-QMS is the electronic version institutional-programmatic quality-accreditation management of core essential quality assurance managements policies-processes-procedures-people utilizing statistical data & performance analytics to prepare-process-audit-assess-submit self-study-program-courses continuous efforts towards accreditation.

Integrating Big Data Technology Into Organizational Decision Support Systems

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INTRODUCTION

Organizational Decision Support Systems (ODSS) is defined as “a new type of DSS, focusing on the organization rather than the individual or the group,” (George 1992, p 109). With the growing trend of global competitiveness and business complexity, the design of ODSS faces two critical challenges (Jespersen, 2018; Garrido, 2015). The first is the high pace of decision scenario relative to the corresponding decision-making cycles. The second challenge is the large scale of volume, variety, and velocity of data that exceeds the capability of traditional databases and data-warehouses in the system. A proposal of meeting such challenges is to provide the decision-makers with the capabilities of allowing them to feel, recognize, abstract, comprehend, analyze, and decide faster than the scenario pace. Using Big-Data technology (BDT) in ODSS would provide the decision-making team with such faster decision-making capabilities.

The BDT is a high resolution representation of real life in such a way that all movements, activities, thoughts, conversations, relations, feelings could be tracked, recorded and processed almost online (Sagiroglu & Sinanc, 2013). Such BDT as an accurate representation of real life could be used in both ways, to understand the real life and to control it (Wu et al., 2014). Fast cycles of understanding and controlling real life situations are the key functions of ODSS. The need for BDT is well recognized on several decision-making levels. The “Global Pulse” is a recent initiative of the United Nations Secretary General for accelerating discovery, development and scaled adoption of Big-Data innovation for sustainable development (UN Global Pulse, 2015). The impact of BDT on the economy has been referred to as “the new oil” (Kolb & Kolb, 2013: p. 10).

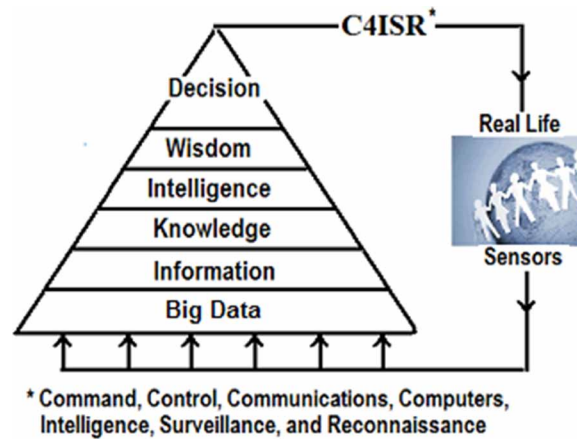
The goal of this chapter is to describe a conceptual framework for integrating BDT with traditional designs of ODSS. The updated conceptual design is validated using the Analytical Hierarchy Process (AHP) and the Quality Deployment Function (QFD) technique. The QFD technique correlates the design modules to common ODSS requirements after prioritizing it through the AHP. The conceptual design provides a system that is flexible and responsive to decision makers’ need in developing their own ODSS. The initial stages required for implementing the conceptual design are given.

BACKGROUND

Decision support systems have traditionally supported the problem definition, alternatives development, alternatives analysis, choice, and implementation phases of the decision-making cycle. Courtney (2001) suggests moving from a classic decision-making paradigm model to a cycle that emphasizes synthesis and post implementation review as well as environment scanning.

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Figure 1. From Big-Data to Decision in ODSS
(Adapted from Kabeil & Kabil 2018)



The quality of decision, such as any other engineering product, is built from the very beginning all through the decision processing cycle (Davern et al. 2008). The generic decision cycle starts with data gathering that is processed further to higher levels of information, knowledge, intelligence, wisdom, and decision. The decision is implemented to move a real-world-situation to be more suitable for the next decision or action (Kabeil & Kabil, 2018).

Leverage the “Data” concepts and technologies to “Big-Data” ones affects all higher levels of the model depicted in figure 1. Information is defined as useful data. Usefulness of data depends on the user, time and context of the use (Shankaranarayanan & Cai, 2006). Transforming data to useful information starts with data cleansing and interpretation, which has been changed with the radical increase of Volume, Variety, and Velocity of Big-Data (LaValle et al 2011).

In the model under consideration, knowledge is defined as the know-how of object or concept behavior. According to the United Nations Development Program (UNDP), knowledge management is defined as “the practice of capturing, storing and sharing knowledge so that we can learn lessons from the past and apply them in the future.” (UNDP, 2007: p. ix). Big-Data technologies open doors for new knowledge management methodologies using parallel processing on clusters of data servers (Cuzzocrea, 2014).

In the same context, intelligence is defined as the capacity of handling new situations. This definition is consistent with Wang’s definition, which considers intelligence as the capacity to adapt under insufficient knowledge and resources (Wang, 1995).

Wisdom is defined, in the same context, as the values, ethics and beliefs that form the preferences of a decision maker (Kabil & Kabeil, 2011). Bellinger, et al. (2004) present a model of Data, Information, Knowledge, and Wisdom hierarchy in both the Knowledge Management and Information Science domains.

Decision is defined as a selection of course of actions among several alternatives to interact with a real-world-situation according to a set of preferences that reflect the group wisdom. The decision is implemented through a Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) System to move a real-world-situation to next phase of expected scenario (McDowall, 2019). Using emerging technologies of Big-Data in ODSS is reviewed in next sections.

BIG-DATA TECHNOLOGIES FOR ODSS

There are several definitions of the term “Big-Data.” Perhaps the most popular definition is based upon the IBM’s differentiation of Big-Data according to 3 attributes of the 3 V words, Volume, Variety, and Velocity (Sagiroglu & Sinanc 2013; LaValle et al 2011). The “Volume” attribute of Big-Data reflects the large quantity of data being generated from various resources including data captured from different devices and sensors that are networked together as well as the information accessible on common social media such as Facebook and Twitter (Centola 2010).

The “Variety” attribute of Big-Data is referred to the numerous types and sources of data required to understand or control a situation. Big-Data goes beyond traditional structured relational databases to include less structured data such as weblogs, social media, e-mail, sensors, photographs, and videos (Sagiroglu & Sinanc 2013). The different kinds of data feature up to the level of individuals with highly various sets of structured, semi-structured, and unstructured data (LaValle et al 2011).

The “Velocity” attribute of Big-Data represents the high dynamics of situations under investigation and the rapid change in data over time (Sagiroglu & Sinanc 2013). As the world becomes more developed and connected, as the dynamics of situations and change in data increase.

After reviewing several definitions of Big-Data, De-Mauro et al. (2014) provide a consensual definition that synthesizes common themes of reviewed definitions as “Big Data represents the information assets characterized by such a high Volume, Velocity and Variety to require specific Technology and Analytical Methods for its transformation into Value” (p. 8). Such a definition of Big-Data points at its need for specific technologies and analytical methods.

The main technologies and analytical methods used for creating Big-Data as reported in literature are Crowdsourcing, Location-Based Services (LBS), Radio Frequency Identification (RFID), Near-Field Communication (NFC), Remote Sensing, and Big-Data analytics.

Crowdsourcing

Estellés-Arolas and González-Ladrón-de-Guevara (2012) conducted a comprehensive study to reach a consensual definition for crowdsourcing. The developed definition reads “... a type of participative online activity in which an individual, an institution, a non-profit organization, or company proposes to a group of individuals of varying knowledge, heterogeneity, and number, via a flexible open call, the voluntary undertaking of a task.” (p. 195). Kahl et al. (2012) believe that developing more new technologies capable of collecting, communicating and disseminating individuals’ information on macro scales has led to more forms of crowdsourcing in organizational decision-making. Alam & Campbell (2016) state that crowdsourcing is part of a historically significant trend in which organizations target individuals, for value co-creation in completely new ways of Internet-based technologies.

The Crowdsourcing Framework defined by Liu (2014) uses the same traditional information-gathering six dimensions of why, who, what, when, where, and how to identify the interaction mechanisms that should be considered by designers of crowdsourcing systems. The “Why” dimension identifies the information requirement of a problem and the tasks needed from each crowd category. The “Who” dimension identifies the categories of crowd and matches the experience of each category to relevant required tasks. The “What” dimension identifies the interaction flows for engaging each crowd category in the process. The “When” dimension identifies the dynamic aspects of crowd categories interaction. The “Where” dimension identifies locations and geographical aspects of crowd categories, category activities, and scenario. The “How” dimension identifies the interfacing devices and applications with

crowd categories. Also, in the “Where” dimension, the geographically-oriented data could be provided using Location-Based Services (LBS).

Location-Based Services (LBS):

The LBS could be used to locate living entities or objects across telecommunication networks (Oh et al., 2019). Several technologies are utilized by LBS for knowing where an information device is geographically located. Examples of technologies used for LBS are the Global Positioning Satellites (GPS), Assisted Global Positioning Satellites (AGPS), Cell Identification (Cell ID), Broadband Satellite Network (BSN), Radio Frequency Identification (RFID), and Near-Field Communication (NFC).

Radio Frequency Identification (RFID)

The emerging technology of smart watches with embedded sensors to recognize objects and forearm gestures expands the use of such applications in full integration with RFID and NFC technologies. The RFID is a generic term for technologies that use radio waves to automatically identify entities, whatever inanimate, movable, or live. The entities are identified by information that may include a unique identifier or more data such as profile, transactions, measurements, account, weight, or birthdate (Garfinkel & Holtzman, 2006). The RFID has been identified as one of the ten greatest contributory technologies of the 21st century (Chao et al., 2007).

Near-Field Communication (NFC)

The NFC is a form of short-range wireless communication where the antenna used is much smaller than the wavelength of the carrier signal. NFC devices can be used as an identification label, master key, and a link for data transfer. As the NFC standard builds upon established standards of RFID technology, it enables devices to act both as a RFID tag as well as a reader of RFID tags (Kranz et al., 2013). By using the NFC along with wireless sensors and smartphone applications, data is collected from NFC enabled devices (Zhang & Li, 2011).

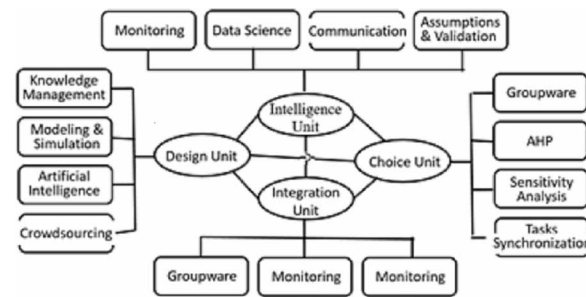
Remote Sensing

Remote sensing is a valuable source of spatial information, and its utility has been proven on many occasions of strategic decision-making (Kumar et al., 2014). Joyce et al. (2009) address the use of remote sensing as a rapid-response data source and present a number of data types and image processing techniques along with relevant satellite technologies.

Big-Data Analytics

Big-Data provides opportunities to find insights in new and emerging types of content to answer questions that were previously considered beyond the reach (Trelles et al 2011). The Big-Data Analytics is the way to harvest the available opportunities of Big-Data (IBM, 2015). Big-Data analytics is defined as “the systematic use of data and related business insights developed through applied analytical disciplines (e.g. statistical, contextual, quantitative, predictive, cognitive, other models) to drive fact-based decision-making for planning, management, measurement, and learning” (Cortada et al., 2012: p. 2).

Figure 2. Conceptual Design of ODSS



Baboo and Kumar (2013) present an overview of the next generation data warehouse architecture based on Big-Data for better business insights. The proposed architecture consists of three tiers, which are the extracting of Big-Data from multiple sources, storing and cleansing, and the analytical reporting. Within such architecture, a typical Big-Data processing framework relies on cluster computers with a high-performance computing platform. The data processing tasks are being deployed by running parallel programming tools on a large number of computing nodes. A single data processing task is split into many small tasks each of which is running on one or multiple computing nodes (Wu et al., 2014).

Che et al. (2013) review several attempts that have been made on exploiting massive parallel processing architectures for Big-Data Analytics. Google created a programming model named MapReduce (Dean & Ghemawat, 2010) that was supported by the Google File System GFS, which is a distributed file system where the data can be partitioned over thousands of nodes in clusters. The MapReduce framework allows users to define and run two functions, map and reduce, to process a large number of data entries in parallel within reasonable time frame.

Other big companies created the Apache's Hadoop MapReduce, which is an open-source version of Google's MapReduce framework. The Hadoop MapReduce uses the Hadoop Distributed File System (HDFS), which is an open source version of the Google's GFS. The Apache open-source community created HBase, which is an open-source version of Google's BigTable built on top of HDFS and Cassandra. Cassandra is an open-source version of Amazon's Dynamo. Apache Hive is an open source data warehouse system built on top of Hadoop for querying and analyzing files stored in HDFS using a simple query language called HiveQL (Cuzzocrea et al., 2011).

Hadoop has several competitor platforms. Some of the competitors improved on existing platforms, and others came up with a fresh system design. Google Cloud Platform analyzes Big-Data in the cloud with BigQuery, which is an SQL-like query runs against multi-terabyte datasets in seconds to give real-time insights about the data (Hashem et al., 2015).

DEVELOPING A FRAMEWORK FOR INTEGRATING BDT WITH ODSS

Simon (1960) presents a process model for decision-making and problem solving in four phases, which are (1) Intelligence, (2) Design, (3) Choice, and (4) Implementation. Based upon Simon's model, a generic conceptual design of ODSS has been updated to include emerging BDTs as illustrated in figure 2.

The conceptual design consists of four functional units, which are the Intelligence Unit including four modules, the Design Unit including four modules, the Choice Unit including four modules, and

the Integration & Display Unit including three modules. The updated unites and modules of the ODSS conceptual design are defined in the following items.

ODSS-1. Intelligence Unit: The information relevant to the decision situation is gathered and maintained by the intelligence unit all through the decision-making cycle. Information gathering is conducted on both strategic and operational levels (Chen et al. 2008). Data may need to be related to a larger intelligence picture using Big-Data Analytics. Data may cause the user to consider new operational concepts that require the intelligence to be interpreted in a new context. Evaluation and feedback are continuously performed during every other phase of the intelligence cycle. The main quality attributes of data collected at the unit are timeliness, relevancy, completeness, accuracy, usability (tailored to the specific needs), objectivity, availability (including appropriate security classification), and synchronization with associated operations. The unit ensures that both data and Big-Data is filtered and processed to relevant information that is timely accessible to the team members and other modules while still adhering to security standards. Security standards include the need-to-know principles. The updated structure of the Intelligence Unit includes four modules as defined in the following items.

1. **ODSS-1.1. Monitoring Module:** It supports the production, dissemination, and display of data. It consists of nodes that can create, receive, edit, transmit, and store video clips as well as images, graphics, voice, text data, and sensors signals. Data can be shared interactively among system subscribers on a point-to-point or multi-point basis with a “push-pull” capability. The data is delivered interactively in such a way that the module can support the subscribers with further clarification or direct interpretations. The module may include several technologies such as Location-Based Services (LBS), Radio Frequency Identification (RFID), Near-Field Communication (NFC), and Remote Sensing.
2. **ODSS-1.2. Data Science Module:** It allows specific access privileges to several categories of users and multiple applications of the system. However, the huge expansion in volume, variety and velocity of Big-Data, as discussed before, exceeds the capacities of traditional Relational Database and Data-warehousing technologies. The module includes several technologies and analytical methods such as Big-Data Analytics.
3. **ODSS-1.3. Communication Module:** This module is responsible for building and managing a network of distributed data sources. The coordination protocols between the ODSS and each one of these sources include type of contents, structure, format, updating times, security, and error control of data exchange. Some data of this module may be subject to Big-Data processing technologies.
4. **ODSS-1.4. Assumptions & Validation Module:** The first responsibility of this module is to fill gaps of data in the decision structure with best estimates (Byrne 2005). There are several techniques for assuming missing data including statistical distributions, regression, cross references, modeling, and simulation models. Big-Data Analytics can effectively fill the gaps of missing data by comparing and matching techniques. The second responsibility of the module is to conduct forecasting activities including meteorological forecasts and prediction of decision consequences (Fildes et al. 2006). The third responsibility of the module is to check the validity of data collected through the Intelligence Unit’s modules and deliver data reasoning (Hernandez & Stolfo 1998). There are several methods for testing validity of data including both simple cross checking and sophisticated statistical tools (Castano et al 2008).

ODSS-2. Design Unit: The main responsibility of the Design Unit is to develop enough alternatives for decision choices. Creativity in developing diversified alternatives is a key factor in decision-making. Specifications, course of actions, and planning of alternatives and possible switching from one alternative to another should be clearly formulated. The updated structure of the Design Unit includes four modules as defined in the following items.

1. **ODSS-2.1. Knowledge Management Module:** The module is responsible for dealing with both explicit and tacit knowledge. Explicit knowledge is documented and easy to be programmed into the system by its own analysts and acquired by the system through repeated use. Tacit knowledge, on the other hand, is built in human beings as mental models and technical experiences. The tacit knowledge is managed in the ODSS through a network of experts in different domains and protocols of communicating with them. Knowledge engineers in the module interview the domain experts and gather the information necessary for the system (Wang & Belardo, 2005). A variety of knowledge acquisition techniques are used to transfer tacit knowledge into explicit knowledge including interviewing, Delphi technique, brain storming, and modeling (Nevo & Chan, 2007). The module is in full coordination with the Data Science Module (ODSS-1.2) in the Intelligence Unit for Big-Data mining and extracting knowledge about behavior of individuals, groups, concepts, and objects.
2. **ODSS-2.2. Modeling & Simulation Module:** The first responsibility of this module is to develop and maintain the model-base of the ODSS. The module provides vehicles for estimating the possible outcomes of decision problems over a wide range of possible conditions. The second responsibility of the module is to represent decision makers' preferences, to incorporate qualitative factors in decision structure, to integrate all models related to the case in consideration, and to develop the complete decision structure. The model base contains both optimizing and satisficing or heuristics models (Barkhi et al., 2005). The ability to run individual or combined models or to construct new models makes the ODSS a powerful tool.
3. **ODSS-2.3. Artificial Intelligence Module:** The module is responsible for improving the effectiveness and efficiency of decision-making processes using several Artificial Intelligence & Expert Systems methods (Khalil et al. 2012). The module can help in providing multi-agent systems for real time support and simulated environments. The module can also help in developing and using Fuzzy Logic and Neural Networks models for supporting decisions in specific domains (Brynielsson, 2007).
4. **ODSS-2.4. Crowdsourcing Module:** In most decision contexts, public participation is an emerging, large-scale arena for Internet-mediated interaction that has implications for both informal and formal response (Liu, 2014). With a focus on persistent customers' communication as one form of interaction, the module follows how the emerging information pathways that result serving different functions (Palen & Liu 2007). Crowdsourcing is used in ODSS for several purposes, such as production development and configuration, product design, community reporting, community work, and open innovation (Randhawa et al., 2016). Crowdsourcing Typology technique is one of the tools used for measuring public group wisdom (Tripathi et al. 2014).

ODSS-3. Choice Unit: The Unit is responsible for developing a preferences structure of group decision makers (Limayem et al., 2006). Once the problem definition, objectives, and policy strategies are agreed upon among legitimate stakeholders, the criteria hierarchy and preferences structure are developed and used for ranking the alternatives and measuring the degree to which each objective is met. However, the measurable criteria may change with time (Frijda, 2005), which need Big-Data

Analytics. The criteria for making the decision are refined, expanded, and weighted by interactions between the decision makers and the decision analysts. The main measure of merits of the Choice Unit is the selection of best alternative at each phase of decision-making based upon well-defined criteria that accurately represent the group wisdom. The updated structure of the Choice Unit includes four modules as defined in the following items.

1. **ODSS-3.1. Groupware Module:** Several groupware technologies are used to integrate and incorporate the wisdom of decision makers in the choosing process (Adkins et al. 2002). Several functions are conducted in this module, including a “Road Map” of the partial judgments leading to the recommended decision.
2. **ODSS-3.2. AHP Module:** The analytic hierarchy process (AHP) is a mathematically rigorous, proven process for prioritization using pairwise comparison judgments (Saaty, 1982). The AHP is used in the ODSS for several purposes including:
 - a. Organizing the complexity of decision structure.
 - b. Determining the internal and total priorities of alternatives.
 - c. Forecasting about next move of actors.
 - d. Allocating resources in all modes of operation.
 - e. Selecting the most relevant cases to retrieve for investigation.
 - f. Integrating qualitative factors with quantitative factors in decision structure.
 - g. Evaluating the ethical responsibilities in inverse decision support cases (Kabil 2012).
3. **ODSS-3.3. Sensitivity Analysis Module:** The main responsibility of the module is to check the sensitivity of a decision to any changes may arise in decision parameters. Also, to check the validity of data received from the Assumptions & Validation Module (ODSS-1.4) of the Intelligence Unit to be incorporated in the decision structure. Sensitivity of the decision to assumed data is analyzed for deciding if the assumption is accepted or it needs further effort for validation.
4. **ODSS-3.4. Tasks Synchronization Module:** The module is responsible for monitoring, controlling and adjusting the pace of decision cycle over operational events. An E-Net based on Petri net-based formal model (Liu et al., 2015) is used for modeling and analyzing response timing and synchronization considering uncertain activity, execution duration, uncertain resource quantity, and uncertain duration of resource preparation.

ODSS-4. Integration & Display Unit: The unit is responsible for integrating all unites and modules of the ODSS and facilitating its team to access transparently the internal and external components of the system (Huang et al., 2002). The main objective is to provide everybody with the right information at the right time and in the right way. Incorporating an intelligent visualization module helps in providing at the time the relevant information that is necessary for the adequate behavior for fulfilling a specific task in specific situation. It also helps in providing the relevant information in the right way that promotes its rapid perception, proper understanding, and effective use. The main measure of merits of the Integration & Display Unit is to insure transparent seamless secure work of the ODSS all through the phases of decision-making process. The updated structure of the Integration & Display Unit includes three modules as defined in the following items.

1. **ODSS-4.1. Team Interface Module:** The main function of the Team Interface Module is to create and provide interface that minimizes the time of team comprehension. Shen-Hsieh and Schindler (2002) suggest approaches to use web-based interface technologies to create visual metaphors for data including visualizing time, collaborating, and modeling scenarios. They also demonstrate approaches to embedding more abstract constructs like decision theory,

statistical analysis, and competitive advantage into these interfaces. Bharati and Chaudhury (2004) discuss the quality of interface in web-based decision support systems. The module is also able to combine several displays in a single dynamic presentation and to supply the displays being generated with various interactive facilities such as zoom, pan, rotate, focus, query, mark, filter, or follow a hyperlink.

2. **ODSS-4.2. Visualization Module:** The module is responsible for effective preparation, organization, and representation of Big-Data in intelligent maps relevant to the goals and suitable to intended recipients considering the time pressure and stress factor (Andrienko & Andrienko, 2007). The intelligent maps help reducing the information load on the recipient, increasing the clarity of the information presentation, and allowing quick recognition of the meaning of the information conveyed.
3. **ODSS-4.3. Administration & Security Module:** The module is responsible for managing a role-based access control and security system. The system assigns and maintains the authority level depending on the situation and the needs, goals, and characteristics of the intended recipient. The needs depend, among others, on the role of the addressee in the decision-making situation. The module specifies the level of authority and type of access for each of the roles. An integrated security mechanism may be used to optimize security protocols and mechanisms of various heterogeneous networks in ODSS. One requirement of the integrated security mechanism is to interface with security protocols of open ubiquitous sensor networks. Such integration includes the support of mobility management, quality of service provision, and security interoperability.

CHECKING THE VALIDITY OF CONCEPTUAL DESIGN

The exercise suggested in this study for testing validity of the updated conceptual design of the ODSS is to recall the four perspectives of Balanced Scorecard (BSC) of organization strategic management as core requirements of ODSS (González, et. al, 2012). The administrative requirements of ODSS is adapted from (Kabil & Kabeil 2014). Based upon the definition of both core and administrative requirements, a model of Quality Function Deployment is developed to test the capability of the ODSS to provide these types of support.

The four perspectives of the BSC are the financial, customer, business processes, and learning and growth (Kaplan & Norton 1996). The BSC is used in several types of research for measuring and supporting organizational strategies (Mehralian et al. 2018; Gupta & Salter, 2018). The definition of both core and administrative requirements are listed in Table 1 with examples of their relative priorities using the Analytical Hierarchy Process (AHP). The table includes summary of requirements in 10 rows along with the Weight and Relative Weight Percent of each.

The evaluation of the conceptual design modules is based upon the use of Quality Function Deployment (QFD) technique. The set of ODSS Requirements and their priorities are used as inputs for the QFD model. The QFD is an overall concept that correlates design quality with user requirements (Sankaran et al., 2008). It has been used in several domains including decision support (Kabil & Kabeil, 2014; Kara-Zaitri & Al-Daihan, 2008; Simitsis & Vassiliadis, 2008). The technique uses matrices to collect, analyze and manage goals towards a final product. However, 95% of the studies applying QFD so far use only the first matrix, called House of Quality “HoQ” (Chan & Wu 2002). Basically, such matrix correlates requirements “what” to design modules “how”. The correlations between the requirements

Table 1. Priorities of ODSS Requirements

RN	% Rel. Weight	Weight (1-5)	Requirements
1	10.6%	5	Supporting financial aspects of the organization.
2	10.6%	5	Supporting customer's aspects of the organization.
3	10.6%	5	Supporting business processes aspects of the organization.
4	10.6%	5	Supporting learning and growth aspects of the organization.
5	10.6%	5	Rapidly deploying compatible information and communication systems to decision-making team.
6	8.5%	4	Calling for expert review of decision proposals.
7	8.5%	4	Locating an individual, facility, vehicle, or object on a map.
8	8.5%	4	Keeping historical Big-Data of the entire case for analysis and research.
9	10.6%	5	Insuring availability and security of the system
10	10.6%	5	System admin being able to setup and manage the system.
		47	Total Scores

and the design modules are specified using symbols of “strongly related,” “moderately related,” “weakly related,” or “not related,” which represent the corresponding numerical values 9, 3, 1, or 0 in the matrix calculations. The row score of design modules is the sum of the product between the relative weights of the integrated requirements and the correlations (between requirements and modules) as partially depicted in figure 3.

SOLUTIONS AND RECOMMENDATIONS

The output of the HoQ matrix is summarized in table 2. The relative weights (%) of the ODSS modules represent the percentage of the total score that each component contributes in the conceptual design.

Figure 3. Part of HoQ of the ODSS

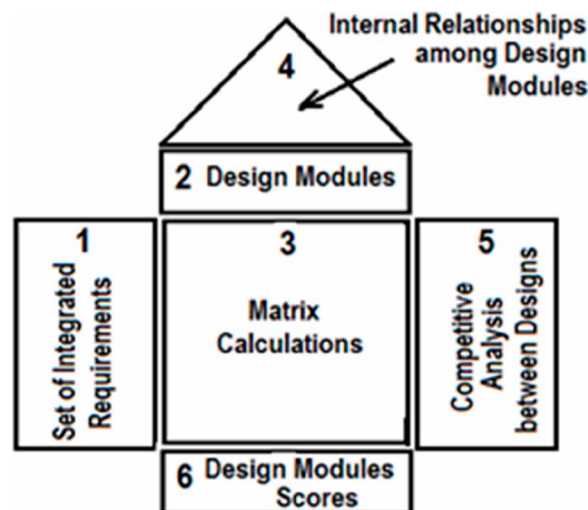


Table 2. Relative weight percent of the ODSS modules

ODSS1.1	ODSS1.2	ODSS1.3	ODSS1.4	ODSS2.1	ODSS2.2	ODSS2.3	ODSS2.4	ODSS3.1	ODSS3.2	ODSS3.3	ODSS3.4	ODSS4.1	ODSS4.2	ODSS4.3
8.6	9.6	7.7	7.2	7.2	5.0	5.0	8.2	6.1	4.5	6.0	7.0	5.9	5.8	6.2

As the table indicates, the modules of the conceptual design support all requirements of ODSS. Each requirement is supported by a set of integrated modules in a balanced way. The modules of the highest contribution in the conceptual design are the modules most related to BDT. These modules are the Big-Data Science module (ODSS-1.2), the Monitoring module (ODSS-1.1), and the Crowdsourcing Module (ODSS-2.4).

The Implementation of Conceptual Design

The Basic modules of ODSS are developed as a conceptual design, which provides a general foundation for the detailed design and implementation of an application. The conceptual design provides a system that is flexible and responsive to decision makers' need in developing their own system. The initial stages of the implementation of ODSS consist of the establishment of facilities and staffs to carry out the basic functions of the system. Once an initial allocation of resources has been made, the functions of the system can be established in an operating condition. The major task in the development of the system involves integrating the various and widespread strategic information activities already existing in the organization with the new Big-Data activities.

FUTURE RESEARCH DIRECTIONS

There are three main avenues for future research on the same topic. First, to test empirically the validity of the adapted conceptual design of BDT in ODSS. Second, to test the applicability of the proposed theoretical models of adapted ODSS across several countries with different levels of infrastructures, ethics and cultures. The third avenue is to explore the user and organizational acceptance of the proposed model.

CONCLUSION

With the growing trend of global competitiveness and business complexity, the need arises for integrating BDTs in the design of ODSS (Jespersen, 2018; Garrido, 2015). BDTs enable ODSS to deal with data of volume, variety and velocity beyond the capability of traditional databases and data-warehouses in ODSS.

The basic modules of updated ODSS with BDT are presented as a conceptual design, which provides a general foundation for the detailed design and implementation of an application. The validation of the proposed conceptual design is conducted on a test-case based upon the BSC perspectives as well as requirements common for ODSS scenarios. The relative percentage of the total score that each module contributes in the conceptual design is evaluated using the Quality Function Deployment (QFD) technique. The results show that each requirement of the system is supported by a set of integrated modules

in a balanced way. The modules of the highest contribution in the conceptual design are the modules most related to BDT.

The conceptual design provides a system that is flexible and responsive to decision makers' need in developing their own ODSS. The initial stages of the implementation of the system are given. By combining the conceptual design with a test of internal validity and guidance of implementation, the study has provided some useful information to build upon.

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KEY TERMS AND DEFINITIONS

Big-Data: The term “big data” is related to gathering and storing extra-large volume of structured, semi-structured and unstructured data with high Velocity and Variability to be used in advanced analytics applications.

Big-Data Analytics: Big data analytics is the process of examining large and varied data sets of big data to uncover information including hidden patterns and unknown correlations that can help organizations make better business decisions.

Big-Data Technology: There are several sources for big data including streaming data such as data from a web of connected devices and IoT. social media such as marketing, sales and support data, and publicly available sources such as the US government’s data.gov and the European Union Open Data Portal. These different sources need different technologies to deal with such as Apache Hadoop, Microsoft HDInsight, NoSQL, Hive, Sqoop, and PolyBase.

Crowdsourcing: Crowdsourcing is related to the act of collective intellectual gathering of information that comes from the public to be used in completing a business-related task.

Data Science: Data science is a multi-disciplinary field that follows scientific approaches, methods, and processes to extract knowledge and insights from structured, semi-structured and unstructured data.

Decision Support Systems: A decision support system (DSS) is an information processing system that supports decision-making activities. DSSs can be data-driven, model-driven, or a combination of both.

Organizational Decision Support Systems: Organizational decision support systems (ODSS) is a special type of DSS that focuses on organizational tasks affecting several organizational functions.

6

Data Mining for Fraud Detection

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INTRODUCTION

The term fraud involves one or more people, they deliberately act secretly to take away some one valuable thing for their benefit. The statement fraud is as old as human being, it takes various forms. Because of expansion of modern technology, number and scenario of fraud are increasing dramatically. Reputation blemish and losses caused are primary motivations for technologies and methodologies for fraud detection. The Association of Certified Fraud Examiners (ACFE) estimates that 5% of revenue is lost to fraud and embezzlement every year. Applied to the U.S. GDP, this amounts to \$730 billion every year (<https://www.acfe.com/press-release.aspx?id=4294973129>).

Fraud detection is based on huge logged data sets, it involves: monitoring and tracking the behavior of users, constructing models and profiles of fraudulent behavior.

The problem is very difficult because fraudsters takes many different forms and they are adaptive, in order to avoid security measure.

Data mining refers to extracting knowledge from a mass of data, in order to acquire the rules that provide decision support and determine what action should be taken. Data mining techniques are usually applied to fraud detection, due to their great flexibility, adaptivity and speed.

The aim of this contribution is to describe data mining techniques for fraud detection, in order to achieve higher cost savings and legal evidence. Solutions and recommendations regarding automobile insurance, credit card, e-commerce, telecommunications and others are also discussed.

BACKGROUND

The Association of Certified Fraud Examiners ACFE defines fraud as: “The use of one’s occupation for personal enrichment through the deliberate misuse or misapplication of the employing organization’s resources or assets”. Therefore, a fraud is a criminal deception, use of false representations to obtain an unjust advantage, or to injure the rights and interests of another.

The main reason behind the commitment of fraud is to achieve gain on false ground by an illegal means. This has a dramatic impact on the economy, law and the human moral values.

There are different kinds of fraud: internal/occupational or external. Internal frauds happen when an employee commits fraud against his or her organization. External frauds involve a wide range of schemes, including vendors, customers or thefts by other third parties.

Frauds can be classified according to three areas:

- **Motive:** The main reason behind commit fraud;
- **Means:** The nature or form of the fraud involved to achieve the goal;
- **Methods:** The facilities and tools that are used to commit fraud.

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Diversity of fraud regards organizations, governments, and individuals such as external parties, internal employees, customers, service providers and suppliers.

Each fraud area has its specific characteristics and faces different challenges, therefore it is important to analyze the fraud scenario in order to establish:

- What is a fraudulent behavior and modus operandi over time;
- What is a fraudulent person;
- Degree of available knowledge about known fraud;
- Quantity and type of available data.

Planning audit strategies is a posteriori fraud detection problem with prevention purpose of analyzing historical audit data and constructing models of planning effectively future audits. A case study is presented by Bonchi (1999) which illustrates how techniques based on classification can be used to support the task of planning audit strategies.

Implementing the right technology is the key factor in order to analyze and to prevent fraud. Fraud prevention and detection are the proper protection mechanism against fraud, but fraud prevention alone is not sufficient, fraud detection is required to protect vital services in business systems. Some of the major benefits of investing in fraud detection software include:

- Detecting and preventing loss;
- Tracking of vulnerable points in a system that can leave it open to fraudsters, such as lack of data on behavior of users;
- Efficiently safeguarding organizational, security, operational and financial data;
- Providing a sense of reliability in an organization that has succeeded in avoiding catastrophes in an environment, where fraud attacks can be expected due to risk factors and complexity.

Applying data mining to fraud detection is suitable to search for patterns indicative of fraud, as stated in next paragraphs of this chapter.

A common obstacle for predictive fraud detection models is the rare occurrence of the target event. The proportion of identified fraud cases in the model input data is usually very small, making it difficult to extract the fraud signal in the data.

It is difficult to provide estimates since some fraud may never be detected, and the operators are reluctant to reveal fraud losses, due to show an appearance of reliability and security in business operations, to avoid reputation blemish.

It is necessary to take into account cost of fraud detection and cost of fraudulent behavior, because stopping a fraud of few dollars can require a very expensive system. This is possible by introducing a decision layer on top level system, in order to decide the action taking into account factors, like the amount of transaction and the risk associated to user doing the transaction.

The development of new detections methods is more difficult, due to the severe limitation on privacy and on exchange of ideas due to confidentiality reasons. Moreover, data sets are not available and results are often not disclosed.

DATA MINING

Data mining is about finding insights which are statistically reliable, unknown previously, and actionable from data (Elkan, 2001). This kind of approach must be well-defined, cannot be solved by query and reporting tools, and guided by a data mining process model.

In particular contest of fraud detection, data mining analyzes the huge volumes of transactions and billing data and seeks out patterns, trends and clusters that reveal fraud.

Relevant technical problems are due to:

1. Imperfect data not collected for purpose of data mining, so they are inaccurate, incomplete, and irrelevant data attributes;
2. Highly skewed data, there are many more legitimate than fraudulent examples, so by predicting all examples to be non-fraud a very high success rate is achieved without detecting any fraud;
3. Higher chances of over fitting, that occurs when model high accuracy arises from fitting patterns in the training set that are not statistically reliable and not available in the score set.

The main steps for implementing fraud detection based on data mining regarding business organization are:

1. Analyze the fraud objectives and the potential fraudsters, in order to converting them into data mining Objectives;
2. Data collection plan, to collect clean data and maximize anti fraud impact;
3. Data cleaning and normalization;
4. Build a data mining model;
5. Use the model on data set to discover data relationships;
6. Segment data and drill down on the differences between actual and projected charges;
7. Pinpoint records that have a higher chance of being fraudulent;
8. Evaluation results in order to review the process;
9. Insert the model into the business data stream, in order to examine only the records that meet this selection Criterion;
10. Compare your subset to the entire data population, to examine the frequencies with which fraud appears.

Data mining approaches differ in the classes of problems they can solve, as follows.

- Classification builds up and utilizes a model to predict the categorical labels of unknown objects to distinguish between objects of different classes. These categorical labels are predefined, discrete and unordered. Examples: Neural Networks, CART, logistic regression.
- Clustering (also known as data segmentation or partitioning) is used to divide objects into conceptually meaningful groups (clusters), with the objects in a group being similar to one another but very dissimilar to the objects in other groups. Examples: Neural Networks, K-means, Kohonen, Factor analysis.
- Prediction estimates numeric and ordered future values based on the patterns of a data set. Examples: time series analysis.

- Outlier detection is employed to measure the distance between data objects to detect those objects that are grossly different from or inconsistent with the remaining data set.
- Regression is a statistical methodology used to reveal the relationship between one or more independent variables and a dependent variable. Examples: Neural Networks, CART, Regression, generalized linear model.
- Visualization refers to the easily understandable presentation of data and to methodology that converts complicated data characteristics into clear patterns, to allow users to view the complex patterns or relationships uncovered in the data. Example: bar charts, 3d charts, parallel coordinates.

In particular, typical detection approach consists in outlier detection where the non-fraudulent behavior is assumed as normal and identify outliers that fall far outside the expected range should be evaluated more closely. Many algorithms use concepts of proximity in order to find outliers based on their relationship to the rest of the data. However, most applications can contain hundreds of data dimensions, the data is sparse and the proximity becomes substantially more complex. creating the lack of all likely patterns needed to train suitable data mining models. This problem accentuates when the fraudulent patterns are not only scarce, they also change over time. Change in fraudulent pattern is because fraudsters continue to innovate novel ways to circumvent measures put in place to prevent fraud. Limited data and continuously changing patterns make learning significantly difficult. The work of (Porwal and Mukund, 2019) hypothesizes that good behavior does not change with time and data points representing good behavior have consistent spatial signature under different groupings. Based on this hypothesis, this paper proposes an approach that detects outliers in large data sets by assigning a consistency score to each data point using an ensemble of clustering methods, the main contribution is proposing a novel method that can detect outliers in large datasets and is robust to changing patterns.

Many fraud detection systems operate in this way: supervised approaches on labelled data, hybrid approaches on labelled data, semi-supervised approaches with legal (non-fraud) data, unsupervised approaches with unlabelled data (Phua, 2010).

In case of pattern recognition problem requiring great flexibility, adaptivity and speed, neural networks are suitable because they are inspired by the biological neural networks that constitute animal brains, might prove even more effective in rooting out e-commerce fraud (Weatherford, 2002). Unsupervised neural networks can mainly be used because they act on unlabelled data, in order to extract an efficient internal representation of the data distribution structure.

Fraudsters often involve a group of people who work together. To uncover these groups, organizations need to be able to extend the analysis beyond single accounts. Techniques like link analysis, association analysis, and path analysis can help to uncover relationships that point to suspicious behavior.

The relational approach (Kovalerchuk, 2000) is useful for discovering financial fraud, because overcome difficulties of traditional data mining in discovering patterns having only few relevant events in irrelevant data and insufficient statistics of relevant data.

Three classification algorithms and one hybrid meta-learning was introduced by Phua (2004), to process the sampled data partitions, combined with straightforward cost model to evaluate the classifiers, so the best mix of classifiers can be picked.

One relevant obstacle for using neural network techniques is the high diagnostic quality: since only one financial transaction in a thousand is invalid no prediction success less than 99.9% is acceptable (Jayasingh and Swain, 2011). Other disadvantages include greater computational burden, proneness to overfitting, the empirical nature of model development and black box nature, in the sense that while it

can approximate any function, studying its structure won't give you any insights on the structure of the function being approximated.

Visualization techniques are based on the human capacity in pattern recognition, in order to detect anomalies and are provided with real-time data. A machine-based detection method is static, the human visual system is dynamic and can easily adapt to the typical ever-changing techniques of the fraudsters. Visual data mining is a data mining approach that combine human detection and statistical analysis for greater computational capacity, is developed by building a user interface to manipulate the visual representation of data in fraud analysis.

Key fraud indicators (KFI) regard performance metrics like detection rate, false alarm rate, average time to detection after fraud starts, average number of fraud or minutes until detection. As first step, it is important to define a specific metric considering that misclassification costs can differ in each data set and can change over time. The false alarm rate is the percentage of legitimate that are incorrectly identified as fraudulent; fraud catching rate (or true positive rate or detection accuracy rate) is the percentage of transactions that are correctly identified as fraudulent; false negative rate is the percentage of transactions that are incorrectly identified as legitimate. The purpose of this kind of detection is to maximize correct fraud predictions and maintain incorrect predictions at an acceptable level. A realistic objective consists on balance of the performance criteria. A false negative error is usually costlier than a false positive error. Other important considerations regards: how fast the frauds can be detected and average time of detection, how many kind of fraud detected, on-line or off-line detection mode. A KFI is not only a financial indicator, and it might have no connection with finance. The way you set up a KFI is very different from the usual methods to set up a KPI (Key Performance Indicator, a measurable value that demonstrates how effectively a company is achieving key business objectives), because your needs are more complex and challenging.

CASE STUDY

Almost all technological system that involves money and services can be compromised by fraudulent acts. The works of Bolton (2002), Kou (2004), Ngai et al (2011), Abdallah (2016), Wells (2004) discuss a survey of different techniques and more details to detect frauds in some relevant applications. A taxonomy that combines research on patterns of observed fraud schemes with an appreciation of areas that benefit from data mining is discussed in Gray (2014).

The work of Lin (2015) discusses whether or not the suggestion of the experts agrees with the results obtained from adopting data mining techniques, this study uses both expert questionnaires and data mining techniques to sort out the different fraud factors and then rank the importance of them.

Automobile Insurance fraud

Insurance companies suffer due to dishonest insured claims, in many different types and sizes. Staged vehicle and rental car are the most prevalent fraudulent behavior. Real time support for detection challenge does not exist in this kind of fraud. Only a small portion of accidents participate in fraudulent cases, making them difficult to detect.

The work of Šubelj et al. (2011) discusses an expert system for detecting fraud using social network analysis for finding organized fraud groups. The system uses networks for representation of data, domain,

allowing formulation and analysis of complex relations between entities. Fraudulent entities are found by employing an assessment algorithm named Iterative Assessment Algorithm.

Visual analysis of insurance claims by the user helped discover the fraudster. NetMap (2004) is used to form groups of tightly connected data and to the capture of an actual elusive fraudster by visually analysing twelve months' worth of insurance claims.

Credit Card Fraud

As a result of the growing usage of credit card, fraudsters try to find more opportunities to commit frauds that can cause huge losses to card holders and banks. This kind of fraud takes many forms and categories (Laleh, 2009; Delamaire et al., 2009).

There are two class: a stolen credit card number is used for making a purchase that appears on account statement, the cardholders used a legitimate credit card but deliberately denies the transaction upon receiving the service because a dishonest merchant use the card without permission from the cardholders (Leung, 2004).

Offline fraud is committed by using a stolen physical card and the institution issuing the card can lock it before it is used in a fraud. Online fraud is committed via web or phone shopping because only credit card details are needed, a manual signature and card imprint are not required.

The work of Dorronsoro (1997) describes two characteristics: a very limited time span for decisions and huge amount of credit card operations to be processed that continue to grow in number.

Scalable techniques to analyse massive amounts of transaction data that efficiently compute fraud detectors in a timely manner is an important problem, especially for e-commerce (Chan, 1999).

Example of behavior feature: value and kind of purchases in a specific time, number of charges made from specific postal codes. Behavior analysis can also help uncover suspicious behaviors, such as a small gasoline purchase followed by an expensive purchase may indicate that someone was verifying that a charge card still worked before going after serious money. Departures from these norms may indicate fraud, especially in case of two or three such instances ought to attract investigation.

Machine learning techniques such as back-propagation neural networks and Bayesian networks are compared for reasoning under uncertainty (Maes, 2002) showing that Bayesian networks are more accurate and much faster to train but they are slower when applied to new instances.

E-payment systems with internal logics that are capable of detecting fraud transaction are more powerful when combined with standard network security schemes, so there is a well user acceptance of credit card as payment solution. The work of Leung (2004) issues on add-on module for detection in e-payment system, based on atomic transactions implemented in e-wallet accounts.

The strategy of detection by pattern recognition of user spending behavior is described in Chandola et al. (2009). The most frequently methods are the classification method, in specific neural networks techniques under supervised learning manner.

The work of (Pumsirirat, 2018) discusses a model of deep Auto-encoder and restricted Boltzmann machine (RBM) that can reconstruct normal transactions to find anomalies from normal patterns, an approach based on deep learning using Tensorflow library from Google.

Telecommunications Fraud

The fraud in telecommunications, as any transmission of voice or data across a communications network, regards the intent of fraudster to avoid or reduce legitimate call charges, so obtaining unbillable services,

acquire free access, reselling the services. Significant loss is in wireless and international calls, because they are most expensive, so when fraud is committed the costs mount quickly. In 2015 a telecom fraud association study estimated that the loss of revenue due to global telecom fraud was worth 38 billion US dollars per year (Sahin et al, 2017).

In this kind of application there are specific problems: callers are dissimilar, so calls that look like fraud for one account look like expected behavior for another, while all needles look the same. Sometime fraudsters create a new account without having the intention to pay for the used services. Moreover, fraud has to be found repeatedly, as fast as fraud calls are placed.

The work of Gossett and Hyland (1999) provides a classification of telecommunication systems fraud and grouped fraud into four categories:

- contractual fraud: using a service with no intention to pay;
- hacking fraud: breaching the systems of business and take advantage of available resources illegally;
- technical fraud: capitalizing on weaknesses exist in system technology;
- procedural fraud: attacks against the procedures implemented to reduce the risk of exposure to fraud, often attack the weaknesses in the business procedures.

The taxonomy proposed by Sahin (2017) differentiates the root causes, the vulnerabilities, the exploitation techniques, the fraud types and finally the way fraud benefits fraudsters. This work uses Caller NAME revenue share fraud as a concrete example to illustrate how taxonomy helps in better understanding this fraud and to mitigate it.

Due to legislation on privacy, the intentions of the mobile phone subscribers cannot be observed, but it is assumed that the intentions are reflected in the calling behavior and thus in the observed call data. The call data is subsequently used in describing behavioral patterns of users. Unfortunately, there is no specific sequence of communications that would be fraudulent with absolute certainty, because the same sequence of calls could as well be fraudulent or normal. Therefore, uncertainty in creating the model is needed. The calling activity of each mobile phone subscribers is recorded for billing in call records, which store attributes of calls like the identity of the subscriber, the number to call, time of the call, duration of the call, etc. Call data (or events input) are ordered in time, so it is possible to describe the daily usage formed by number and summed length of calls, and it is possible to separate them in sub-categories.

A common approach is to reduce the call records for an account to several statistics that are computed each period. For example, average call duration, longest call duration, and numbers of calls to specific countries might be computed over the past hour, several hours, day, or several days. Account summaries can be compared to thresholds each period, and an account whose summary exceeds a threshold can be queued to be analysed for fraud. The summaries that are monitored for fraud may be defined by subject matter experts,

It is possible to improve the threshold (Fawcett, 1996) using an innovative method for choosing account-specific thresholds rather than universal thresholds that apply to all accounts. This approach detection has several disadvantages: thresholds may need to vary with time of day, type of account, and type of call to be sensitive to fraud without setting off too many false alarms for legitimate traffic, so it is necessary periodically to review the setting by an expert to accommodate changing traffic patterns. Moreover, accounts with high calling rates or unusual, but legitimate, calling patterns may setting off more false alarms. These problems lead to expensive multiplying the number of thresholds.

An efficient solution must be tailored to each account's own activity, based on historic memory of the use, and must be able to learn the pattern on an account and adapt to legitimate changes in user behavior. It is possible to define the user signature, in order to track legitimate behavior for an user, based on variables and values described by a multivariate probability distribution. The disadvantage consists in estimating the full multivariate distribution.

Cahill (2002) describes an approach based on tracking calling behavior on an account over time and scoring calls according to the extent that they deviate from that pattern and resemble fraud; signatures avoid the discontinuities inherent in most threshold-based systems that ignore calls earlier than the current time period.

The cloning fraud is a superimposition fraud upon the legitimate usage of an account. The work of Fawcett (1997) describes a framework for automatically generating detectors for this cellular fraud, that is based on analysis of massive amounts of call data to determine patterns for a set of monitors watching behavior with respect to one discovered pattern. A monitor profiles each customer behavior and measures the extent to which current behavior is abnormal with respect to the monitor particular pattern. Each monitor output is provided to a neural network, which weights the values and issues an alarm when the combined evidence for fraud is strong enough.

The work of Ferreira et al. (2006) describes the problem of superimposed fraud, that is the fraudsters make an illegitimate use of a legitimate account and some abnormal usage is blurred into the characteristic usage of the account. The approach is based on signature that corresponds to a set of information, or vector of feature variables, that captures the typical behavior of legitimate user during a certain period of time. In case of an user deviates from typical signature a statistical distance is evaluated to detect anomalies and to send an alarm.

Concerning visualization methods, it is possible to create a graphical representation of quantities of calls between different subscribers in various geographical locations, in order to detect international calling fraud (Cox et al., 1997). As example, in a simple representation the nodes correspond to the subscribers and the lines from the nodes to the countries encode the total number of calls, so investigations on the brightly colored nodes revealed that some of them were involved in fraud. In this way it is possible to show a complete set of information and several tools on a dashboard to facilitate the evaluation process.

E-Commerce

As e-commerce develops rapidly, online auction is also becoming more popular, therefore several detection schemes are used (Aleem and Antwi-Boasiako, 2011)

In online auction, instantaneous support and detection is extremely important, so automatic procedure consists of two steps (Chang and Chang, 2014):

1. Construct features which extract user profiles and transaction histories of suspended accounts in order to discriminate between legitimate trader and fraudster;
2. Build a detection model based on these constructed features.
3. The work of Chiu et al. (2011) describes a feasible method to detect fraudulent accounts using social network analytical metrics and data mining approaches.

Adaptive Neuro-Fuzzy Inference System, which is a hybrid of neural networks along with fuzzy inference, can adapt to newer instances of fraudulent transactions (Shaji and Panchal, 2017).

The work of (Carta et al, 2019) proposes a novel data intelligence technique based on a Prudential Multiple Consensus model which combines the effectiveness of several state-of-the-art classification algorithms by adopting a twofold criterion, probabilistic and majority based, the goal is to maximize the effectiveness of the model in detecting fraudulent transactions regardless the presence of any data imbalance.

Other Case Studies

Bayesian networks can uncover simulated anthrax attacks from real emergency department data (Wong et al 2003).

The work of Cabral et al. (2009) presents two computational system for fraud detection for voltage electrical energy consumers, based on Self-Organizing Maps and a hybrid of data mining techniques, so electrical energy companies will better direct its inspections to avoid commercial losses.

Click fraud regards the deliberate clicking on advertisements (ads fraud) with no real interest on the product or service offered, it is one of the most daunting problems in online advertising. The book of Zhu et al. (2017) systematically review methods and techniques to prevent and defeat such fraud. The authors categorize such fraud into three categories: placement, traffic, action.

FUTURE RESEARCH DIRECTIONS

The available statistical models are unable to detect new types of fraud as they occur, because they must be aware of fraud methods such making a prevention effort, based on amounts of historical data, that can be implemented before the fraud occurred producing. Unfortunately, preventing fraud is an evolving and dynamic process and fraudsters create new schemes daily, thus making not suitable this static solution.

Future research is based on dynamic, self-correcting and self-adaptation in order to maintain continuous accuracy and adapt to identify and predict new scenarios to detect fraudulent activities as they occur. Relevant challenges consist on information silos, disparate systems and departmental processes that create information leakages.

Moreover, a useful feature is due to detailed results including the reason for suspicion of fraud, so the user can establish the priority of the suspicious transaction and its remedy.

CONCLUSION

Fraud cases have increased in recent years, particularly in business areas. The forms and styles of fraud are changing regularly. Thus, one big challenge regards coming up with algorithms that can learn to recognize a great variety of fraud scenarios, quickly enough to detect fraudulent activities as they occur.

The suggested strategy based on data mining consists in monitoring the behavior of users and analysis of contextual information, in case of this approach is applied on a specific problem with a-priori analysis of the problem domain and a specific choice of performance metric.

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KEY TERMS AND DEFINITIONS

ACFE: World's largest anti-fraud organization and premier provider of anti-fraud training education and certification, web site <http://www.acfe.com>.

Data Mining: Finding insights which are statistically reliable, unknown previously, and actionable from data.

Financial Statement Audit: The examination of an entity's financial statements and accompanying disclosures by an independent auditor.

Fraud: A fraud is a criminal deception, use of false representations to obtain an unjust advantage, or to injure the rights and interests of another.

Fraud Detection: An automatic system based on description of user behavior and fraud scenario, in order to detect a fraudulent activity as soon as possible to reduce loss.

Fraudster: A person who commits fraud, especially in business dealings.

Art Innovative Systems for Value Tagging

6

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INTRODUCTION

Consumers entering the art market are faced with an environment that gives them a vast number of options, but a limited amount of useful knowledge. While data on the current market are widely available, the necessary context to understand this ecosystem is much harder to effectively obtain. How can consumers know what artworks are good purchases without hiring an external consultant or conducting extensive research on their own? How can artists set the ideal price for their work, when this price is driven by numerous outside factors?

Today, artwork evaluations are conducted by human experts. Collectors with high budgets may hire highly priced art consultants and dealers to select artworks for them. For other buyers and sellers some online services exist, and they tend to rely heavily on extensive datasets of past sales. With these services, either the artists themselves or hired experts find comparable works and use these to determine a market price. These comparables are similar works that have already been sold and can be used to provide a basis for pricing. However, using these services can be time-consuming and expensive.

The art market is a unique problem area for modeling prices. Artworks are unique and their prices are driven by aesthetic and emotional considerations, as well as simple financial ones. Artworks seldom follow traditional economic models and need to be considered differently (Beckert, 2013; Velthuis, 2005). An artist seeking information on pricing his/her own artworks is faced with a challenging task. Gallerists sometimes recommend prices based on their own personal market experiences or on their professional contacts. Sometimes, these judgements are highly subjective and are based on emotional considerations about what price the work should be to fit with the narrative that the price is conveying to a buyer (Velthuis, 2005).

The nature of the art market has changed significantly since the 1940s becoming an “unpredictable financial roller coaster” (Shnayerson, 2019). Artists or art galleries have become brands, where buyers use the brands as a guarantee for quality (Pendergast, 2014). That creates a situation which restricts the number of participants on the top level as well as conditions where the phenomenon of promotion plays a crucial role in the artist’s success. In the reality of the 21st century art market, there are no longer artists who try to hide themselves from the social aspect of their artistic careers. The numerous artist accounts on Instagram and Facebook are clear examples of this statement. Artists, art galleries, and art dealers provide significant information to the Internet to increase an artist’s popularity. Active and established artists have personal websites and Wikipedia pages. If an artist does not have a Wikipedia page with many references, he/she is not considered an established artist. Galleries often create the promotion for

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emerging artists. It is almost impossible for an established artist today to not have a considerable amount of information on the Internet. Emerging artists often try to follow the same strategy to provide as much as possible about their art and themselves.

The complexity of the market is exacerbated by the role of “superstars” (McAndrew, 2017). Consumers looking to reduce the amount of work that they must do to find a quality piece of art look for artists with well-known names and established reputations. This concentrates sales in a very small subset of artists and raises their prices accordingly.

An artist may experiment with using the Internet as a resource to help him/her determine a price for his/her artwork. However, while the amount of information available is vast, sifting through that information to find a comparable work is much more of a challenge. This can create problems for artists, who may overprice their work and lose sales, or underprice their work and diminish their market potential. Artists must take care to ensure that their prices are appropriate to the current stage of their career, so that they can fit into their role in the current market (Velthuis, 2005). Being perceived as too concerned with making money on artworks can be a significant hindrance to an artist’s career (Velthuis, 2005). In contrast, pricing too low can make an artist’s work less appealing from an investment perspective.

Past research on combining fine art with modern computing technology has been limited. Several works have addressed problems such as identifying the style, artist, or artistic period of a work based on its visual characteristics. Other works have used consumer data to identify which artworks a given user will interact with or purchase (He, Fang, Wang, & McAuley, 2016; Messina, Dominguez, Parra, Tratter, & Soto, 2018). However, integrating artworks into the broader context of the art market itself has been largely neglected by researchers.

This article will discuss the problem area of the art market, review a selection of past works that address developing recommender systems for artwork, and propose a design for a recommender system that will provide prices for a given artwork. The system is called ArtIST, which stands for Art Innovative Systems in Value Tagging.

BACKGROUND

The global art market plays a significant role in the international economy. The global art market was valued at 63.7 billion USD in 2017 (Freeman, 2018). Online sales are becoming increasingly significant, with over 29% of today’s gallery sales being made online (ArtTactic, 2018). Additionally, galleries are closing at a significant rate; more art galleries closed their doors in 2018 than opened them (Freeman, 2018). In the online market, consumers, especially newer consumers, are uncertain about making large purchases, due to their concerns about price instability (ArtTactic, 2018). The role of artworks as a means of investment must also be considered. Contemporary and Post-War Art were found in 2018 to have gains since 2000 on a par with the S&P 500 (Artprice.com, 2018).

The concept of automatic classification of artworks has received a large amount of attention in recent years. Identifying specific artists or artistic periods by developing features is a notable trend that has been addressed in several works (Falomir, Museros, Sanz, & Gonzalez-Abril, 2018; Gultepe, Edward. Conturo, & Makrehchi, 2018). Other researchers are exploring the idea of tagging based on other types of features, such as retrieving photographs according to their emotional content (Machajdik & Hanbury, 2010). Still, further work has been done on developing systems that allow images to be retrieved based on specific artistic concepts (Yelizaveta, Chua Tat-Seng, & Irina, 2005).

Artworks are unique in their role in the marketplace. They are not only valued as financial instruments, although they are comparable to more traditional instruments for investment in returns (Artprice.com, 2018), but for their aesthetic and cultural value. Over 40% of the collectors who were surveyed could not value their art collections (Freeman, 2018). Collectors make purchases for different reasons and behave differently when they are faced with market forces pushing them to buy or sell (Lovo & Spaenjers, 2018). This creates problems for consumers who want to understand the value of their purchases. Simple metrics, such as price lists, do not provide the context which is needed for consumers to understand the reasoning behind prices (Coslor, 2016). This creates tension between art buyers, who are armed with context-free price lists, and dealers, who are more accustomed to the nuances of the marketplace.

While developing recommender systems for prices has not received significant attention, several past authors explored the challenge of recommending works of art to users. In Messina et al.'s (2018) study, the authors use a dataset of past purchases to recommend artworks to a user that he/she is likely to purchase. These authors used features they derived from the manually provided artwork tags and the visual attributes of the work. Predicting which artworks a user would interact with on an artwork sharing site was a research question in He et al.'s study (2016). These researchers integrated the social relationships between artists as well as visual and temporal features into their model (He et al., 2016). Other works in the area of automated artwork recommendation include Saleh and Elgammal's (2015) study, in which the researchers attempted to classify works of art based on style and genre and predict the artist. They used this to recommend artworks such as a past work which was selected to a user.

Pawlowski (2019) developed a recommender system that could predict prices for works of contemporary art. The author trained the model on a sample of 20,543 popular paintings and used a set of features to derive recommendations. The researcher constructed the dataset by scraping an art sales site, and, by extracting features from the artist, provided text and the uploaded images. This project used features such as the area of the work, the artist's highest degree, the number of exhibitions the artist held, the number of comments, the brightness of the image, the blurriness of the image, and the dominant color of the work. In this work, the researcher concluded that the features that indicate the amount of time an artist spends on the art, such as its size, the popularity of the work and the artist's reputation are the most crucial toward determining the price.

FOCUS OF THE ARTICLE

This section proposes a design for the ArtIST system, which will utilize the same information that would be sent to a price consulting company to predict the price using big data analytics. The system has several main components. This section will explain the different components of the system and the rationale for their use. This section will also address the dataset that has been constructed to be used in the system as well as the features for it. Some features have already been developed, and they will be discussed here, as will other features that are currently being designed and tested. This provides an overview, but Powell, Gelich and Ras's (2019) research provides more details on the dataset and the features discussed in this work.

Overview of the ArtIST System

While artwork classification and recommendation have received some attention, the role of price prediction is largely handled by human experts. MutualArt ("MutualArt," 2019) has an extensive database

of past sales which its experts use to appraise new works. Another price advising tool can be found on FindArtInfo ("FindArtInfo," 2019). They also have an extensive dataset. Artists can use this to find other works like their own to use as a basis for their prices. Suggestions for how to price artworks can be found on a number of Web sites. An alternative method is that artists can also submit their works to professional appraisers. These can charge several hundred dollars for a consultation, which may place them out of reach for an artist early in his/her career. The challenge of pricing work is significant for artists without proven sales records.

ArtIST is a knowledge-based recommender system. Knowledge-based systems, in contrast to other types of recommender systems, are especially useful when they are applied to areas with high value items that have many characteristics and are purchased infrequently (Aggarwal, 2016). Consumers making artwork purchases have many different factors to weigh and may have very explicit requirements. The use of domain knowledge makes knowledge-based recommender systems a good fit for this application area.

The authors used Web scraping to extract the primary dataset for the ArtIST system. There are many Web sites that allow artists to post their work. They selected Artfinder.com to construct the current iteration of the ArtIST system (Artfinder, 2019). This site was a good fit for this project, due to the broad variety of mediums and styles which were showcased, as well as the large number of artists and nationalities that were represented. At the time of the writing of this article, the dataset has approximately 197,000 artworks, from over 2,700 artists in over 70 countries. The prices range from less than 20 USD to a million USD. However, it is notable that works most of the works are valued by their creators at less than 1000 USD. Most of the works that are bought and sold online are valued at less than 1,500 USD (Fischer, 2015). The works discussed here are targeted more toward casual art consumers rather than the higher end art collectors.

The system is built to recommend prices for specific platforms based on other artworks on that sales platform. The current system uses Artfinder.com, however, by expanding the dataset recommendations could be developed for other sales platforms. Different art websites and galleries may sell the same work for different prices. The results are personalized to the sales website or marketplace which the user is considering.

ArtIST Features

This dataset consists of a number of features that can be directly used for prediction or developed into other features. All artists on Artfinder have an about page where they may provide biographical information. Information can consist in, for example, the number of works that are currently posted on Artfinder and the artist's current country. It may also include details about their education, awards, and events that they have held. An artist's reputation is a key part of making a consumer feel comfortable in their purchase (Beckert, 2013). On their artist pages, artists also often provide links to their social media accounts. Social media are very widely used, with approximately 86% having Facebook accounts, 41% with Twitter accounts, and 56% with Instagram accounts. Instagram is very popular in the art world and among art buyers under 35 more than 75% of those surveyed use it to discover and keep up with artists (ArtTactic, 2018). Whether an artist had a social media presence listed was tested as a predictive feature. However, it had little value, possibly due to the high usage.

Additionally, a number of artists on Artfinder have reviews of their work listed by their past customers. However, these reviews are not particularly effective as a feature. Artists acquire reviews over the course of their time on the site. Approximately 50% of artists who are represented in the dataset do not have any reviews. Few artists have negative reviews, making the star ratings of an artist of limited value

as price predictive features. It is possible that, by utilizing sentiment analysis or other text processing tools, useful features could be extracted from the reviews.

An artwork also has multiple pieces of information provided on its page. All works have at least one image as well as a title. Many works provide short textual descriptions of the artwork. Additionally, artists tag their works to make them easier to find in the search engine. Works can be tagged with styles, mediums, subjects, as well as sizes. The artwork pricing model was developed using this same set of features.

How artists present themselves to their customer base can be used as a price predicting feature. This is explained by the important role that an artist's reputation plays in assuring consumers that his/her works have value. This work will discuss some of the features that have been developed for ArtIST below.

When testing features for the ArtIST system, the authors used a subset of 150,000 records to construct models. They used Orange (Demšar, 2013) for the testing. First, a model is built using the base set of features. The model chosen is random forest, and 100 trees are used. Then, a model is created using the new feature as an extension to the base set of features. The two models are then tested using 10-fold cross validation and their accuracy is compared. Often, multiple new features are tested together as extensions to the base dataset, so that their overall impact on the accuracy of the classifier can be assessed.

The base set of features that is used for these comparisons includes: The artist's unique username, which may or may not be their legal name; the medium of the artwork, which is tagged by the artist for the search engine of Web site; the style of said artwork, which is similarly tagged; the subject of that artwork, which is also tagged by the artist; the number of reviews that artist has, the percentage of five, four, three, two, and one star reviews that the artist has earned; the width of the artwork in inches; the height of the artwork in inches; the artist's current county; the artist's method of authenticating the work, which is whether or not the work is signed.

Table 1 shows a confusion matrix of a random forest model with 100 trees trained 150,000 records using only the base feature set. All prices are in USD and each price level is represented by a letter: A = (0 - 105), B = (105 - 205), C = (205 - 405), D = (405 - 605), E = (605 - 810), F = (810 - 1030), G = (1030 - 1445), H = (1445 - 1825), I = (1825 - 2455), J = (2455 - 3855), K = (3855 - 5000), L = (5000

Table 1. Confusion matrix with base features

	A	B	C	D	E	F	G	H	I	J	K	L	M
A	28898	4032	696	50	13	4	4	3	1	3	1	0	2
B	4697	21293	4167	382	63	24	16	5	2	5	0	0	0
C	934	4120	22109	2883	395	203	118	34	19	19	2	2	4
D	182	594	4151	10236	1409	472	245	55	45	33	7	4	3
E	74	171	1099	2161	4041	982	391	89	55	73	9	6	2
F	28	101	642	850	1044	3052	831	198	226	74	12	15	1
G	23	66	382	486	477	837	3144	542	244	160	23	26	0
H	19	37	164	235	149	252	670	1924	428	233	21	31	1
I	13	22	136	166	115	270	324	398	1915	466	45	41	3
J	11	21	105	144	70	91	197	193	443	1931	163	106	14
K	1	11	31	46	18	23	56	27	73	275	509	171	5
L	1	12	44	16	17	11	34	25	62	181	128	930	49
M	5	4	17	13	9	3	11	6	11	48	9	109	156

- 10000), and M = (10000 +). The number of works actual at the listed price is represented by the rows and the predictions by the columns.

For example, the word count of artwork descriptions, artwork titles, and artist biographies is one of the simplest features that has been tested for effectiveness in price classification in the system. When it is used as an extension to the dataset, the word counts have value as price predictive features. One possible reason for this is that a lengthier biography is representative of a more experienced, and therefore higher, priced artist. Interestingly, the highest priced works often had the shortest artwork descriptions. The lack of extensive descriptions may due to the very dominating nature of the artwork photograph.

The authors also used whether the artist had a Facebook, Twitter or Instagram page listed on their profile as a feature. These features were of limited value alone. However, when combined with other features they improved the accuracy of the classifier. The large percentage of artists that have social media links posted may be the reason that it is not particularly useful as a predictive feature alone.

The authors tested the overall sentiment of the biography, artwork title and artwork description using VADER (Hutto & Gilbert, 2015). The text was largely neutral. The authors detected very little negativity in any of the analyzed text. However, the presence of positive sentiment had a place as a feature that could predict the price of a work.

Paragraph Vector, which was developed by Le and Mikolov (2014), was used by the authors to cluster biographies, education paragraphs, award information, and past events, as well as the artwork descriptions and titles. This was meant to place artists that had similar written content together. Ideally, artists with similar biographical information would have been placed in the same cluster. This clustering method was tested on a sample of the dataset with 150,000 records. The clustering of the biography, awards, education, or events section had a positive impact on the accuracy of the resulting classifier.

These features had some success in predicting the prices for works of art. With the addition of these features, the prices of artworks could be predicted with a precision of 0.685 and a recall of 0.69. However, more features will be needed, in order to develop a predictive system. New features must be constructed to fully take advantage of the value that the biography of an artist has in understanding his/her reputation.

Table 2. Confusion Matrix with word counts, social media, sentiment and text clustering features

	A	B	C	D	E	F	G	H	I	J	K	L	M
A	29617	3485	568	26	8	1	0	0	0	2	0	0	0
B	4209	22221	3962	212	28	8	10	2	1	1	0	0	0
C	919	3832	23335	2289	239	120	71	16	9	11	1	0	0
D	188	577	4602	10216	1228	340	198	34	30	19	1	3	0
E	73	150	1283	2222	4112	838	325	65	40	34	7	4	0
F	38	89	671	908	1025	3212	851	151	66	54	3	6	0
G	29	61	461	555	448	786	3237	496	195	114	7	19	2
H	21	22	222	243	155	228	716	1936	388	203	9	20	1
I	9	29	158	169	113	135	320	390	2042	471	32	43	3
J	5	22	139	96	88	92	196	164	437	1991	141	115	3
K	6	9	44	33	14	22	35	38	70	304	498	167	6
L	7	13	40	25	10	20	42	23	52	188	121	930	39
M	8	4	26	9	7	2	17	2	6	33	9	122	156

Table 2 is a confusion matrix that was developed using the experimental features discussed above as an extension to the base feature set.

The authors are developing features derived from the image of the artwork. These features include the percentage of edges in the work, the dominant colors of the work, and the lines and edges of the work. Developing visual features that can indicate the price is a very notable challenge.

Proposed Design of ArtIST

The current design for the system is two-tiered. It relies on the idea that artists who are at different places in their careers and with different styles will naturally price their work differently and be attractive to different buyers.

When a new artist is added to the system, he/she will be placed in one of the several clusters. These clusters will hold artists that are at similar career stages and ideally have similar methods of pricing their work. An artist will be placed based on the features of his/her career information as well as information about the types of work that he/she produces.

For example, an artist who is at a late stage in his/her career and primarily creates large watercolor landscapes which are sold for high prices should not be in the same cluster with an artist that is just beginning his/her career and primarily creates small, inexpensive, acrylic, and abstract works.

The features that will be used for this clustering will include features such as the artist's education level, information about his/her current country, his/her social media presence, and information extracted from his/her biography. Attributes of an artist's background, such as whether they attended art school or how many events, they have participated in may be used as a measure of an artist's career.

The ArtIST system will use the artists' collected works in a cluster to train a classifier. As this classifier was built for artists in that specific cluster, it will provide a level of personalization for the system. The classifier will use features specific to the work itself, such as the title, description, tags, and information derived from a photograph of the artwork.

This will help with addressing differences in prices that appear among works that are visually quite similar but were created by artists at vastly different stages of their careers. These features will be created based on the image, the textual description of the work, and its title and tags.

SOLUTIONS AND RECOMMENDATIONS

One of the most problematic aspects of developing this system is the task of clustering artists. Judging the state of an artist's career is a challenge even for an expert. The value of an artist's works can be influenced by factors such as what museums and notable collectors have acquired his/her work. The amount of deep domain knowledge which is needed to project the impact of thousands of different art education institutions, awards, art events, and collectors is truly staggering.

Developing a truly accurate means to find similar artists will require extensive collaboration with domain experts from different perspectives and backgrounds. Is it possible, for example, to place different art institutions into tiers of prestige? Does the style that the artist uses alter the impact on his/her reputation that participating in a particular show provides? Does time need to be a factor? If, for example, a museum suddenly dropped in quality, how that would impact the assessed value of the artists whose work it holds? In order to answer these types of questions, experts' advice is necessary.

One possible solution for this issue is developing a set of metrics, similar to the impact factor, which is used for the writing of academic papers, to assess the “impact” of representation in collections and at events. This allows for a more direct comparison between different classes of events. While those inside the art market can say that one art show is more influential than another, this information is largely hidden to the common art buyer.

Additionally, relevant features must be developed for classifying artworks. These must go beyond simple meta tags of subject and style but represent the work on a more complex level. While the mechanics of extracting low-level features, such as color, has been extensively researched, capturing the emotional resonance of a work of art is a challenge that must be addressed by computer scientists and artists together.

How can the aesthetic characteristics of a work be captured as features? One possible method of representing an artwork is to attempt to capture the emotional qualities of a work using visual features. For example, the psychological impact of color on emotion has been researched extensively but creating a direct link between a specific emotion and the percentage of the work that is painted a specific hue of orange with a specific level of saturation and particular value is not as directly linked to emotion. This also requires a link between specific emotions and the sales value of a work. Do specific emotions make a consumer more or less likely to want to make a purchase?

FUTURE RESEARCH DIRECTIONS

The integration of technology with both the artworks themselves and the broader context of the art market is an increasingly notable area of research. If current trends continue, online art sales will have an increasingly prominent role in the global art market. This will demand the development of tools that can make the experience of purchasing artworks online simpler and less uncertain for users.

Recommender systems in the context of artwork have received much less attention. With the considerable size of the investments that consumers make in their artworks, this creates an opportunity to be explored by later researchers.

For this research, the next phase will be the construction and testing of the ArtIST system. This will require the development and testing of more features for both stages. The clustering of artists must have new features added to make the clusters useful. Ideally, the clusters should be descriptive.

Additionally, features describing the artwork must be improved, so that a distinction can be drawn between artists within the same cluster, but with different values.

Finally, the addition of data from other sales platforms would allow models to be built that were customized for those platforms. While the accuracy of the models on Artfinder is high, the addition of data from a greater variety of sources would permit the development of a more personalized system.

CONCLUSION

It is not enough to merely consider a work of art in a vacuum. Artworks exist in a complex environment, and their prices reflect this fact. The reputation of their creating artist, the level of innovation of the work, its aesthetic power, and its investment potential influence one another to provide a price for a work of art.

This demands the development of a system that can integrate this domain knowledge to provide artists, buyers, and dealers with a means to navigate the complexity of the market. Simple lists of past sale

prices are not enough to allow artists and buyers for informed decisions. Artists must be able to price their works to best appeal to new skeptical online buyers.

The current environment provides human experts. However, these are often expensive, and may take days to come to a conclusion about the price for an artwork. Online lists of prices from past auctions do not provide sufficient context for an artist to make an educated decision about the price for his/her work. Prices in the art market are highly personal.

This work discusses one possible design for a knowledge-based recommender system that could address this issue. The system will not require large amounts of information about an artist but will utilize what an artist would provide to a comparable human based system. The use of biographical information, photographs of the work, and tags as features make the system accessible for an artist.

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KEY TERMS AND DEFINITIONS

Classifier: A model that can be used to place objects into discrete categories based on some set of features. Classifiers are trained on datasets.

Confusion Matrix: A table that represents the error rate of a classifier.

Contemporary Art Market: In the context of this work, the contemporary art market consists of artists, art dealers, art collectors or other buyers working in or near the present day.

Emerging Artist: An emerging artist is an artist that has had some professional development as an artist. However, they are not widely recognized and are not at the potential height of their career.

Established Artist: An established artist is an artist that has a solid reputation as an artist among art critics, art buyers, galleries, and other stakeholders in the art world. They generally can sustain themselves through their art and are represented by leading art galleries and art museums.

Feature: An attribute or characteristic of an object that can be used to develop a classifier.

Knowledge-Based System: A recommender system that uses knowledge of the application area to make suggestions to users. The recommendations use domain knowledge to offer recommendations that fulfill the constraints provided by the user.

Primary Art Market: Works of art that are being sold by either the original artist or a direct intermediary. This is in contrast to the secondary art market which consists of artworks that are being sold by collectors or other purchasers.

Recommender System: A system that aids in decision making by providing users with suggestions. These suggestions are developed based on past information or domain knowledge.

Section 7

Cyber and Network Security

Designing an Effective Information Security Policy for Public Organizations: ISO 27001 as a Success Framework

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INTRODUCTION

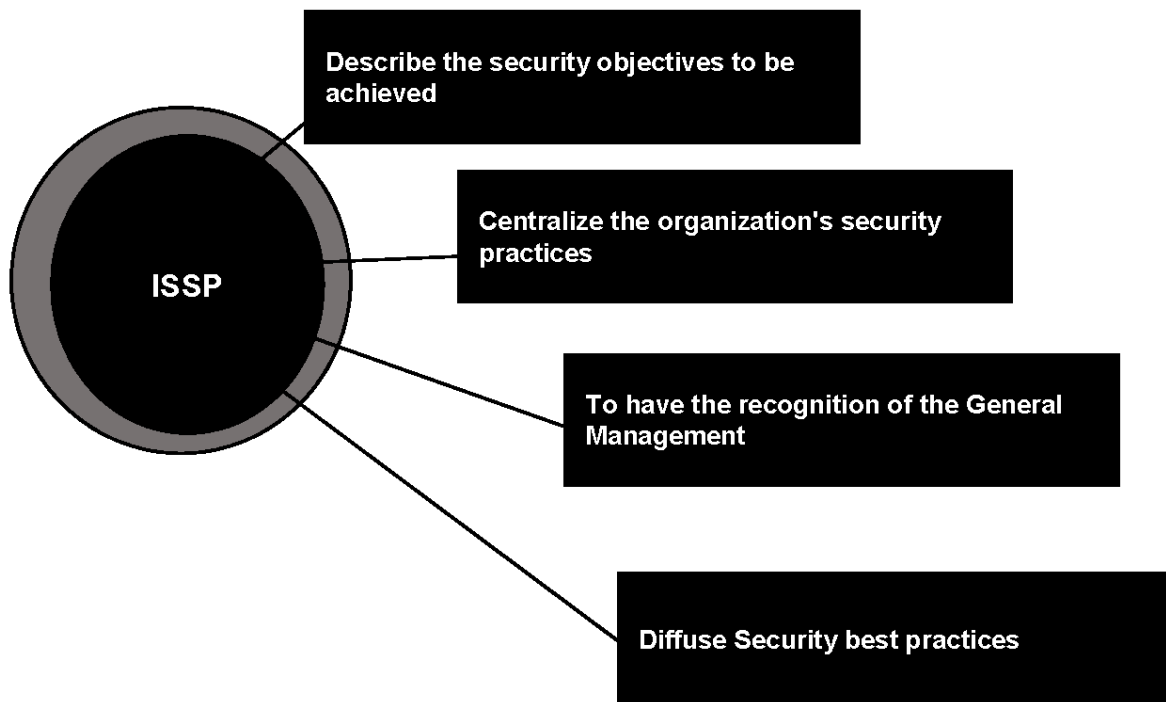
Information Systems (IS) are today an integral part of the functioning of public administrations and bodies, the activity of businesses and the way of life of citizens. The security of these information systems has become a major issue for all public or private sectors, which would be very strongly affected in the event of serious malfunctions (T. R Peltier, 2016).

Information security policy is the general term used to describe any document that transmits an element of the security program in order to ensure compliance with the organization's security goals and objectives. Since this definition covers a wide range of security policy documents, it is useful to describe the various types of information security policies that an organization may use. The terms used below to describe these types of information security policies are generally used in the information security industry and will be used consistently throughout this paper (Ifinedo, 2014). However, it is not unusual for a government organization or agency to have different names for the same types of information security policies. For example, in many organizations and certainly in government departments, the word "policy" is closely associated with laws and regulations (Rees, Bandyopadhyay, & Spafford, 2003). In these cases, a limited number of individuals (e.g., the legislature) have the power to create a policy, so that an information security policy is generally referred to by other names such as "information security statement", or "information security document" or other terms avoiding the use of the word "policy". The term used by an organization to describe these documents is irrelevant. The overall organization and completeness of these documents are important (Hong, Chi, Chao, & Tang, 2006).

The Information Systems Security Policy (ISSP) reflects the expectations and requirements of the Executive Management with regard to the Information System (Canavan, 2003; Höne & Eloff, 2002b) (Canavan, 2003). It must take into account at least the needs in terms of availability, confidentiality and integrity of applications and data used and transiting on networks and systems. It consolidates a set of technical, organizational, legal and human security rules and principles to ensure an efficient and uniform level of security (Fomin, 2008). The ISSP is the counterpart of the Information Systems Master Plan for security. It can lead to an ISSP action plan that prioritizes projects to meet ISSP objectives. The objectives of the Information Systems Security Policy (ISSP) are described in figure 1.

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Figure 1. Information system security policy objectives



There are several standards and best practice guidelines to assist organizations in implementing an information systems security policy such as ISO 27000, ISACA, NIST, etc. ISO 27001 (ISECT, 2012) is an international standard that is part of the ISO 27000 family of standards (Von Solms, 2005). It refers to a set of standards relating to the information security management system. The ISO 27001 standard is a British standard that came into being in October 2005, succeeding in the BS 7799-2 standard. It describes the requirements for the implementation of an Information Security Management System as shown in figure 1. This standard allows companies to choose security measures to ensure the protection of sensitive assets within a well-defined perimeter by implementing a systematic and proactive approach to security risk management.

Best practice guides such as ISO 27001, COBIT, ISACA do not provide the practical framework for implementing an IS security policy (Höne & Eloff, 2002a). The objective is to guide organizations in their approach to implementing an IS Security Policy through a practical guide to implementing an IS Security Policy.

Problem Statement

Many prescriptive approaches to ISO 27001 already exist, for example, ISO 27003, which is the official standard with guidelines for ISO 27001 (Talib, M. A., El Barachi, M., Khelifi, A., & Ormandjieva, 2012). Several steps to implement the management framework provided in ISO 27001, called information security management system ISMS, are presented. However, a practical methodology for implementing an information security policy does not exist.

Figure 2. A brief history of ISO/IEC 27001



Many organizations do not have the resources or expertise to conduct a risk analysis and implement an ISMS (Mintzberg, H., Lampel, J., & Quinn, 2003). Therefore, they could now know what aspects of security might be relevant to them. Instead of doing a comprehensive risk analysis, an organization could also look to its peers. What are they doing? Although it is not as good to follow your peers as it is to do an extensive risk analysis, it is certainly better than setting up controls for no reason.

Modern times require different approaches to problems. Nowadays, mobile phones and tablets are common products. Employees are supposed to work everywhere. Information is quickly shared via social media. How do companies manage these new issues - what controls do they put in place and how do they select them?

To date, there was no literature on practical research using ISO 27001. Almost all the results had a very limited number of references. However, some were still useful.

There are very few scientific papers on ISO 27001, and none found that research practice uses ISO 27001 controls as described in the background section. This paper can be considered exploratory: The data collected in this research may well be used to formulate hypotheses for other research projects.

Research Question/Approach

The research question in this work is: What relevant ISO 27001 controls and good practices do corporate information security managers choose to implement, and why are they chosen?

The approach taken in this research is qualitative research, using interviews with experts. Expert interviews are a good way to explore an area of research. Experts often know a lot about the research topic. By talking to several of them, it is possible to know whether there is a consensus or whether there is still much debate on certain subjects. Both results could be used in future research.

Unlike quantitative research, qualitative research is used to focus more on “why” and “how” questions. As a result, qualitative research generally takes smaller, but more focused samples than quantitative research. Qualitative research often does not have a clear hypothesis in advance. Instead, we need an open question. The selection is not made by statistical chance, but according to what is available. When

interviewing information security officials, the objective is to get an overview of the controls they choose and why they have been chosen over others.

Purpose

As there is very little scientific literature on the practical use of ISO 27001, this research can be used as exploratory research. The purpose of this paper is to investigate what controls are commonly used and how they are selected to the implementation of an information security in large public organizations in the Middle East and North Africa MENA through ISO 27001 (Calder, A., & Watkins, 2010), with a specific focus on practical framework for the implementation of an effective information security policy through ISO27001 (Calder, A., & Watkins, 2010).

BACKGROUND

The ISO/IEC 2700x Family

Several standards, methods and repositories of good practices in information systems security are available. They constitute methodological guides as well as the means to guarantee a coherent security approach.

ISO has undertaken a major effort to streamline existing work, resulting in the ISO/IEC 27000 series of standards. This number corresponds to the reservation of a series of safety standards. To date, only standards 27000, 27001, 27002 and 27006 are published. Some are mandatory to obtain certification, others are mere guides:

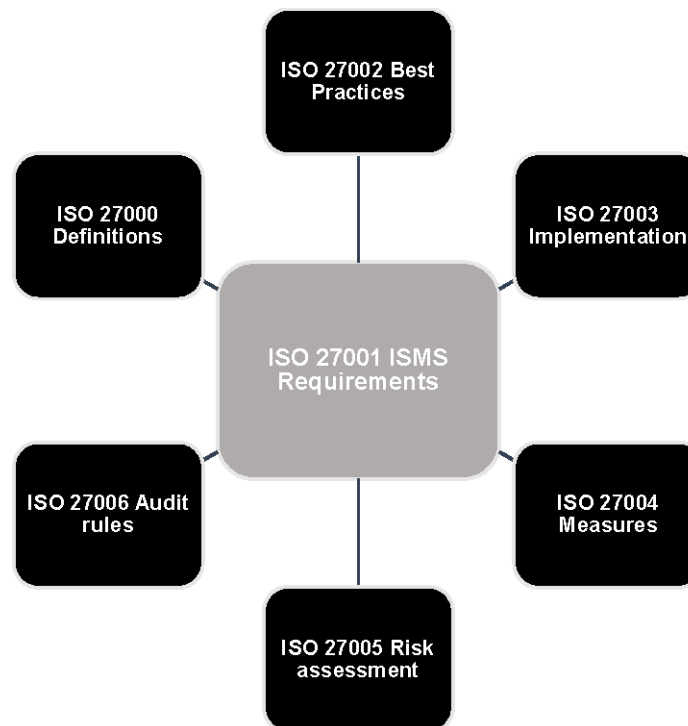
- ISO/IEC 27000 presents the vocabulary and definitions of the security field, applicable to each of the standards;
- ISO/IEC 27001 describes the information systems security management policy within a company that serves as a reference for certification;
- ISO/IEC 27002 is the best practice guide for IS security;
- ISO/IEC 27003 is intended to be an implementation guide;
- ISO/IEC 27004 will be a new standard for steering indicators and measurements in the field of IS security;
- ISO/IEC 27005 will be a new standard on risk management for IS security;
- ISO/IEC 27006 summarizes the requirements applicable to external auditors in their ISO 27001 certification assignment.

As shown in Figure 3 below, ISO/IEC 27001 is the center of gravity of the Information security management system ISMS referential.

ISO/IEC 27001

The ISO/IEC 27001 standard, published in November 2005, defines the IS security management policy within a company (Johnson, 2014). It is derived from the BS 7799-2:1999 specification (Specification for Information Security Management Systems) which defines the requirements to be met to create an

Figure 3. The ISO 2700x series



ISMS (PRGL, 2011). It specifies in the annex certain safety controls, taken from the ISO/IEC 17799 standard, the implementation of which is mandatory. ISO 27001 comprises six process areas.

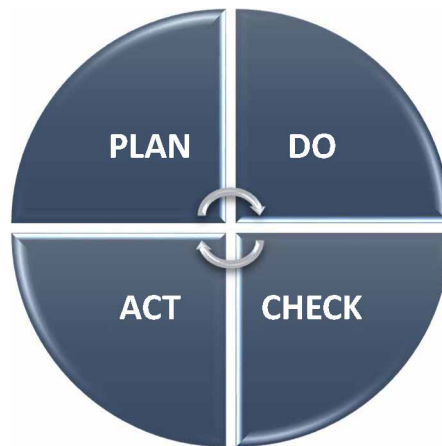
- Define an information security policy.
- Define the scope of the information security management system.
- Conduct a safety risk assessment.
- Manage identified risks.
- Select and implement controls.
- Prepare a SoA (Statement of Applicability).

ISO 27001 specifies the processes that enable a company to build, manage and maintain an information security management system. It integrates the process approach and the PDCA (Plan-Do-Check-Act) cycle of continuous improvement already contained in ISO 9001 and ISO 14001 standards:

- **Plan:** Organize the implementation of the information security management system;
- **Do:** Set up and operate the system ;
- **Check:** Monitor system effectiveness through internal audits and risk assessments;
- **Act:** Improve the system through appropriate corrective and preventive actions, maintain it through communication and training actions.

In terms of security, the improvement loop is synonymous with a risk reduction loop. In practice, procedures should be put in place for:

Figure 4. PDCA cycle



- Quickly detect processing errors;
- Immediately identify any non-compliance with safety rules and organize the immediate reporting of incidents;
- Verify that all safety-related tasks are actually performed, whether by men or automatons;
- Identify the actions to be taken to correct non-compliance with safety rules.

As regards control, regular reviews of the effectiveness of the system should be carried out on the basis of audit results, incident reports and suggestions and comments received from the parties concerned. On the other hand, acceptable residual risk levels must be continuously reviewed and adapted in the light of organizational, technological, legal and regulatory developments or public opinion.

Measurement requirements are explicitly contained in the standard in the form of risk assessments, audits, incident data collection and non-compliance. However, the standard lacks metrics that would make it easier to compare certified entities with a single repository.

ISO/IEC 27002:2005 (revised by ISO/IEC 27002:2013)

ISO/IEC 27002:2005 is another generic standard that can be applied to health information systems to ensure security. It establishes general principles and guidelines for effective initialization, implementation, maintenance and improvement of information security management. The objectives outlined therein provide general guidance on the commonly accepted goals of information security management. Thus any organization seeking to adopt a comprehensive information security management program or improve its existing information security practices can use the standard. The ISO standard asserts that information can be protected using a wide variety of controls. Such controls include hardware and software functions, procedures, policies, processes and organizational structures. Organizations including healthcare organizations, must develop, implement, monitor, evaluate and improve these types of security controls (PRGL, 2011).

ISO/IEC 27002:2005

ISO/IEC 27002 2005 is entitled Information technology - Security techniques - Code of practice for information security management. It is published by the International Organization for Standardization (ISO) and International Electrotechnical Commission (IEC).

ISO/IEC 27002:2005 was developed from BS7799, a British standard that was published in the 1990s. ISO/IEC adopted this standard as ISO/IEC 17799:2000 in December 2000. In June 2005, the standard was revised and officially published as ISO/IEC 17799:2005. On July 1, 2007, it was renumbered ISO/IEC 27002:2005 to align with the other ISO/IEC 27000-series standards (ISO/IEC, 2013). On the other hand, ISO/IEC 27002:2005 has been revised by ISO/IEC 27002:2013 (ISECT, 2012).

In this research, ISO 27001 serves as the framework for measuring information security in organizations. It is surprisingly well suited to this work, as the idea behind ISO 27001 is to have a list of controls that should be able to mitigate all possible information security risks.

ISO/IEC 27002:2005

The thirty-nine main security categories of the standard are specified under eleven security control clauses. Each main security category contains one control objective stating what is to be achieved. In addition, one or more controls are specified to help achieve the control objective. The standard also has one introductory clause that discusses risk assessment and treatment. The control clauses include:

1. Risk assessment and treatment
2. Security policy
3. Organization of information security
4. Asset management
5. Human resources security
6. Physical and environmental security
7. Communications and operations management
8. Access control
9. Information systems acquisition, development and maintenance
10. Information security incident management
11. Business continuity management
12. Compliance

Although ISO/IEC recommends a complete consideration of the practices, organizations do not have to implement every recommended security practice stated therein. The important thing is to know what works best for the unique information security risks and requirements (ISO/IEC, 2013).

ISO / IEC 27001: 2013 now contains 114 controls for 14 domain areas as shown in table 1 below (ISO/IEC, 2013):

Information Security Policies

Objectives: To establish an Information Systems Security Policy published, regularly updated and supported by general management, in order to provide information security guidance in line with business requirements and regulations in force.

Table 1. ISO / IEC 27001: 2013 controls and domains

#	Domain	Number of Controls
1	Information Security Policies	2
2	Organization of Information Security	7
3	Human Resource Security	6
4	Asset Management	10
5	Access Control	14
6	Cryptography	2
7	Physical & Environmental Security	15
8	Operations Security	14
9	Communications Security	7
10	System Acquisition, Development & Maintenance	13
11	Supplier Relationships	5
12	Information Security Incident Management	7
13	Information Security Aspects of Business Continuity	4
14	Compliance	8

The ISSP centralizes the organization's information protection strategy. It is validated by the COSI and approved by the General Management and is available to all the organization's agents and transmitted to the third parties concerned.

Organization of Information Security

Objectives: To manage, monitor and guarantee the security of information within the organization in a transversal way, and to define the responsibilities and roles of the various security actors.

The organization of information security clause addresses the need to define and allocate the necessary roles and responsibilities for information security management processes and activities. This includes controls related to the definition of information security roles and responsibilities, segregation of duties, contact with authorities, contact with special interest groups, information security in project management and mobile devices and teleworking.

Human Resource Security

Objectives: To ensure that employees and contractors understand their responsibilities and are suitable for the roles for which they are considered. •To ensure that employees and contractors are aware of and fulfill their information security responsibilities. And to protect the organization's interests as part of the process of changing or terminating employment.

The Human Resource Security clause addresses the required controls for processes related to staff recruiting, their job during employment and after the termination of their contracts. These considerations should include information security coordination, allocation of information security responsibilities, authorization processes for information processing facilities, confidentiality agreements, contact with authorities, contact with special interest groups, independent review of information security, identifica-

tion of risks related to external parties, addressing security when dealing with customers, addressing security on contractors' agreements, etc.

Asset Management

Objectives: To identify, inventory and classify all assets required for information management. For each of them, a person in charge must be identified. The latter is responsible for enforcing the security policy for its assets.

The asset management clause addresses the responsibilities that need to be defined and assigned for asset management processes and procedures. The owner of the assets and other parties involved in this issue should be identified to be held responsible for the security of the assets, including classification, labeling and information processing; and the information processing facilities should be identified and maintained. In addition, this clause addresses the control of removable media management, media disposal and physical media transfer.

Access Control

Objectives: To ensure that users are aware of security responsibilities. To reduce the risk of accidents, errors and/or malicious acts by integrating safety principles into human resources management, from recruitment to the end of collaboration

The access control clause addresses the requirements for controlling access to information assets and information processing facilities. Controls focus on protection against accidental damage or loss, overheating, threats, etc. This requires documented control policies and procedures, registration, removal and review of user access rights, including here physical access, access to the network and control of privileged utilities, and restriction of access to program source code.

Cryptography

Objectives: To ensure proper and effective use of cryptography to protect the confidentiality, authenticity and/or integrity of information.

The Cryptography clause addresses policies on cryptographic controls for protection of information to ensure proper and effective use of cryptography in order to protect the confidentiality, authenticity, integrity, non-repudiation and authentication of the information. It also includes the need for digital signatures and message authentication codes, and cryptographic key management.

Physical and Environmental Security

Objectives: To ensure the protection and availability of sensitive equipment. To ensure that only authorized persons have access to the organization's buildings, technical and archive premises and that accesses are traced.

The physical and environmental security clause addresses the need to prevent unauthorized physical access, damage and interference to the organization's information and information processing facilities.

Operations Security

Objectives: To ensure correct and secure operations of information processing facilities. To ensure that information and information processing facilities are protected against malware. To protect against loss of data. To record events and generate evidence. To ensure the integrity of operational systems. To prevent exploitation of technical vulnerabilities. To minimize the impact of audit activities on operational systems.

The Operations security clause addresses the organization's ability to ensure correct and secure operations. The controls cover the need for operational procedures and responsibilities, protection from malware, backup, logging and monitoring, control of operational software, technical vulnerability management, information systems audit considerations.

Communication Security

Objectives: To ensure the protection of information in networks and its supporting information processing facilities. To maintain the security of information transferred within an organization and with any external entity.

The communications security clause addresses the organization's ability to protect information in systems and applications of supporting networks and information processing facilities. Controls cover information security in connected networks and services against unauthorized access, transfer policies and procedures, secure transfer of business information between the organization and external parties, information involved in e-mail, the need for confidentiality or non-disclosure agreements.

System Acquisition, Development and Maintenance

Objectives: To guarantee security management throughout the lifecycle of Information Systems. To reduce the risks associated with exploiting technical and application vulnerabilities.

The System Acquisition, Development and Maintenance clause covers controls for identifying, analyzing and specifying information security requirements, securing application services in development and support processes, technical review restrictions on changes to software packages, secure system engineering principles, secure development environment, outsourced development, system security testing, system acceptance testing and test data protection.

Supplier Relationships

Objectives: To ensure protection of the organization's assets that is accessible by suppliers. To maintain an agreed level of information security and service delivery in line with supplier agreements.

The Supplier Relationships clause addresses controls for supplier's relationship issues, including here information security policies and procedures, addressing security within supplier agreements, communication and awareness about technology supply chain and service delivery management.

Information Security Incident Management

Objective: To ensure a consistent and effective policy for the management of information security incidents. To guarantee the reporting of security events and vulnerabilities. To identify indicators and report on security incidents.

The information security incident management clause covers controls over responsibilities and procedures, reporting information and security weaknesses, assessing and deciding on information security events, responding to information security incidents, learning from information security incidents, and gathering evidence.

Information Security Aspects of Business Continuity Management

Objectives: After a minor incident (equipment failure), provide computer backup according to business needs. After a major incident affecting an entire engine room, ensure continuity of IT activity for sensitive assets as quickly as possible and according to business needs.

The business continuity management clause addresses the organization's ability to counter normal business interruptions, including the availability of information processing facilities, verify, review and assess information security continuity, implement information security continuity and plan information security continuity.

Compliance

Objectives: To avoid any violation of intellectual property, legal, regulatory and contractual provisions and security requirements of the organization.

The compliance clause addresses the organization's ability to comply with regulatory, statutory, contractual and security requirements, including identification of applicable laws and contractual requirements, intellectual property rights, record protection, confidentiality and protection of personally identifiable information, regulation of cryptographic controls, independent review of information security, compliance with security policies and standards, and review of technical compliance.

Other ISO 27000 standards

In addition to ISO 27001 and 27002, there are several other ISO standards in the 27000 range. These other standards guide and support ISO 27001/27002 for both organizations and auditors.

ISO 27003

ISO 27003 is used as the implementation standard for ISO 27001. This standard is intended to obtain management approval, define CMSS, conduct an organizational analysis and a risk analysis.

ISO 27004

ISO 27004 is a standard that helps measure the effectiveness of ISMS. ISO 27004 includes the following chapters:

- Overview of Information Security Measurement; Management Responsibilities;
- Measurement and measurement development;
- Measurement operation;
- Data analysis and reporting on measurement results;
- Evaluation and improvement of the information security measurement program.

ISO 27005

ISO 27005 is a standard that provides guidance for the implementation of ISO 27001. ISO 27005's approach begins by setting the context - defining the scope (primary processes and related assets) and boundaries of the organization. When defining the scope, a risk analysis will be carried out. Risk analysis consists of identifying the assets and the threats they face. In addition, the impact of a successful exploitation of a certain threat must be analyzed. When this is done, for each threat, an estimate of the likelihood that the threat will be successfully exploited will be multiplied by the costs of the impact of that exploitation. Based on this list, each risk should be mitigated through the implementation of controls, risk acceptance, risk avoidance or risk transfer.

RESEARCH METHODOLOGY

Data Collect

As part of this research, MENA large organizations experts are interviewed. These experts hold the title of a security officer, or what most closely resembles their organization. We chose the large public sector organizations because there are interesting problems specific to this sector. For example, government organizations usually possess many privacy-sensitive data - e.g., information about citizens. In addition, it appears that data leaks from public bodies are often well exposed in the media.

For the first round. We mailed a letter with details of the research content, what they would be asked for and what their own benefits were, before sending the final question, which is an optimized version of the ISO 27001 questionnaire presented. A total of 20 organizations were selected, 6 organizations agreed to give us interviews to answer our questions, i.e. 30%, a percentage too credible for this research.

In the second round, we validate the first study result with a qualitative methodology through a case study in a large public organization in Morocco.

As we conducted interviews by e-mail, we did not need to go to the locations of the interviewees. Therefore, the interviews did not require travel expenses. When participants sent me answers that we could not understand, we could then ask them to give me more details or explanations on previous comments. The email interviews allowed us to interview several participants at the same time. They were also easy to transcribe. At the same time, there was a lack of richness in the responses we received from participants. It was also not easy for participants to get clarification on the meaning of the questions, so we sent them a brief explanation of the theories by email. These explanations would improve their possibilities if they gave appropriate answers. Table 2 shows a summary of key attributes of participating organizations.

Data Analysis

For each interview, a report was written. The size was limited to about one page. The following section contains the reports from each interview. For reasons of anonymity, organizations are indicated by alphabets from A to F. The questionnaire results for each organization are presented in the next section. For each organization, the scores for each sub-theme are displayed.

The data were collected by means of a Likert scale from 0 to 5 (5: Very Important; 4: Important, 3: Moderately, 2: Slightly Important, 1: Unimportant). The items for each construct are adopted from

Table 2. Summary of key attributes of MENA organizations

Organizations	A	B	C	D	E	F
No of employees	1125	2400	7000	12000	2400	1700
No of IT staff	80	190	220	420	44	35
No of IT Security staff	5	12	9	10	3	5
Government (Gov.)/ Multinational (multi.)	Gov.	Gov.	Gov.	Gov.	Gov.	Gov.
ISO 27001 Version	2013	2013	2013	2013	2013	2013
Certified ISO 27002 Lead auditor staff	6%	5%	3%	3%	7%	0%

previous studies and each question relates to an item (Bergner, Witherspoon, Cockrell, & Stone, 2013; Pat & Piattini, 2011). To estimate the extent of non-respondent bias, it was not possible to compare respondents with non-respondents' answers. This is because the survey was anonymous and we had access only to names and e-mail addresses of participants, unlinked to their responses, and not those who chose not to participate. As a result, a non-response bias test was undertaken by comparing early respondents with late respondents instead (Lewis-Beck, M., Bryman, A. E., & Liao, 2003).

Discussion and Finding

The following figure 5 provides an overview of how the six organizations ranked for each of the sub-themes.

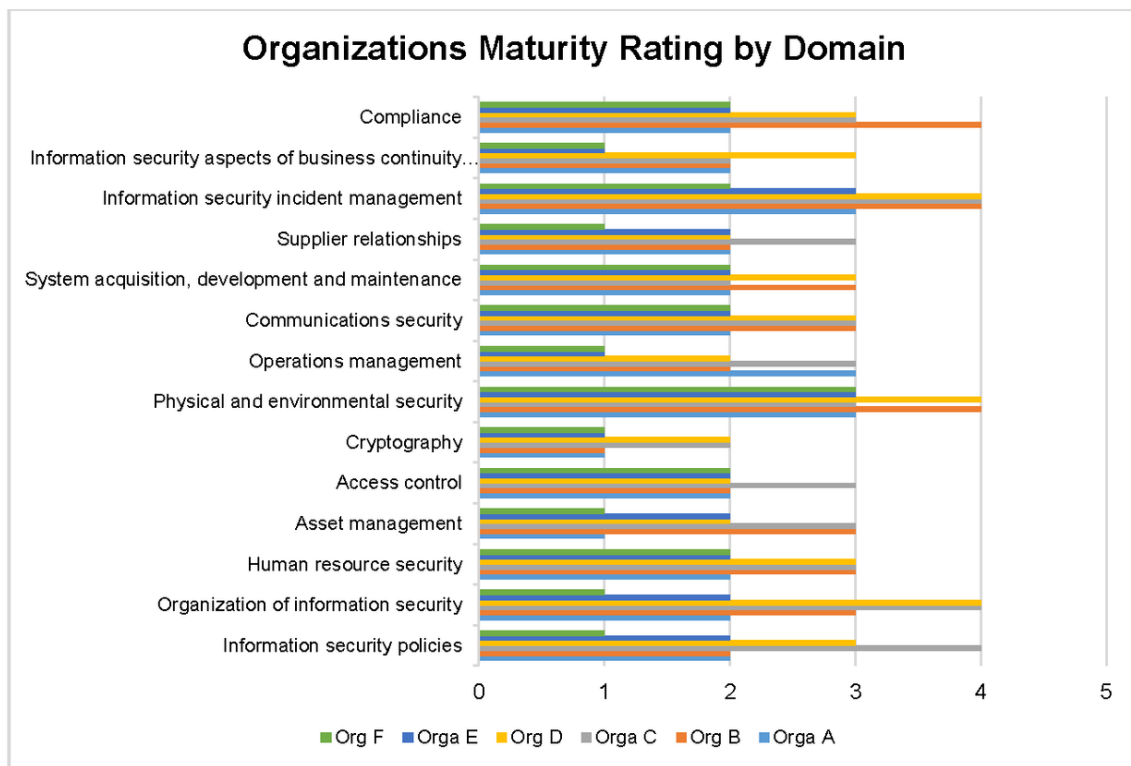
For organization A, E and F there is no specific security agent. However, one group of people is responsible for information security. The Information Security Policy was created in 2012 and is approved by management. However, the IT security policy is not signed by management.

For these organizations, the most important controls are those related to information security, for example, high-level policies, risk assessment. This means that the following three documents must exist and be signed by management:

Table 3. ISO 27001 Metrics

Status	Meaning	Proportion of ISMS requirements	Proportion of information security controls
Unimportant	Development has barely started and will require significant work to fulfill the requirements	%	%
Slightly important	Progressing nicely but not yet complete	%	%
Moderately important	Development is more or less complete although detail is lacking and/or it is not yet implemented, enforced and actively supported by top management	%	%
Important	Development is complete, the process/control has been implemented and recently started operating	%	%
Very Important	The requirement is fully satisfied, is operating fully as expected, is being actively monitored and improved, and there is substantial evidence to prove all that to the auditors	%	%

Figure 5. Organizations maturity rating through ISO/IEC 27001:2013



- Information Security Policy Information Technology Policy
- Classification of information sources

Security awareness should also be emphasized. In these organizations, awareness training is organized so that employees are knowingly incompetent in information security, rather than unconsciously incompetent.

Management should become more aware of safety issues themselves in order to play an exemplary role vis-à-vis, other employees. An example of this is: According to the information security policy, identification badges must be displayed at all times. Management does not do it itself.

Organization E. One of the major problems within the organization is that information security is not an integral part of the organization, but something that is considered an IT problem. This results in several problems for the security guard, for example:

- Lack of management commitment - information security policy has not been approved/signed by management.
- Not all information security issues are technical. For example, in the past, employees did not need a non-disclosure agreement. This situation changed in the spring of 2014, requiring all new employees to sign a non-disclosure agreement.
- There is no confidentiality classification for the information.
- There is no list of processes within the organization.
- There are several courses for employees, for example, a LinkedIn course or an Office course.

However, information security is little or not taken into account in these courses. Employees know little about how their actions (online) could harm the organization's image.

All contracts with third parties contain information security clauses. This includes cleaners. An outside company disposes of used paper and hard drives.

There are employment procedures, both for new employees and for dismissals. However, these procedures are not always followed correctly - employees only get more access rights and almost never less, even if their work no longer requires it. It is possible for employees to work from home. Authentication works with an SMS token, which gives the user access similar to what is possible in the office.

For organization F. For the moment, there is still no information security policy. However, interviews were conducted with experts within the organization to develop a list of ISO 27001 controls that should be implemented.

The systems used are shared with other organizations in a shared service centre. This centre also includes a service desk for incidents. For high priority incidents, a process is in place that includes management and impact analysis. Physical access is regulated by the use of tokens, where access is distributed according to need. Utility offices have emergency buttons that can be used in the event of disturbance in freely accessible areas. At night, the inner courtyard is locked with fences by the security team.

The organization has undergone intrusion tests, for example using a mystery guest. A mystery guest is a person hired by the organization to pose as a stranger trying to access critical information. This mystery guest made a video about how to get in. This video was shown to management to raise awareness.

It is possible to bring a mobile phone or a tablet computer. There are three different wireless networks - a public network, one for guests and one for employees. These use a ticket system, which allows only one device for a certain time. Thereafter, a new ticket must be requested.

Basically, information security is always a secondary issue, and the level of maturity switches between level 1 (ad hoc) and 2 (repeatable). Efforts must be made to complete level 3 (defined) and 4 (managed), especially in the areas of asset management, operation management, supplier relationships, business continuity and compliance.

For organizations B, C and D. Within these organizations, ISO 27001 is used as a guideline for information security. Currently, a baseline is applied across these organizations.

On third parties: Paper waste is disposed of by a company specializing in organization C and D. For as much software as possible, a SaaS solution is used. However, change management is always done within the organization. Backups are performed regularly and tested. Physical security has three different zones: Public areas, employee areas and specific areas, such as server rooms. Organizations support telework through a VPN virtual private network.

For organizations C and D. In these two organizations, a difference is made between the information security policy and the information security plan. The policy is higher than the plan. The plan is based on ISO 27001 controls. Controls are selected using a risk analysis: A matrix of estimated risks and impacts is established and serves as the basis for the selection of controls.

Employees of these organizations were not sworn in, with the exception of temporary staff. Instead, they must sign a non-disclosure agreement. Employees are informed of information security through intranet bulletins, but there is no policy in place for security awareness training.

For third parties, for example application hosting, information security clauses are either included in the terms of service or included in the contract.

A third party takes care of all the equipment that needs to be disposed of, including paper, old computers, printers, etc. When it comes to new applications, ready-to-use solutions are preferred to custom software. If necessary, they can be modified to meet additional needs. For large requests, a tendering

procedure is organised. There is a formal change management process, which has improved considerably in recent years.

There are several networks within this organization, and they are physically or virtually separate. For example, there is a network on which employees are connected, one for servers, a public wireless network, a wireless network for employees. Both can be used for mobile devices and are therefore not connected to other networks.

Each week, a list of terminated employees is generated and used to ensure that these employees no longer have access to the applications. There is an employee transfer procedure. However, since a transfer may take some time during which the employee may still need their former access rights, it is more difficult than hiring and termination.

It is possible to work from home. A virtual office system is used, giving a virtual workplace at home. In the future, the computers in the office will use the same system. In the office, all office spaces are flexible: no fixed rooms for employees.

For incidents, a form exists on the intranet for organization E. Depending on the incident, it is assigned either to facilities management or to IT. There, priority is given, depending on the impact of the incident. There is an escalation procedure: the more important an incident is, the more important the follow-up of an incident is. This may be management or a subsequent evaluation.

In general, the 3 organizations are at level 3 (defined). At least efforts must be made in areas such as cryptography and Information security aspects of business continuity management.

CONCLUSION

The objective of this study was to establish a practical framework for the formulation and implementation of the IS security policy. The problem arising from this situation is an ineffective IS security policy and, therefore, a vulnerable system. To achieve this objective, we reviewed the ISO 20001 security policy frameworks and conducted a case study in six organizations to define the IS policy maturity state.

The maturity level assessment reflects the organization's ability to implement and maintain its security system, in order to ensure the identification and regular assessment of risks, the implementation, management and audit of controls to deal with these risks.

Improving the level of information security management requires significant technical, human and organizational resources that must be deployed and managed at all levels of organizations.

To conclude, it can be said that the process of implementing an effective IS security policy depends above all on the involvement of employees and the top management. The level of security required also depends on the need of the organization.

In general, an effective information security management system must establish a continuous improvement cycle to keep the level of security maturity at an acceptable level.

FUTURE RESEARCH DIRECTIONS

Further research is needed to determine the situation within more controlled environments, such as commercial or private organizations. Being a state educational entity may have distorted the results to a degree and having additional, more diverse data would validate the framework to a greater level. Also,

this study focused on the relatively small subset of those most directly involved in policy. A quantitative examination of a wide base of users might shed some additional light on policy implementation.

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KEY TERMS AND DEFINITIONS

Authentication: Is the process of verifying a claim of identity. Three different types of information can be used for authentication: something you know (a PIN, a password, mother's maiden name), something you have (magnetic swipe card) or something you are (biometrics).

Availability: Information and supporting IT systems should be available to authorised users when needed.

Confidentiality: Data or information prevented from the exposure to unauthorized individuals is labeled as confidential.

Encryption: The action of changing the information by using an algorithm to make it unreadable to anyone.

Information Security: Is defined as “a well-informed sense of assurance that information risks and controls are in balance”. The goal of information security is to protect business assets and reduce costs by avoiding security violations and reducing the negative effects they have on an organization.

Information Security Policy: Is a written, living document outlining the actions and procedures that employees should follow in order to protect an organization's information security assets, an information security policy outlines the function and tasks of employees in order to protect an organization's information assets.

Integrity: Integrity is the quality of being whole, uncorrupted and complete.

ISMS: An information security management system (ISMS) is a tool that helps organizations to establish, implement, operate, monitor, review, maintain and improve the desired level of information security in the organization.

ISO/IEC 27001:2013: Information security standard published by the International Organization for Standardization (ISO) and by the International Electrotechnical Commission (IEC), entitled Information Technology – Security Techniques – Information Security Management Systems – Requirements.

ISO/IEC 27002:2013: Information security standard (list of controls) published by the International Organization for Standardization (ISO) and by the International Electrotechnical Commission (IEC), entitled Information Technology – Security Techniques – Code of practice for Information Security - Controls.

Top Management: High level management.

Vulnerability: Is a weakness in the organization, network that can be exploited by a threat.

Auditor Evaluation and Reporting on Cybersecurity Risks

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INTRODUCTION

Just a few decades ago information systems consisted primarily of mainframe computers with what were commonly referred to as “dumb terminals” that granted access into a mainframe computer which performed an organization’s information processing. The risk of intruders accessing such systems was significantly less and physical security measures such as locked doors and security guards served as an effective approach in protecting information systems from outsiders. Substantial information processing capabilities were then added with the widespread use of the Internet, company networks, and the distribution of computing power to the end user. Unfortunately, it also resulted in an immense increase in the danger of outsiders hacking into company information systems gaining access to sensitive information and causing various types of malicious behavior.

A recent cybersecurity attack at the Marriott hotel chain illustrates what can happen when cybersecurity incidents occur and are not thoroughly resolved. In 2015, Marriott Hotels acquired another hotel, known as Starwood Hotels and Resorts Worldwide, as part of a \$13.6 billion deal which made Marriott the No. 1 hotel chain in the world. Four days after the announcement of this 2015 merger, Starwood stated that credit card information had been stolen in some of its hotel restaurants and gift shops as a result of malware that attackers installed on point-of-sale systems in 2014. In December 2018, The Wall Street Journal reported the theft of personal information for up to 500 million customers as a result of a hack of Marriott’s customer database for its Starwood properties. Although Marriott claimed that the 2018 discovery was unrelated to the prior incident, security experts believe that a more thorough investigation of the initial intrusion would have identified a second intruder who was able to stay in the Marriott reservation system for the more than three years following the initial security breach (McMillan, 2018).

The objectives of this research are to provide an overview of some of the considerations that are involved in an assessment of an organization’s system of cybersecurity including: lines of defense, audits and reporting, and standards and frameworks for evaluation. This article begins by considering challenges facing today’s audit committees, the need to understand the common profile of the cyber perpetrator, and the necessity of employee training to overcome complacency in dealing with cybersecurity risks. This is followed by guidance from both the Institute of Internal Auditors (IIA) and the American Institute of Certified Public Accountants (AICPA). A thought-provoking discussion based on IIA literature considers what the IIA refers to as “three lines of defense” to address risks in today’s cyber environment. Guidance from the AICPA describes reporting on an entity’s cybersecurity risk management program and controls. In the audit of security systems to address cybersecurity risks, it is also essential to make use

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of standards and frameworks to facilitate a proper evaluation. This is also addressed by considering how guidance from COBIT, the National Institute of Standards and Technology, and the Center for Internet Security can be mapped into five cyber infrastructure domains.

BACKGROUND

A primary focus of an audit committee is to provide an independent oversight function to ensure that the processing and storage of information is performed in a secure and reliable manner to meet the needs of information users. Although the birth of the Internet and extensive networking capabilities has substantially increased the ability of organizations to process and disseminate information, it has also opened the door to allow greater access to information systems by unauthorized and many times malicious intruders. It is certainly a difficult task to address these security issues due to the constantly changing availability of technology that is both within and outside of an organization's control. This section discusses challenges faced by audit committees as a result of cybersecurity issues. It also considers common profiles of the cyber perpetrator and how noncompliance with information security policy by well-meaning organizational personnel can allow unauthorized access into an organization's information system.

Challenges Facing Today's Audit Committee

Lanz (2014) points out that today's audit committee faces challenges in their governance of cybersecurity, including:

- Organizations must reconcile between the availability of products and services to enable business in cyberspace and protecting information in accordance with business and regulatory requirements.
- The periodic briefings that information security professionals provide to audit committee members may not be relevant enough for them to properly perform governance duties.
- Lack of cybersecurity training for organization personnel can serve as a weak link despite large investments in information security technology.
- Organization's that rely on third parties to provide information processing services should ensure that a vendor management program exists to provide evidence that the vendor follows due diligence to protect sensitive information.

Common Profiles of the Cyber Perpetrator

Galligan and Rau (2015) stress the importance of having a risk assessment process that considers the cyber risk profile(s) most likely to pose a threat to an organization. They point out that certain industries may be more susceptible to a specific type of cyberattack. They describe the following broad categories of perpetrators:

- **Nation-states and Spies:** Involve hostile foreign nations looking to obtain trade secrets and intellectual property to achieve competitive and military advantages.
- **Organized Criminals:** Involve persons seeking to steal money and private information such as through identify theft of an organization's customers.

- **Terrorists:** Involve persons who want to launch cyberattacks against important infrastructure such as banks.
- **Hacktivists:** Involve persons who desire to make a political or social statement through the theft or publication of sensitive organization information.
- **Insiders:** Involve persons who are trusted members of an organization that want to sell or share sensitive information.

Organizational Noncompliance

Although the ability of an organization to deal with the malicious behavior of persons is certainly an issue that must be considered, another significant threat arises from insiders who intend no harm to the information system but simply fail to understand and follow appropriate security policies. Stafford, Deitz, and Li (2018) posed the research question: “How can auditors identify and contribute to the correction of non-malicious insider threats to cybersecurity in the firm?” Through two specific case studies and depth interviews with trained auditors, these researchers defined and considered the following types of non-malicious insider threats:

- **CyberComplacency:** Computer users who are less concerned about cybersecurity diligence than their company would like because they believe they are working with invulnerable platforms.
- **Cybersecurity Loafing:** technically competent employees who take unauthorized steps to bypass specific security policies in order to achieve greater workgroup efficiency.

The results of the research concluded that applying sanctions against employees for these non-malicious threats is less effective than having information system auditors consult with system users to better educate them regarding system vulnerabilities and the importance of following established information security policy.

FOCUS OF THE ARTICLE

Auditing standard setters from the Institute of Internal Auditors and the American Institute of Certified Public Accountants have issued guidance about lines of defense and reporting on an entity’s cybersecurity risk management program and controls, respectively. Standards and frameworks from COBIT, the National Institute of Standards and Technology, and the Center for Internet Security can be used in the evaluation of a system of cybersecurity.

Internal Audit and Cybersecurity

The Institute of Internal Auditors (IIA) (2016) defines cybersecurity as “the technologies, processes, and practices designed to protect an organization’s information assets – computers, networks, programs, and data – from unauthorized access.” They also point out that the risks of cybersecurity extend well beyond the general and application controls that internal audit has traditionally assessed in regard to information technology. This increased risk is largely attributable to global connectivity that allows persons outside of the organization to access information. To address this additional risk, the IIA suggests that organizations have in place three lines of defense.

The First Line of Defense

The IIA (2013) states that “operational management naturally serves as the first line of defense because controls are designed into systems and processes under the guidance of operating management.” The key aspect of the first line of defense is to ensure that appropriate positions of responsibility are established and staffed with qualified talent to address current and emerging cybersecurity issues. The IIA (2016) includes the following examples of key operating management positions that can be established:

- **Chief Technology Officer (CTO):** Responsible for supplying knowledge and direction regarding the availability of technologies to guide the organization’s mission. The CTO is often responsible for protecting the intellectual property of the organization.
- **Chief Information Security Officer (CISO):** Serves as a foundation in the identification and understanding of cyber threats. The CISO often takes a lead role in the development of oversight programs to ensure the protection of organization assets and stakeholder data.
- **Chief Information Officer (CIO):** Acts to drive an organization’s competitive advantage and strategic change. The CIO is often responsible for developing an information cybersecurity program and implementing entity-wide cybersecurity training.

In situations where it may be impractical to establish the above positions, the assignment of the various cybersecurity responsibilities can be approached through “a council of business and information technology (IT) managers who have a stake in responding to cybersecurity risk.” The IIA (2016) also identifies some specific examples of activities in the first line of defense including:

- Administration of security procedures, testing, and training.
- Putting in place intrusion detection systems and handling penetration testing.
- Maintenance of an inventory of technology devices, information assets, and associated software.
- Recruiting and retaining appropriately certified IT talent.

The Second Line of Defense

The IIA (2013) explains the second line of defense as being what management does to set up “various risk management and compliance functions to help build and/or monitor the first line of defense controls.” The IIA (2016) mentions the following three points in describing the responsibilities of the second line of defense:

- An assessment of cybersecurity risks and exposures to evaluate whether they are in line with the risk appetite of the organization.
- Monitoring the organization for changes in legal requirements and risks.
- Working with the functions established in the first line of defense to make certain that suitable controls are designed.

The second line of defense therefore involves the specific activities that operating management implements to ensure cybersecurity risk control and compliance (IIA 2013).

The Third Line of Defense

The IIA (2013) defines the third line of defense as having an organization's "internal auditors provide the governing body and senior management with comprehensive assurance based on the highest level of independence and objectivity within the organization. This high level of independence is not available within the second line of defense." The IIA (2016) uses the following points to illustrate some of the activities of the third line of defense:

- Provide regular independent evaluations of preventive and detective measures regarding cybersecurity issues.
- Track the diligence with which remediation takes place to address identified cybersecurity concerns.
- Work with the second lines of defense to perform cybersecurity risk assessments of various third parties including service organizations and suppliers.

The Cybersecurity Risk Management Examination

In May 2017, the American Institute of Certified Public Accountants (AICPA) issued an attestation guide entitled "Reporting on an Entity's Cybersecurity Risk Management Program and Controls" ("Cybersecurity Guide"). In contrast to a CPA's evaluation of internal accounting controls that is integrated with an audit of a public company's financial statements, which focuses exclusively on objectives of external financial reporting, a more detailed examination is required for a CPA to attest to whether an entity's cybersecurity risk management program achieves an organization's overall business objectives.

The Standard Examination Report

The cybersecurity risk management report can cover a specific point in time or be for a period of time. Three major components of the report include:

1. Management's description of the entity's cybersecurity risk management program consists of a narrative that describes how an organization identifies its information assets, defines management's approach to dealing with the cybersecurity risks faced by those assets, and describes the primary security policies and processes that have been put into operation to protect its information assets.
2. Management's assertion addressing whether (i) "the description is presented in accordance with the description criteria and," (ii) "the controls within the entity's cybersecurity risk management program were effective to achieve the entity's cybersecurity objectives based on the control criteria." (See section on "Assessing Cybersecurity Objectives").
3. Practitioner's report stating separate opinions on whether the components of management's assertion described above have been met. (See section on "Forming the Opinion").

It should be recognized that due to the high likelihood of security events or breaches, a cybersecurity risk management program is considered effective if the program can detect security events in a timely manner and recover from them with a minimum amount of disruption to company operations.

Assessing Cybersecurity Objectives

One of the first issues in dealing with an evaluation of an organization's Cybersecurity Risk Management Program involves an evaluation of whether management's description of the program includes appropriate cybersecurity objectives that address specific cybersecurity risks that the organization faces. The Committee of Sponsoring Organizations of the Treadway Commission (COSO) framework points out criteria that can be used to evaluate whether cybersecurity objectives are appropriate, including that they:

- **Specifically explain** cybersecurity risks that need to be lessened;
- **Are measurable or observable** so that it can be determined whether the objective has been met;
- **Are attainable** in that controls can be implemented that if suitably designed and complied with can achieve each objective;
- **Are relevant** in that they support the organization's overall objectives including the availability of system processing, confidentiality of information, and the integrity of both system data and processing;
- **Are time bound** to represent the desired functioning of cybersecurity controls over time.

If a practitioner were to conclude that management's cybersecurity objectives were either incomplete or not suitable, the issues should be brought to management's attention so that they can be addressed. A lack of willingness on the part of management to make appropriate revisions could result in either the practitioner's refusal to accept the engagement or restricting the use of the report to those who understand the risks not addressed.

Forming the Opinion

The opinion that the practitioner expresses in a cybersecurity risk management examination covers two different but related subject matters:

1. Description of the entity's cybersecurity risk management program, and
2. The effectiveness of controls within the program to achieve the entity's cybersecurity objectives.

Table 1. Other opinion possibilities

Nature of Matter Giving Rise to the Modification	Practitioner's Professional Judgment About the Pervasiveness of the Effect or Possible Effects on the Description or on the Effectiveness of Controls	
	Material but Not Pervasive	Material and Pervasive
Scope limitation · The practitioner is unable to obtain sufficient appropriate evidence.	Qualified opinion	Disclaimer of opinion
Material misstatements · Subject Matter 1: The description is materially misstated. Or · Subject Matter 2: The controls were not effective to achieve the entity's cybersecurity objectives.	Qualified opinion	Adverse opinion
It is possible for different opinions to be issued regarding the two subject matters.		

An unmodified report is a report in which the auditor feels that the above subject matters have been appropriately addressed. Table 1 taken from the Cybersecurity Guide presents some other opinion possibilities.

The Design-Only Examination

In situations where an organization has either a very young or significantly changed cybersecurity risk management program, it may be appropriate to temporarily bypass forming an assertion about the effectiveness of controls to accomplish cybersecurity objectives until the program has had more time to actually function. In such situations, the Cybersecurity Guide points out that the design-only report would just address:

1. “The description of the entity’s cybersecurity risk management program and
2. The suitability of the design of the controls implemented within that program to achieve the entity’s cybersecurity objectives.”

Practitioners should consider restricting the use of a design-only report to the client’s board members, organizational personnel, and specific third parties likely to understand it.

Examining a Portion of the Cybersecurity Program

Although the Cybersecurity Guide addresses an entity-wide evaluation, it also points out that management may elect to have only a portion of the program evaluated. The determination of the acceptability of this limited evaluation depends on whether the subject matters of the engagement are expected to appropriately address the needs of the intended users. For example, such a situation could exist if an organization intends to sell off a portion of their operations and intends to examine only the independent program issues of that segment to address the needs of the prospective buyers. In any case involving a partial examination, a practitioner should evaluate whether it is appropriate to restrict report usage to a limited group of users.

Standards and Frameworks for Auditing Cybersecurity

Standards provide a set of rules that can be monitored for compliance by a specialized field’s authoritative bodies and related professionals. The grouping of rules and related concepts into appropriate frameworks furnishes the basic building blocks to identify and decide upon appropriate courses of action to address complex problems. Although the enumeration of an exhaustive set of standards and frameworks appropriate for a cybersecurity audit is beyond the scope of this article, this section presents standards and frameworks selected from four prominent and published works including contributions from the ISACA (formerly known as Information Systems Audit and Control Association), the National Institute of Standards and Technology (NIST), and the Center for Internet Security (CIS). These published works cover, in an overlapping manner, the Risk Management Framework (RMF) as set out by the NIST.

COBIT® 2019

COBIT® 2019 is a framework for the governance and management of enterprise information and technology whose purpose is to facilitate the achievement of the enterprises' goals (ISACA, 2019). It provides control objectives with which the effectiveness of Information Technology (IT) controls can be evaluated. While the governance objectives of COBIT ® 2019, are grouped into the three domains: Evaluate, Direct and Monitor; the management objectives are group into the following four domains (ISACA, 2019):

1. **Align, Plan, and Organize (APO):** Addresses the overall organization, strategy and supporting activities for Information and Technology (I&T).
2. **Build, Acquire and Implement (BAI):** Deals with the definition, acquisition, and implementation of I&T solutions for the enterprise.
3. **Deliver, Service and Support (DSS):** Is concerned with the delivery of secure operations and support of I&T services.
4. **Monitor, Evaluate and Assess (MEA):** Addresses the performance monitoring and conformance of I&T with performance targets, internal control objectives and external requirements.

NIST SP 800-37

The *National Institute of Standards and Technology (NIST) Special Publication (SP) 800-37, Revision 2* (also known as *Risk Management Framework for Information Systems and Organizations A System Life Cycle Approach for Security and Privacy*) (NIST, 2018) describes the Risk Management Framework (RMF) and provides guidelines for applying the framework to information systems within an organization with the intent of helping the organization manage its security and privacy risks. The RMF promotes real-time risk management and common control authorization through a continuous security monitoring process. The seven steps of RMF are as follows:

1. **Prepare:** Requires the establishment of context and priorities in preparation for the management of security and privacy risks.
2. **Categorize:** The systems and information are properly triaged based on the analysis of the impact of loss.
3. **Select:** In order to properly mitigate the identified risks, initial sets of controls are selected.
4. **Implement:** The controls are implemented and described.
5. **Assess:** The implemented controls are assessed and evaluated.
6. **Authorize:-** The system and the common acceptable controls are authorized.
7. **Monitor:** The system and controls are continuously monitored, documented, evaluated, and improved.

NIST SP 800-53

National Institute of Standards and Technology (NIST) Special Publication (SP) 800-53 Revision 4 (also known as *Security and Privacy Controls for Federal Information Systems and Organizations*) (NIST, 2015) describes a set of standards and guidelines to help federal agencies and partners meet the requirements set by the Federal Information Security Management Act (FISMA), which was signed into law as part of the Electronic Government Act of 2002. The law applies to any component of an information

system that stores, processes, or transmits information. The security controls specified in this set are divided into 18 families of controls that are categorized according to severity as being: Low-impact, Moderate-impact and High-impact.

Center for Internet Security Controls

Center for Internet Security (CIS) Controls (CIS, 2019) are best practice guidelines for computer security that were initially developed and introduced by the SANS Institute in 2008 and later transferred to the Center for Internet Security (CIS) in 2015. The 20 CIS Controls, also known as CIS Critical Security Controls, are delineated into three groups: Basic, Foundational and Organizational. These controls are developed by leading security experts and, if correctly implemented, could reduce security risks and operational costs and thereby, significantly improve an organization's defensive posture. The 20 CIS Controls (CIS, 2019), grouped into Basic (**B**), Foundational (**F**), and Organizational (**O**), are as follows:

1. (**B**) Inventory and Control of Hardware Assets
2. (**B**) Inventory and Control of Software Assets
3. (**B**) Continuous Vulnerability Management
4. (**B**) Controlled Use of Administrative Privileges
5. (**B**) Secure Configuration for Hardware and Software on Mobile Devices, Laptops, Workstations and Servers
6. (**B**) Maintenance, Monitoring and Analysis of Audit Logs
7. (**F**) Email and Web Browser Protections
8. (**F**) Malware Defenses
9. (**F**) Limitation and Control of Network Ports, Protocols and Services
10. (**F**) Data Recovery Capabilities
11. (**F**) Secure Configuration for Network Devices (Firewalls, Routers and Switches)
12. (**F**) Boundary Defense
13. (**F**) Data Protection
14. (**F**) Controlled Access Based on the Need to Know
15. (**F**) Wireless Access Control
16. (**F**) Account Monitoring and Control
17. (**O**) Implement a Security Awareness and Training Program
18. (**O**) Application Software Security
19. (**O**) Incident Response and Management
20. (**O**) Penetration Tests and Red Team Exercises

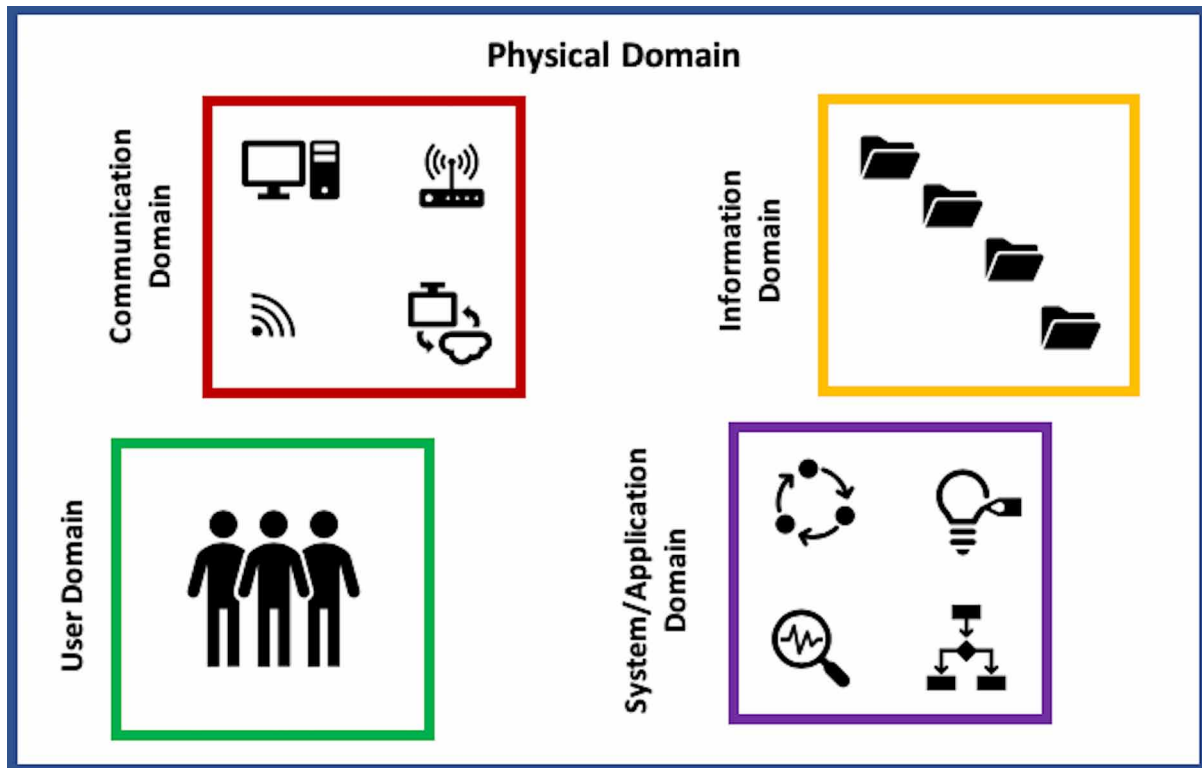
SOLUTIONS AND RECOMMENDATIONS

The previously presented cybersecurity guidance from COBIT, the National Institute of Standards and Technology, and the Center for Internet Security can be mapped into five cyber infrastructure domains to provide an approach to evaluate a system of cybersecurity.

Cyber Infrastructure Requirements and Controls

The cyber infrastructure is the backbone of the information technology (IT) enterprise. In this research, the authors' based their study on five cyber infrastructure domains--a departure from the more granular seven domains found in a typical IT infrastructure. Figure 1 presents the five cyber infrastructure domains showing that all domains fall within the realm of the Physical Domain.

Figure 1. The five cyber infrastructure domains



For each domain, the authors' examined it, specified its predominant requirements, identified the controls to satisfy the requirements, and mapped those controls to the standards and frameworks that are described in the previous section of this article. The remainder of this section illustrates the application of the standards and frameworks to the requirements and controls that are found in each of the cyber infrastructure domains.

Physical Domain

The *Physical Domain* includes the equipment, devices, mechanisms, policies, and controls that are used to physically secure the cyber assets. Examples of these are locks, gates, fences, alarm systems, computing devices and storage, and badges, among others. The four critical security requirements of the physical domain are as follows:

1. **Security of Physical Access to Assets:** Requires the protection of physical assets through the implementation and monitoring of secure access mechanisms.
2. **Training of Physical Security Personnel:** Involves the periodic training of personnel on both physical and cybersecurity.
3. **Facility Management:** Entails the implementation and enforcement of safety and health policies, the maintenance of facilities to enable smooth operations, the creation of contingency plans including power and data backups, and the record keeping of physical incidents and assets.
4. **Asset Management:** Includes the safeguarding and handling of information assets. It also involves the proper transfer, backup, and destruction of information storage systems and devices.

The mapping of the requirements and controls with the frameworks and standards for the physical domain is depicted in Table 2.

Table 2. The Physical Domain Requirements and Controls

Requirements	Controls	Frameworks and Standards
Secure physical access to assets	· Physical asset and activity monitoring · Event Logs · Physical access mechanism	COBIT 2019: DSS 01.03 CIS: 1, 12, 14 NIST 800-37 Rev 2: Task P-10 NIST 800-53 Rev 4: AC-3, PE-6, PS-1
Physical security personnel adequately trained	· Periodic cybersecurity awareness training	COBIT 2019: APO 07.03 CIS: 17 NIST 800-37 Rev 2: Task P-17 NIST 800-53 Rev 4: AT-2, AT-3, AT-4
Facility management	· Regular monitoring and testing of uninterruptible power supplies · Records of facility incidents · Maintained compliance with safety and health regulations	COBIT 2019: DSS 01.05 CIS: 9, 17 NIST 800-37 Rev 2: Task P-15 NIST 800-53 Rev 4: AC-3, PE-2, PE-3, PE-6
Asset management	· Formal process of disposition, transfer, and removal of IT assets	COBIT 2019: BAI 09.03 CIS: 1 NIST 800-37 Rev 2: Task M-7 NIST 800-53 Rev 4: MP-2, MP-3, MP-4, MP-5, MP-6, PE-20

User Domain

The *User Domain* includes the various users that maintain and interact with the cyber assets. It also includes the access and authorization mechanisms whose purpose is to protect the cyber system from unauthorized access. The four critical security requirements of the user domain are as follows:

1. **Identification and Management of Users:** Entails the documentation and delineation of user responsibilities.
2. **User Training:** It is imperative that all users undergo periodic security awareness security training.
3. **Identity Management, Authentication and Access Control:** The management of user credentials and the provision for user access, authentication and authorization mechanisms.

4. **Continuous Security Monitoring:** Entails the continuous and persistent monitoring of user activities.

The mapping of the requirements and controls with the frameworks and standards for the user domain is depicted in Table 3.

Table 3. The user domain requirements and controls

Requirements	Controls	Frameworks and Standards
Identify and manage users	· Documented cybersecurity roles and responsibilities	COBIT 2019: APO 01.02, 07.06, DSS 06.03 CIS: 17, 19 NIST 800-37 Rev 2: Task S-4 NIST 800-53 Rev 4: AC-1, AC-2, AC-5, AC-6
Train users on cybersecurity awareness	· Periodic cybersecurity personnel awareness training	COBIT 2019: APO 07.03, BAI 05.07 CIS: 17 NIST 800-37 Rev 2: Task P-17 NIST 800-53 Rev 4: AT-2, AT-3, AT-4
Identity management, authentication and access control	· Managed identities and credentials for users · Managed access and authorizations for users · Authentication of users	COBIT 2019: DSS 05.04, 05.10, 06.03 CIS: 1, 5, 12, 14, 15, 16 NIST 800-37 Rev 2: Task M-1 NIST 800-53 Rev 4: AC-1, AC-3, CM-5, CM-10, IA-5
Continuous monitoring of user activities	· Monitored personnel cyber activity for potential cyber incidents	COBIT 2019: DSS 05.07 CIS: 5, 7, 14, 16, 17 NIST 800-37 Rev 2: Task M-2 NIST 800-53 Rev 4: AC-6, AC-7, AC-8

Communication Domain

The *Communication Domain* includes the network systems and peripherals that facilitate the transfer of information from one cyber endpoint to another. It also includes the various communication media, such as fiber optics, copper cables, and radio waves. In addition, this domain considers mechanisms that facilitate secure data transmissions. The five critical security requirements of the communication domain are as follows:

1. **Management of Communication Assets:** Communication assets must be managed and secured. Controls for this requirement include the mapping and tracking of communication flow and a periodic vulnerability assessment of communication assets.
2. **Manage Device Authentication and Access Control:** Entails the provision for device authentication and access control for the protection of system and data integrity and confidentiality.
3. **Network Defense:** Includes securing the network and all its peripherals.
4. **Continuous Monitoring of Network Behavior:** Similar to the constant monitoring of user behavior, network traffic must also be monitored for abnormal behavior.

5. **Incident Response and Recovery:** Entails the creation and maintenance of the organization's incident response and recovery plans.

The mapping of the requirements and controls with the frameworks and standards for the communication domain is depicted in Table 4.

Table 4. The communication domain requirements and controls

Requirements	Controls	Frameworks and Standards
Manage communication assets	· Mapped organizational communication and data flows · Vulnerability assessment	COBIT 2019: DSS 05.02 CIS: 12, 16 NIST 800-37 Rev 2: Task A-3 COBIT 2019: APO 12.01, 12.02, 12.03 CIS: 3 NIST 800-53 Rev 4: CA-2, RA-5
Manage device authentication and access control	· Managed remote access · Protected network integrity · Authenticated network devices	COBIT 2019: APO 13.01, DSS 01.04 COBIT 2019: DSS 01.05, 05.02 CIS: 9, 14, 15, 18 NIST 800-37 Rev 2: Task P-11 COBIT 2019: DSS 05.04, 05.10, 06.10 CIS: 16 NIST 800-53 Rev 4: AC-17, AC-18, IA-3, SC-40, SC-41
Network Defense	· Protected communication and control networks	COBIT 2019: DSS 05.02, APO 13.01 CIS: 8, 9, 12, 14, 15 NIST 800-37 Rev 2: Task R-2 NIST 800-53 Rev 4: PE-9, SC-8, SC-10, SC-41
Continuous monitoring of network behavior	· Monitored network for potential cyber incidents · Periodic network vulnerability scan	COBIT 2019: DSS 01.03, 03.05, 05.07 CIS: 1, 7, 8, 9, 12, 14, 15, 16 COBIT 2019: BAI 03.01, DSS 05.01 CIS: 3, 20 NIST 800-37 Rev 2: Task S-5 NIST 800-53 Rev 4: CA-7, SI-4
Incident response and recovery	· Incident response plan · Recovery plan	COBIT 2019: APO 12.06, BAI 01.10 DSS 01.03, 02.02, 03.04 CIS: 19 NIST 800-37 Rev 2: Task A-5 COBIT 2019: APO 12.06, DSS 02.05, 03.04 CIS: 10

Information Domain

The *Information Domain* includes the data that is either transmitted, processed, or stored. Depending on its purpose, it may be presented on various forms: plain, compressed, encrypted, digital, or analog. The four critical security requirements of the information domain are as follows:

1. **Data Protection:** Entails the provision to protect the confidentiality and integrity of information that are critical to the organization.

2. **Data Availability:** The availability of information is an important factor in day-to-day operations of an enterprise and thereby, should always be enabled.
3. **Data Backup:** Demands that provisions must be in place for data to be stored, monitored, reviewed, and restored whenever necessary.
4. **Manage Data Assets:** The management of data assets must include the policy to store, dispose, share, transmit and destroy information as needed.

The mapping of the requirements and controls with the frameworks and standards for the information domain is depicted in Table 5.

Table 5. The information domain requirements and controls

Requirements	Controls	Frameworks and Standards
Data protection	· Stored data protection mechanisms · Transmitted data protection mechanism · Data leak prevention mechanism	COBIT 2019: APO 01.06, BAI 02.01, 06.01 CIS: 13 COBIT 2019: APO 01.06, DSS 05.02 06.06 CIS: 5, 13, 14, 15 COBIT 2019: APO 01.06, BAI 04.04 CIS: 1, 2, 13, 16 NIST 800-37 Rev 2: Task P-10 NIST 800-53 Rev 4: AC-21, MP-2, MP-4, MP-6, MP-7, SC-8
Data availability	· Mechanism to ensure data availability	COBIT 2019: APO 13.01, BAI 04.04 CIS: 1, 2, 13 NIST 800-37 Rev 2: Task P-11 NIST 800-53 Rev 4: SC-5, SC-6
Data backup	· Process for maintaining and testing data backup	COBIT 2019: APO 13.01, DSS 01.01, 04.07 CIS: 10 NIST 800-37 Rev 2: Task P-13 NIST 800-53 Rev 4: CP-6, CP-9, MP-4
Manage data assets	· Managed data repository, asset removal, transfer and disposition	COBIT 2019: BAI 09.03 CIS: 13, 14, 16 NIST 800-37 Rev 2: Task P-12 NIST 800-53 Rev 4: PE-19, SC-8

System and Application Domain

The *System and Application Domain* includes the software, categorized as either system or application. The system software manages the operations of the cyber devices and provides the platform for the application software to operate. Examples of system software are the various operating systems such as Mac OS, Windows, Linux, and Solaris. The application software performs specific tasks for the users. Examples of application software are database management systems, web browsers, image processing software, and other productivity software. The four critical security requirements of the system and application domain are as follows:

1. **Software Asset Management:** Entails the provision for the inventory, prioritization, proper utilization, legitimate acquisition, transfer, and disposal of software assets.
2. **Software Risk Assessment:** Requires the periodic vulnerability assessment and threat evaluation of software assets.
3. **Software and System Security:** Entails establishing security baseline and integrity checking of software assets.
4. **Protection Processes and Procedures:** Entails the provision for processes and procedures for software change/patch management, secure software and system development and maintenance of software/system audit log.

The mapping of the requirements and controls with the frameworks and standards for the system and application domain is depicted in Table 6.

Table 6. The system and application domain requirements and controls

Requirements	Controls	Frameworks and Standards
Software asset management	· Inventory of system and application software · Formal process of disposition, transfer, and removal of software assets · Process to prioritize software asset based on criticality and value to business	COBIT 2019: BAI 09.01, 09.02, 09.05 CIS: 2 NIST 800-37 Rev 2: Task P-10 COBIT 2019: BAI 09.01, 09.02 CIS: 2, 13 COBIT 2019: APO 03.03, 03.04 12.01 CIS: 4, 13, 14 NIST 800-53 Rev 4: AC-1, AC-3, CM-11, MA-1
Software risk assessment	· Software and system assessment for vulnerabilities · Identification and documentation of software and system threats	COBIT 2019: APO 12.01, 12.02, 12.03 CIS: 3 NIST 800-37 Rev 2: Task R-2 COBIT 2019: APO 12.01, 12.02, 12.03 CIS: 3, 4, 18 NIST 800-53 Rev 4: CA-8, PL-2, SI-4
Software and system security	· Software and system integrity checking mechanism · Established and documented system and software baseline configuration	COBIT 2019: APO 01.06, BAI 06.01, DSS 06.02 CIS: 2, 3 COBIT 2019: BAI 10.01, 10.02, 10.03 CIS: 3, 9, 11, 12, 14, 16 NIST 800-37 Rev 2: Task P-4 NIST 800-53 Rev 4: AC-20, CM-10, SI-7
Protection processes and procedures	· Implementation of a secure system and software development life cycle · Process for configuration change control · Maintained and documented software and system audit/log records	COBIT 2019: APO 13.01, BAI 03.01, 03.02, 03.03 CIS: 18 COBIT 2019: BAI 01.06, 06.01 CIS: 3, 11 COBIT 2019: APO 11.04, BAI 03.05, DSS 05.04, 05.07 CIS: 6 NIST 800-37 Rev 2: Task C-2 NIST 800-53 Rev 4: AU-1, AU-2, AU-3, AU-4, AU-9

FUTURE RESEARCH DIRECTIONS

The complexity of the cyber threat and risk landscape portends the difficulty of developing and implementing an audit model that is robust, efficient, and adaptable to the rapid changes and advancements in cyber technologies. Adherence to established standards and frameworks provides guidelines and best practices with which the cybersecurity audit process could depend on. However, there are issues related to the process that remain unresolved or in need of some improvement. In this regard, the authors propose that following research directions:

- Investigate the use of blockchain technology to promote the validation and verification of internal controls;
- Design and develop digital transactions that are recorded on a digital and distributed ledger;
- Develop and implement metrics for cybersecurity audit; and
- Develop and implement a process for mapping cybersecurity controls with regulatory compliance.

CONCLUSION

The integration of cyber infrastructure into the enterprise compels organizations to judiciously build and develop a sound organizational culture on cybersecurity and a set of mechanisms to defend against cyberattacks. To this end, an organization must enable an independent entity with an oversight function to ensure that the cyber related activities are securely performed, and information resources are protected.

This article presents three risk mitigation defenses suggested by the Institute of Internal Auditors, which include suggestions for establishing appropriate positions and policies to address cyber risks, along with regular independent evaluations by internal auditors. To allow for even greater independence, the AICPA provides a reporting framework in which external Certified Public Accountants can be engaged to conduct a cybersecurity risk management examination. Any system of attestation requires an appropriate set of audit objectives upon which to base the evaluation. This research considers criteria for the assessment of cybersecurity objectives that were created by cybersecurity auditing standards and frameworks from four prominent authoritative bodies. It posits a cyber infrastructure that is composed of five domains and the cybersecurity requirements of each domain. Subsequently, internal controls are suggested to satisfy the cybersecurity requirements and mapped to the auditing standards and frameworks that cover the Risk Management Framework (RMF). Lastly, the article illustrates the invaluable benefit of using the standards and frameworks towards the development and implementation of internal controls for cybersecurity.

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KEY TERMS AND DEFINITIONS

Audit Committee: A committee composed of outside members of a company’s board of directors, that is responsible for oversight involving a company’s internal controls and information reporting.

Blockchain: A digital register or ledger which embodies a permanent, time stamped, and cryptographically validated record of transactions.

Cyber Infrastructure: A collection of information technology systems and software, physical and information assets, processes, and people that enables an organization to efficiently and securely function on cyberspace.

Cybersecurity: A set of processes, practices, and technologies designed to protect, on the realm of cyberspace, the three tenets of information security: confidentiality, integrity, and availability.

Frameworks: A grouping of rules and related concepts into a logical approach that can be used to identify complex problems and decide upon appropriate courses of action to address them.

Internal Audit: A group of professionals who work within an organization to perform an independent appraisal activity to achieve efficiency and effectiveness in regard to both operating activities and information reporting.

Regulatory Compliance: The state of being in conformance to the requirements of a relevant law, policy, or regulation.

Security Metric: A quantitative, repeatable, accurate, and scalable measurement of an organization’s security posture.

Security Monitoring: A process of data collection, analysis, and detection with the goal of proactively securing an organization.

Standards: A set of rules that can be monitored for compliance by a specialized field’s authoritative bodies and related professionals.

Threat and Risk Assessment Using Continuous Logic

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INTRODUCTION

The chapter presents a method to help assessing threats and their associated risks. Threat and Risk Assessment encompass a wide area, ranging from building construction to network and computer security through automotive design and construction, and many others such as Supervisory Control And Data Acquisition (SCADA), Energy Management System (EMS) systems among others, many of them closely associated with computer and networks systems.

Assessing threats and the risks associated to them implies several tasks such as identifying threat and risks, detecting them and their level of danger to a particular organization cybersecurity system, as well as to decide what to do with a specific threat, the costs of prevention or correction, the consequences of the actual risks occurring or, alternatively, not paying any attention to them, disregarding them.

Properly identifying, recognizing, making out a possible threat is the first step in this process; consequently, to have a list of characteristics, traits, attributes or requirements can be of help in that task. Therefore, it is necessary in first place to clearly define the set of requirements that can be of use in identifying threats and their related risks. Second, it is important to have a method that using those requirements eases the building of a model that assist people in charge with the job of assessing threats and risks in order to make well informed decisions on the matter.

The method proposed here is aimed at giving help in the area of cybersecurity and it is based on the Framework for Improving Critical Infrastructure Cyber security developed by the National Institute of Standards and Technology (NIST). The proposal integrates this framework with a quantitative method based on the use of a Continuous Logic, the Logic Scoring of Preference (LSP) method. LSP is a method suitable for decision making that provides the guidelines to produce a model/tool to assist the expert in the process of assessing how much a product or system satisfy a number of requirements, in this case associated to the identification, protection, detection, response and recovery of threat and risks in an organization. More specifically, the proposal is aimed to supplement steps 3 to 5 in the NIST program (NIST, 2018) with the necessary activities to develop a quantitative LSP model for assessing threat and risks in an organization. Therefore starting from a set of requirements taken from the NIST Framework, and applying the LSP method, a decision model can be developed. The resulting model can be used as an effective tool to assist professionals in the process of assessing potential threats and risks involved in any kind of organization, be it industrial, service, utilities, etc., providing a global indicator as well as a set of partial indicators, for each system under evaluation. These indicators are values in the interval [0; 100]; the global indicator represents the stage in which a system under evaluation is with respect to

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the whole set of critical threat and risk requirements identified and, in the case of the partial indicators, to cohesive subgroups of requirements.

BACKGROUND

The next two subsections discuss related work on threat and risk assessment and introduce some concepts of the LSP method necessary to understand the rest of the work.

Threat and Risks Assessment

Threat and Risk Assessment is part of an ongoing process of identifying, assessing, and responding to risk. Threat and Risk Assessment in cyber security contexts is becoming more and more a concern for organizations of any kind, i.e. industrial, utilities, service oriented, etc., since computers and networks have penetrated nearly every activity. Organizations increasingly have the need to assess the potential threats and the risks involved in their processes and infrastructures. Not only commercial and government institutions but also utilities are aware of the potential threats to their infrastructures. Many open source and proprietary methods exist today to perform a risk and threat assessment, some focused on specific types of risk and some focused on specific business sectors. Of course the problem of threat and risk assessment is also considered in settings where security is a concern in a wider sense, for instance the threats and risks confronted in cyber terrorism, cyber war, and other similar scenarios; an overview of this can be found in Lewis, J. A. (2002). The threats and risks involved in unmanned aerial vehicles (UAVs) are also considered in Hartmann, K., Steup, C. (2013). In Ciapessoni, E. et al. (2018) the authors developed a method based on probabilities considering that threats can go from natural disasters to deliberate acts of sabotage.

There are also US patents on the subject such as Magdych et al. (2003), and Kelley, J. D., Lahann, J. S., Mackey II, D. H. (2006).

In Cherdantseva, Y. et al. (2016) there is a review of Threat and Risk assessment methods for Supervisory Control And Data Acquisition (SCADA) systems of great size and scope. It must be considered that SCADA systems are prone to attacks that can have serious consequences, e.g. Stuxnet malware (Zetter, K. 2019). Also Bayne, J. (2002) furnishes an overview of the whole process of Threat and Risk Assessment. There are also guides to risk management such as ISO 31000 (2018).

There is an extensive literature on security and network structure concerning smart grid environments, e.g. a Threat and Risk Assessment methodology, presented in Smith P. (AIT), Editor. (n.d.), where a “threat identification approach, based on attack graphs” is proposed. They use *Semantic Threat Graphs* (STGs) as “a tool to precisely determine the necessary countermeasures for the identified threats”.

Also the European Network and Information Security Agency (ENISA) analyzes in ENISA (2010) the future risks in a scenario of future air travel, where Internet of Things (IoT) and Radio Frequency Identification (RFID) technologies are used. The methodology employed is based on the standard ISO/IEC 27005:2008 Information technology — Security techniques — Information Security Risk Management. A very detailed “Vulnerabilities and Threats List” has been developed. A “Risk Identification and Assessment” is considered based on three elements, i.e. $\text{Risk} = f(\text{Asset}, \text{Vulnerability}, \text{Threat})$. A spread sheet was elaborated as part of the development (ENISA, n.d.).

Webb, J., Ahmad, A., Maynard, S. B., & Shanks, G. (2014) posit that they have identified deficiencies in Information Security Risk Management (ISRM), so they propose a Situation Awareness (SA) for ISRM model.

The Logic Score of Preference (LSP) Method

The Logic Scoring of Preference (LSP) method (Dujmovic, J. J., 1996, 1997, 1997b, 2007, 2018) has been adopted in this work as an integral part of the proposed threat and risk assessment decision methodology. LSP is a method for the realization of complex criterion functions and their application in the area of decision, evaluation, optimization, comparison and selection of general complex systems.

Since it is a general decision and evaluation method, it can be applied to different scenarios, particularly to the processes involved in threat and risks evaluation and decision. Given that LSP is not a simple additive scoring method, it is especially useful where the use of complex *and/or* decisions is necessary.

As in many other methods, initially in LSP the user requirements must be clearly determined, i.e. the main attributes to be taken into consideration for the model under development, as well as their corresponding preference values must be defined. These are generally organized in the form of a hierarchical tree, where the leaves of the tree correspond to the attributes to be evaluated. These attributes are called *performance variables*. Each one of these variables is then mapped into an *elementary preference* by defining and applying the corresponding *elementary criterion*, as the schema on Figure 1 shows.

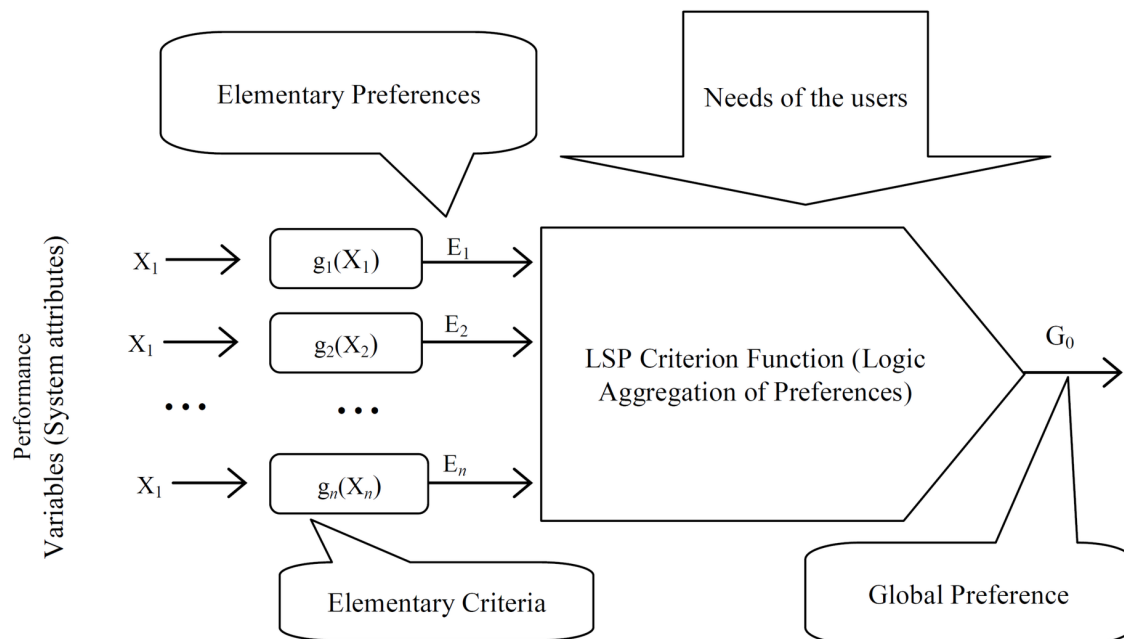
An elementary criterion is a function that transforms a performance variable (real value) into an elementary preference (value in the interval [0; 100]). An elementary preference represents the degree of fulfillment of a requirement, where 0 means that the requirement has not been fulfilled at all and 100 that it has been completely satisfied.

The elementary preferences, obtained from the transformation of each performance variable via their corresponding elementary criteria, are used as input to the LSP *Criterion Function* or *Aggregation Structure*, as Figure 1 shows. These preferences are iteratively aggregated until a single global indicator of the degree of fulfillment of the whole system requirements can be obtained. More specifically, the aggregation structure creation process starts by aggregating elementary preferences by means of a set of operators provided by the LSP method. Aggregating a set of elementary preferences means to replace a group of them by a single output preference, which is a partial indicator of the degree of satisfaction with respect to the group of aggregated preferences. These output preferences are then aggregated again until a single output global preference G_0 is obtained. During this process, not only the elementary and partial preferences must be aggregated but it is also necessary to take into account both the relative importance of each preference as well as the necessary logic relationship between them.

The calibration of the LSP Criterion Function represents the most complex phase in the whole process, since not only it is necessary to take into account the needs of end users but also to validate the model to preserve the representation condition, i.e. the behaviour of the measures in the model to be the same as the corresponding entities in the real world.

Once the calibration of the LSP Criterion Function has finished, the evaluation process of threat and risks can start. It means that the values corresponding to each of the performance variables of the system under evaluation must be collected and provided as input to the model to finally obtain a global performance indicator, corresponding to the degree of compliance to the threat and risks assessment requirements, as well as a series of partial indicators corresponding to each of the subcategories considered in the requirement tree.

Figure 1. An overview of the LSP method evaluation process



The numbers delivered by the model point up the degree of compliance of the security implementations as well as the likelihood of risks that the organization is under. Both the partial indicators as well as the global indicator will assist stakeholders –normally, the threat and risks assessment team– on making decisions about the assessment.

The NIST’s Framework for Improving Critical Infrastructure Cybersecurity

The Cybersecurity Enhancement Act of 2014 granted The National Institute of Standards and Technology with the “role of identifying and developing cybersecurity risk frameworks for voluntary use by critical infrastructure owners and operators.”. (NIST, 2018). The Framework was developed with cybersecurity for critical infrastructures in mind, but it can be used by institutions of any size, degree of risk or sophistication.

There are diverse standards, guidelines, and practices, referenced to by the Framework which allow the organizations to describe their current cybersecurity posture; depict their target state for cybersecurity; identify and prioritize opportunities for improvement within the context of a continuous and repeatable process; assess progress toward the target state and communicate among internal and external stakeholders about cybersecurity risk.

The framework can be used in different ways by organizations. A first direct application is to compare the organization’s current cybersecurity activities with those outlined in the Framework Core. In this way, executives can obtain a feedback about a fundamental question: “How are we doing?” and, consequently, strengthen their cybersecurity practices where and when deemed necessary.

The framework also provides a common language to communicate requirements among stakeholders responsible for the delivery of different services to an organization.

An important use of the framework is establishing or improving a cybersecurity program. In (NIST, 2018) a number of steps to create a new cybersecurity program or improve an existing one are given, namely

Step 1: *Prioritize and Scope*. The organization identifies its business/mission objectives and high-level organizational priorities. With this information, the organization makes strategic decisions regarding cybersecurity implementations and determines the scope of systems and assets that support the selected business line or process.

Step 2: *Orient*. Once the scope of the cybersecurity program has been determined for the business line or process, the organization identifies related systems and assets, regulatory requirements, and overall risk approach. The organization then consults sources to identify threats and vulnerabilities applicable to those systems and assets.

Step 3: *Create a Current Profile*. The organization develops a current profile by indicating which category and subcategory outcomes from the Framework Core are currently being achieved. If an outcome is partially achieved, noting this fact will help support subsequent steps by providing baseline information.

Step 4: *Conduct a Risk Assessment*. This assessment could be guided by the organization's overall risk management process or previous risk assessment activities. The organization analyzes the operational environment in order to discern the likelihood of a cybersecurity event and the impact that the event could have on the organization. It is important that organizations identify emerging risks and use cyber threat information from internal and external sources to gain a better understanding of the likelihood and impact of cybersecurity events.

Step 5: *Create a Target Profile*. The organization creates a Target Profile that focuses on the assessment of the Framework Categories and Subcategories describing the organization's desired cybersecurity outcomes. Organizations also may develop their own additional Categories and Subcategories to account for unique organizational risks. The organization may also consider influences and requirements of external stakeholders such as sector entities, customers, and business partners when creating a Target Profile. The Target Profile should appropriately reflect criteria within the target Implementation Tier.

Step 6: *Determine, Analyze, and Prioritize Gaps*. The organization compares the Current Profile and the Target Profile to determine gaps. Next, it creates a prioritized action plan to address gaps – reflecting mission drivers, costs and benefits, and risks – to achieve the outcomes in the Target Profile. The organization then determines resources, including funding and workforce, necessary to address the gaps. Using Profiles in this manner encourages the organization to make informed decisions about cybersecurity activities, supports risk management, and enables the organization to perform cost-effective, targeted improvements.

Step 7: *Implement Action Plan*. The organization determines which actions to take to address the gaps, if any, identified in the previous step and then adjusts its current cybersecurity practices in order to achieve the Target Profile. For further guidance, the Framework identifies example Informative References regarding the Categories and Subcategories, but organizations should determine which standards, guidelines, and practices, including those that are sector specific, work best for their needs.

Any or all of these steps should be repeated as needed to assess and improve cybersecurity in an organization.

The method proposed here is intended to be of help especially in steps 3 to 5. Building the requirement tree and the LSP Criterion Function provides the organization with a model that reflects the organization needs and the desired cybersecurity requirements, i.e. an ideal target profile. At the same time, its

application to the actual practices makes available a current profile and the possibility of assessing the potential risk, creating action plans and achieving new evaluations in a future.

THE THREAT AND RISKS ASSESMENT MODEL DEVELOPMENT PROCESS

As assessing the threats and the associated risks is of crucial importance to organizations, making the right decisions in that assessment is also important for those involved in the decisions. What are the possible threats?; have we identified all the possible threats?; what is the degree of danger of an identified threat?; can it safely be ignored, since the probability of its occurrence is very low and the cost of taken it in consideration is too high?; is the risk of a threat very low?; have the organization the means to recovery given the occurrence of a specific risk?. These and many more questions are confronted by that people concerned with threat and risk assessment. It is not easy to answer them without resorting to some kind of tools, to recognize possible threats and the risks involved and what to do about them.

Having this motivation in mind, the authors propose the adoption of the method presented here for the development of an assessment model, which is based on requirements taken from the Framework for Improving Critical Infrastructure Cybersecurity by the National Institute of Standards and Technology Version 1.1 (NIST, 2018), and the guidelines of the Logic Scoring of Preference (LSP) method, a soft computing method suitable to help in evaluation and decision making. The NIST Framework is used to identify the requirements associated to threats and risks identification, protection, detection, response and recovery, while the LSP method provides the activities and techniques for the development of a quantitative model built on the basis of NIST Framework requirements.

The following subsections describe the Threat and Risk Assessment model development process that can be adopted when conducting a risk assessment phase in a cybersecurity program.

Threat and Risks Assessment Requirements

An important point when building a model is determining the organization needs. In the first place, the organization must determine the scope of the systems to be evaluated since different business lines or processes within an organization may have different business needs and associated risk tolerances. The same occurs when using the NIST Framework: “To account for the unique cybersecurity needs of organizations, there are a wide variety of ways to use the Framework. The decision about how to apply it is left to the implementing organization.” (NIST, 2018, p. vi). Besides that, NIST establishes that “Because each organization’s risks, priorities, and systems are unique, the tools and methods used to achieve the outcomes described by the Framework will vary.” (NIST, 2018, p. 2). These considerations and other similar ones also apply to the Threat and Risk Assessment model presented here.

Therefore, the first activity when developing an assessment model will be to determine the user’s needs and build a requirement model. Also the LSP method prescribes it as the initial activity, resulting in a hierarchical structure named *requirement tree* as main artifact, which will hold all the non functional requirements, i.e. the characteristics, sub-characteristics and attributes considered for the evaluation process.

A computable characteristic is one that cannot be measured in a direct way and whose value is obtained from other sub-characteristics or attributes that define it, i.e. they represent high level abstraction concepts. A sub-characteristic is also a computable characteristic, while an attribute or performance variable corresponds to a leaf of the requirement tree and can be measured in a direct way or by applying a specific metric.

To develop the threat and risks requirement tree, the five Functions of the NIST Framework Core (NIST, 2019) (Identify, Protect, Detect, Respond, Recover) can be considered as the top level characteristics in the requirement tree. “The Framework Core then identifies underlying key Categories and Subcategories – which are discrete outcomes – for each Function, and matches them with example Informative References such as existing standards, guidelines, and practices for each Subcategory.” (NIST, 2018, p.3). The categories and subcategories mentioned above will form part of the tree as sub-characteristics or performance variables. They are presented in (NIST, 2018, p.3) in table format and have a hierarchical arrangement with four items (columns): Functions, Categories, Subcategories and Informative References.

When adopting the whole NIST Framework Core, the resulting requirement tree model will consist of five Functions, twenty three Categories, one hundred and eight Subcategories, and five hundred and four Informative References, some of these last ones sometimes subdivided as well. Informative References seem to be the obvious choice for the performance variables in the requirement tree model. They could be a great help in assigning the values needed during the evaluation process.

Table 1 shows only the first two levels of the requirement model based on the Framework Core, while Table 2 shows all the requirements for the Category Communications (RC.CO), under the top level function RECOVER (RC). RC.CO contains three subcategories and seven Informative References that are as well subdivided, which for reasons of space are shown abbreviated.

Table 1. The first two levels in the Framework Core (NIST, 2019)

Function	Category
IDENTIFY (ID)	Asset Management (ID.AM):
	Business Environment (ID.BE):
	Governance (ID.GV):
	Risk Assessment (ID.RA):
	Risk Management Strategy (ID.RM):
	Supply Chain Risk Management (ID.SC)
PROTECT (PR)	Identity Management, Authentication and Access Control (PR.AC)
	Awareness and Training (PR.AT)
	Data Security (PR.DS)
	Information Protection Processes and Procedures (PR.IP)
	Maintenance (PR.MA)
	Protective Technology (PR.PT)
DETECT (DE)	Anomalies and Events (DE.AE)
	Security Continuous Monitoring (DE.CM)
	Detection Processes (DE.DP)
RESPOND (RS)	Response Planning (RS.RP)
	Communications (RS.CO)
	Analysis (RS.AN)
	Mitigation (RS.MI)
	Improvements (RS.IM)
RECOVER (RC)	Recovery Planning (RC.RP)
	Improvements (RC.IM)
	Communications (RC.CO)

Table 2. Subcategories and Informative References of Category Communications (RC.CO) of Function RECOVER (RC). (NIST, 2019)

Function	Category	Subcategory	Informative References		
RECOVER (RC)	Communications (RC.CO):	RC.CO-1	COBIT 5 (COBIT® 5. 2012, pp39, 40)	EDM03.02	Activity 1
					to
					Activity 6
			ISO/IEC 27001:2013	A.6.1.4 (ISO/IEC 27001. 2013, p. 10)	Appropriate contacts
					Comm. a)
					to
		RC.CO-2	COBIT 5 (COBIT® 5. 2012, p 214).	MEAO3.02	Comm. e)
					Activity 1
					Activity 2
			ISO/IEC 27001:2013 (ISO/IEC 27001. 2013, p. 6)	Clause 7.4	Comm. a)
					to
					Comm. e)
		RC.CO-3	COBIT 5 (COBIT® 5. 2012, p 111)	APO12.06	Activity 1
					to
					Activity 4
			ISO/IEC 27001:2013 (ISO/IEC 27001. 2013, p. 6)	Clause 7.4	Comm. a)
					to
					Comm. e)
			NIST SP 800-53 Rev. 4	CP-2 (NIST, 2013, pp. F-129, F-131)	CP-2(1)
					to
					CP-2(8)
				IR-4 (NIST, 2013, pp. F-177, F-181)	IR-4(1)
					to
					IR-4(10)

Elementary Criteria for the NIST Framework's Informative References

The next activity, prescribed by the LSP method, consists in the definition of an *Elementary Criterion* for each attribute in the requirement tree, in this case for each informative reference considered. An elementary criterion is a metric that returns a value in the Real interval [0; 100], which represents the fulfillment degree of the respective attribute in the system under evaluation and is referred to as *elementary preference*. During the evaluation process, the performance variables are transformed into elementary preferences by means of the application of their corresponding elementary criteria.

The definition of adequate elementary criteria is part of the work to be done when a model is developed. During the model calibration, sometimes elementary criteria must be modified if it proves necessary to fine-tune the model and preserve the representation condition.

During the process of elementary criteria definition, NIST Framework's Informative References must be taken into consideration. Many of the defined metrics will be direct, i.e. a resulting elementary preference takes the same value assigned to the corresponding performance variable, which sometimes can be obtained from expert's opinions or by simple observation. In other cases, an indirect metric will be necessary, e.g. the Informative Reference MEA03.02 (*IT compliance and support for business compliance with external laws and regulations*) shown in Table 2, which is part of the subcategory RC.CO-2 in COBIT 5, has two Activities. Activity 2 instructs to "Communicate new and changed requirements to all relevant personnel." (COBIT® 5, 2012). This implies that whoever is in charge should produce a list of new and changed requirements and a list of the relevant personnel to whom that should be communicated. Equation 1 shows the elementary criterion $MEA03.02_{A2}$ defined for Activity 2 as the mean value between the percentage of changed requirements effectively received by the relevant personnel and the percentage of new requirements effectively received by the relevant personnel. In Equation 1, $\#New$ denotes the total number of new requirements; $\#Changed$ the total number of changed requirements; NP the total number of relevant personnel to whom the new requirements should be communicated; $\#NewRec_i$ the total number of new requirements effectively received by the relevant personnel i . CP the total number of relevant personnel to whom the changed requirements should be communicated; $\#ChRec_i$ total number of changed requirements effectively received by the relevant personnel i .

$$MEA03.02_{A2} = \left(\frac{\sum_i^{NP} \#NewRec_i \times 100}{\#New} + \frac{\sum_i^{CP} \#ChRec_i \times 100}{\#Changed} \right) / 2 \quad (1)$$

To properly evaluate $MEA03.02_{A2}$, the threat and risks assessment team will have to gather the necessary data for applying the elementary criteria shown in Equation 1, i.e. consulting the appropriate personnel to verify whether the task prescribed in informative reference MEA03.02 has been completed, so as to obtain a correct estimation of the functioning of the involved personnel.

Aggregation of Preferences

Once the requirement tree has been constructed, a new activity can start: the construction of a quantitative threat and risk model. This model consists of an *aggregation structure* referred to as *LSP Criterion Function*, which is the result of a logic aggregation of preferences by means of an iterative process. The process starts with the aggregation of groups of related elementary preferences using GCD (Generalized Conjunction Disjunction) operators, provided by the LSP method, to obtain a group of partial preferences. These partial preferences are then iteratively aggregated by means of appropriated GCD operators until a single global indicator is finally obtained. Therefore, each partial indicator is the result of the aggregation of at least two partial or elementary preferences. In this way, step by step and applying this aggregation procedure, the partial indicators can be conveniently arranged to produce a single global indicator that represents the degree of fulfillment of all the requirements arranged into the requirement tree.

More specifically, to aggregate n elementary preferences $E_1, \dots, E_n$ in a single preference E_θ , i.e. the resulting preference E_θ interpreted as the percentage of satisfaction of the n requirements, is expressed by a function that has the following two properties:

1. The relative importance of each elementary preference E_i ($i = 1 \dots n$) is expressed by a weight W_i ,
2. $\min(E_1, \dots, E_n) \leq E_i \leq \max(E_1, \dots, E_n)$.

The GCD operators are obtained from the instantiation of the weighted power mean (Equation 2).

$$E(r) = (W_1 E_1^r + W_2 E_2^r + \dots + W_n E_n^r)^{1/r}, \quad (2)$$

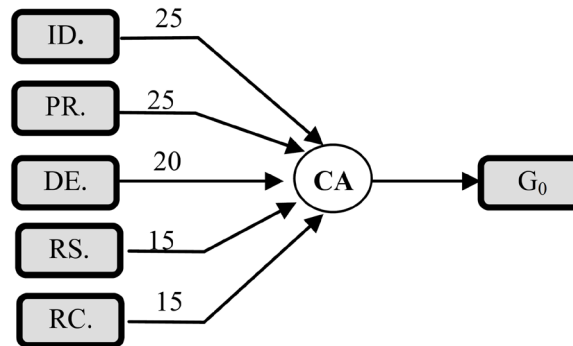
where $0 < W_i < 100$, $0 \leq E_i \leq 100$, $i = 1, \dots, n$, $W_1 + \dots + W_n = 1$, $-\infty \leq r \leq +\infty$

The choice of r determines the location of $E(r)$. For $r = -\infty$ the weighted power mean reduces to the pure conjunction and for $r = +\infty$ to the pure disjunction, giving place to a Continuous Preference Logic. The range between pure conjunction and pure disjunction is usually covered by a sequence of equidistantly located GCD operators named: C, C++, C+, C+−, CA, C−+, C−, C−−, A, D−−, D−, D−+, DA, D+−, D+, D++, D. For a more detailed description of the technique see Dujmovic, J. J. (1997), Dujmovic, J. J. (2007), Dujmovic, J.J. (2018).

As a result of the application of the proposed method, a threat and risk model can be developed and adapted to the particular needs of a given organization. Seven GCD operators have been mainly employed in the aggregation structures shown in this work: CA, C+−, C−, C−, A, DA y D++. Typically, strong simultaneity operators are used for aggregating mandatory inputs, while weak simultaneity operators are adopted in presence of desirable attributes, meaning that the presence of a value of 0 (zero) in any of the inputs do not produce a zero in the output as it happens when a strong conjunction operator is applied. Therefore, in these cases, operators as C− or C−− can be adopted since they represent weak quasi-conjunctions. Operators A, DA and D++ are adopted in presence of optional attributes. In conclusion, the chosen operators should become more and more conjunctive as more mandatory the characteristics aggregated are.

Figure 2 shows a possible final aggregation of the five top level preferences resulting from the aggregation of the five top level categories (IDENTIFY (ID), PROTECT (PR), DETECT (DE), RESPOND (RS), and RECOVER (RC)). These five partial preferences have been aggregated by the operator CA since they all have been judged to be mandatory, meaning none of them should be with a very low value. Note that the rounded rectangles on the left of the figure depict the top level preferences, which serve as inputs to the operator CA; each of them represent the abstraction of a partial aggregation structure.

Figure 2. Aggregation structure for the five top level functions



The weights associated to each elementary preference should be assigned by the person or persons in charge of threat and risk decision making. They must reflect the importance that each preference has in the decision model being constructed. This is also illustrated by Figure 3 and Figure 4, where different parts of the whole aggregation structure built for the requirement tree of Table 2 are shown. In these figures, circles represent GCD operators, rectangles correspond to elementary preferences and the weights are shown over the edges (arrows). Rounded rectangles in light grey do not form part of LSP method notation, they have been introduced to indicate partial preferences corresponding to the abstraction of the aggregation of a set of preferences in the requirement tree.

On Figure 3 a partial aggregation structure for Function RECOVER (RC) is presented. Only the labels of the corresponding categories and subcategories are shown. No Informative References are displayed.

Figure 3. Partial aggregation structure for Function RECOVERY (RC)

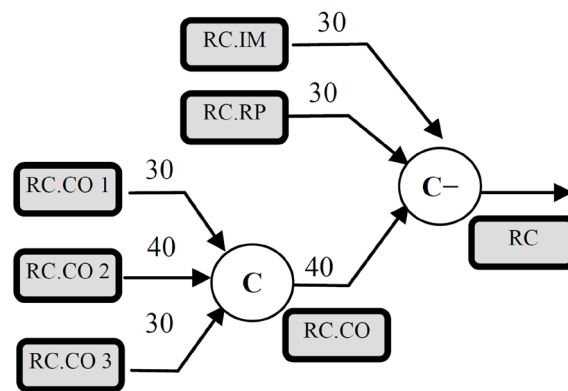
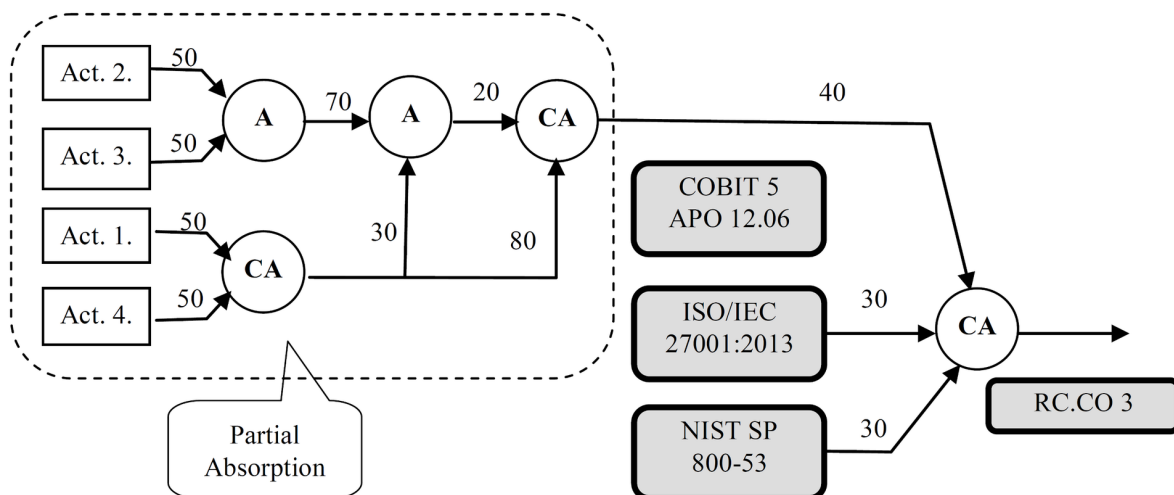


Figure 4. Aggregation structure for Subcategory RC.CO 3, showing a Partial Absorption for COBIT 5



In Figure 4 the aggregation structure built for subcategory RC.CO 3 (*Recovery activities are communicated to internal and external stakeholders as well as executive and management teams*) is shown. Since aggregation structures allow discriminating between mandatory or non mandatory preferences, they permit to graduate how mandatory a given preference is considered by using the adequate GCD operators. However, sometimes there are features considered optional and whose absence should not penalize the result of the whole evaluation. In this situation a particular LSP structure, referred to as *partial absorption*, can be used. This structure is useful when aggregating a mandatory preference with optional preferences. Hence, if the mandatory preference is equal to zero the result of the partial absorption will be zero whatever the values of the optional preferences are. In any other case, the output corresponds to a mean value in a given range (see Dujmovic (1985) for more details on this). In Figure 4 a partial absorption structure can be seen. It corresponds to the aggregation of the Informative Reference for COBIT 5 APO 12.06 and it is shown in the rectangle with a dotted line. In this structure, both preferences “Act. 1” and “Act. 4” have been considered mandatory, while preferences “Act. 2” and “Act. 3” have been deemed optional.

SOLUTIONS AND RECOMMENDATIONS

There is a wide literature having to do with threat and risk assessment since the subject cuts across many and different areas. In multiple cases not only methodologies to use in the assessment but also procedures and techniques dealing with the decisions to be taken in the assessment process can be found. There is also a substantial amount of guidelines and recommendations such as the one being used here, namely NIST Framework, or COBIT, ISO/IEC, etc.; however, although they are very thorough, they are not enough by themselves to make assessment decisions and many of those guidelines are in need of a complementary model that helps in making decisions on the assessment. In this regard, the proposed method in this chapter can be used to assist in the process of building a model for the assessment of threat and risks and then forming the right decisions.

It is important to note that the method proposed here allows the development of a model, that can be adapted to specific needs and at the same time refined by adopting recommendations of other frameworks, not only from NIST. For example, standards such as COBIT, ISO/IEC, could also be used to refine the scope of the requirements considered for building the quantitative model. Therefore, the final aggregation structure can be adapted to different organization requirements and particular needs, as well as the weights and GCD operators employed can be changed to better reflect the necessities of an organization.

FUTURE RESEARCH DIRECTIONS

The requirements and the aggregation structure shown in this chapter can, of course, be changed to be adapted to different needs and demands that are specific to an organization or area. Therefore, the possibility of applying the proposed method to create a new model for other areas of cybersecurity, such as Supervisory Control And Data Acquisition (SCADA), systems that are widely used in assorted environments, or power distribution, construction, etc., should also be possible.

Therefore, potential avenues to explore in future research directions can be found in considering other requirements and in changing the resulting aggregation structure, by taking into account different proposals for cybersecurity according to new fields or different needs.

CONCLUSION

Assessing threats and risks implies making decisions, i.e. identifying threats, what is and what is not a threat, what is the potential of an identified threat, can it be avoided or not, what are the risks associated with a given threat, how can those risks be confronted, what are the costs of them and many other aspects have to be considered when evaluating threats and risks. Every one of these questions –and of course several other– require to figure out, to decide how important the threat is as well as its associated risk. So having methodologies and tools supporting these decisions is of outstanding significance.

Every human organization is prone to be subject to threats and risks and suffer their consequences. Having a flexible and reliable method that help in identifying and making right decisions about threats and risks is of paramount importance for the organization.

The threat and risk assessment method proposed in the chapter can be of great help for those people whose task in an organization is to assess the possible threats and risks confronted by their institution. The method presented makes use of a list of requirements. These requirements are of help in identifying the threats and risks that are likely to be faced up to by an organization dealing with cybersecurity. So this list of requirements is crucial and should be taken into consideration when building a method that can be of help in recognizing possible threats and the risks to be come up against by a cybersecurity installation. The proposal presented has considered the requirements taken from the Framework for Improving Critical Infrastructure Cybersecurity of the National Institute of Standards and Technology. (NIST, 2018). As part of the proposed method, these requirements have been used as input for building a quantitative model by following the directions given by the Logic Score of Preference (LSP) method, a method based on a continuous logic for the evaluation and comparison of complex systems. The model resulting from the integration of the NIST framework and the LSP method returns a series of quantitative indicators that are suitable for discerning and detecting security flaws at different levels, therefore providing insight for the decision making processes involved in determining the possible actions to be done to improve whatever would be necessary in the security and possible mitigation of threats and their associated risks.

The combination of the NIST Framework with the LSP method provides a powerful tool to help in the assessment of the current status of the organization and also a starting point for adopting a decision on the course of action to be taken.

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KEY TERMS AND DEFINITIONS

Continuous Logic: A logic whose truth values can take continuous values in a given range (i.e. [0, 1], [0, 100]) instead of values like Truth or False.

Decision Method: A procedure, technique or planned way of arriving to a decision. Normally it could be said the decision is the process of making up one's mind. There are several decision methods ranging from very simple ones to more formal or axiomatic methods.

Decision Theory: The study of choices that a given agent can take.

Risk Assessment: Documenting the evaluation done of the possibility of occurrence of a risk as well as the damage associated and the measures to avoid it or at least mitigate the outcomes from the risk. Closely related with Risk Management.

Risk Management: Identify, evaluate, and assign priority to the potential risks with the goal of defining the methods, resources to minimize or mitigate the outcomes from the risk. Closely related with Risk Assessment.

Threat and Risk Assessment: Assessing risks is closely associated with a corresponding threat. Nearly any human endeavour has a potential threat and a risk correlated with it. Assessing both is mandatory in some areas, e.g. building construction, country security, network security, etc.

Threat Assessment: The manner of devising the possibility and importance of a potential threat.

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INTRODUCTION

Mobile phones are mainly targeted by malware and they can also be used in botnets. Mobile devices are equipped with high – end, power-intensive resources with more memory, and variety of sensors. These are mainly used to provide a majestic, rich and for a sophisticated purpose. As far as Windows and Mac dominate the laptop world, where Apple and Android rule the smartphone and the tablet universe. Mobile apps were offered for the general productivity and for information retrieval which includes email, calendar, contacts, messages, and weather information. Now a day's mobile phones are also targeted by phishing attacks. So we can't say that mobile phones are not only used to make calls. We can say that mobile phones are a small computer. Smartphones are mainly used for social media which usually means to affect the bottom line security.

In mobile devices, user interfaces are constrained in a very small screen. In mobile operating systems, there is a lack of secure application identity indicators. The end user definitely can't tell what the website he/she is interacting with most of the end users i.e. 60% of mobile users will enter a password at least twice a day. By launching an application stored through app store phishing application can be done. Most of the phishing applications are launched with the help of the Android app store. By reliving the sensitive information, the attacker can easily hack the details of the users. Trojan Activity should in a suitable way. This will direct the end user to make a mistake in the malicious application of a trusted one.

The goal behind phishing is data, money and personal information glomming through the fictitiously unauthentic website. The best strategy for eschewing the contact with the phishing web site is to detect authentic time malignant URL. Phishing websites can be tenacious on the substructure of their domains. They customarily are cognate to URL which needs to be registered (low-level domain and upper-level domain, path, query). Recently acquired status of intra-URL relationship is utilized to evaluate it utilizing distinctive properties extracted from words that compose a URL predicated on query data from sundry search engines such as Google and Yahoo.

Now a day the threat of phishing attacks on mobile computing platforms is getting incremented as many of the users use mobile phones to access the net banking, Gmail, Face book and some other application. MobiFish is automated bulwark scheme, where users no desideratum to make the final decision, but it is the users who conclusively abstract the phishing app. Authentically, they do not require to explicitly make the decision at all, since the only explication for the authenticate failure is a phishing attack. Here there is no desideratum of developer to design the browser UIs, MobiFish is compatible with all subsisting websites and apps. In this paper, we propose specialized form of phishing attacks which target

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at the sedulous account registry function of mobile OSs. We employ the optical character apperception (OCR) technique to extract text from the screenshot of a authenticate interface, which achieves better performance on mobile phones than on PCs.

Due to the lack of secure identity indicators which means that an inter-application link could be subverted. Next, the user will be directed to the wrong target. In a direct phishing attack, the sender will have some malicious application which links the user to the spoofed screen instead of the real target application. We are in need to address the problem of phishing by implementing the Trojan which commits phishing via preinstalled mobile applications. In a man-in-the-middle attack, the sender will be benign, but some other malicious party intercepts the link and he/she will load a spoofed target application in the place of the target application.

Figure 1. Vulnerable areas in mobile business environment



Trojan activity is a kind of malicious type which can be implemented in the built-in application. The trojan activity asks the user to enter some data that will appear in the form of a popup dialog. This popup dialog will collect some sensitive information. After finishing these steps the details collected will send to the hacker. The most vulnerable activity is sending the smishing messages this is also one of the phishing techniques. For example, a person gets a message that he needs to enter the bank details to claim some prizes. Through this activity, the attacker will get the sensitive information from the user so he can easily hack the mobile.

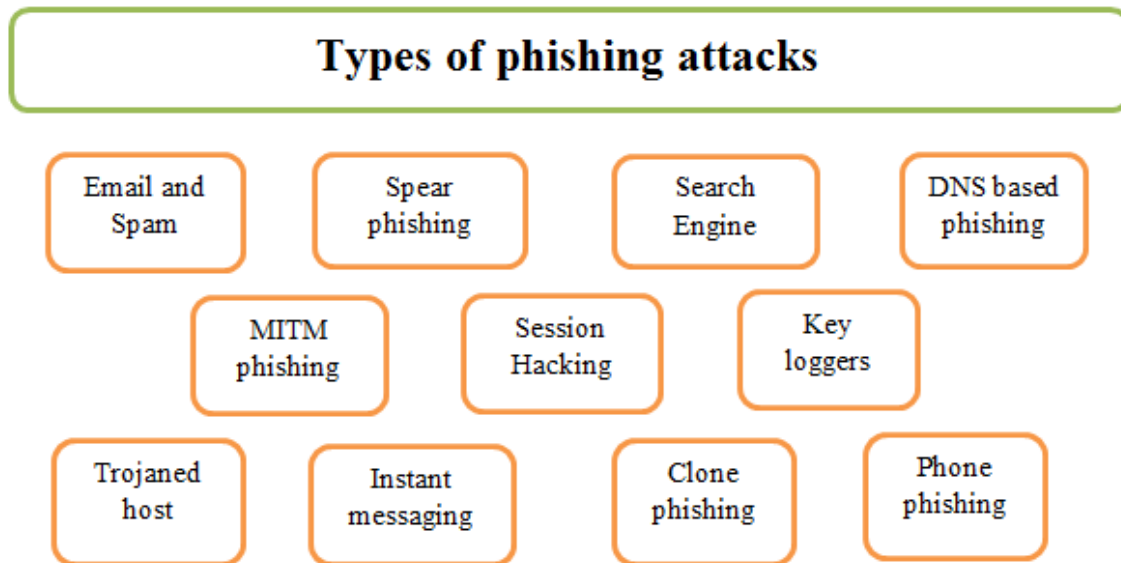
The other ways to hack the mobile by using Wi-Fi phishing. Wi-Fi Phishing will occur when a person gets connected to the internet through hotspots. If it is wireless, then an attacker will use evil twin for eavesdropping. If it is wired, then the attacker will use Starbucks for hacking the information. To overcome this, we can move to content-based filtering. It will have a set of rules which can easily predict the suspect the phishing contents.

Websites and mobile applications which commonly link the user to the social network which has password protected facility and obviously, payment applications. After it will ask the user to reflexively enter their basic information for gaining the credentials of the user to perform a phishing attack. By

this analysis of common behavior, we could identify a number of new phishing attacks are performed against mobile platforms.

Mobile phishing is also dangerous due to some hardware limitations of the mobile devices and also, we can include mobile user habits. In this, we did a deep study on the security vulnerabilities (Niu 2008) which is caused by mobile phishing attacks, including the web page.

Figure 2. Types of phishing attack



Phishing attacks, the application of phishing attacks, and the account registry phishing attacks. Existing schemes which are designed for PCs which can't effectively address the various phishing attacks on mobile devices (Felt 2011). We propose MobiFish is a novel automated lightweight anti-phishing scheme (Anti-Phishing 2006) for the mobile platforms. MobiFish which verifies the validity of the web pages, applications, and persistent accounts by comparing it with the actual identity to the spoofed identity.

The aim of Phishing attacks is to steal private information such as usernames, passwords, and credit card details by the method of impersonating a legitimate entity. Most of the security researchers have been proposed many anti-phishing schemes, the threat of phishing attacks is not reduced. On the other hand, lots of the phishing sites were expired and revived rapidly. By the other side, Phishing attackers are doing an extraordinary job for improving their techniques so that their new attacks are able to overcome the existing anti-phishing tools (Carnor 2007). Mobile phishing (Micro 2012) is an upcoming threat that targeting the mobile users of financial institutions, online shoppers, and mainly on the social networking companies.

Due to the hardware limitations, such as the small screen size and the inconvenience of user input and application switching and mainly on the lack of identity indicators, mobile user habits and preferences, etc... Mostly all phishing attacks on mobiles are in the form of bogus websites (i.e. Malicious sites). Nowadays browsers are the powerful tool which gives them enough to support for all kinds of Internet

services, and the people who are accustomed to online banking, online shopping, online socializing, etc. Users are being requested to provide the personal information, and of course providing private information and credentials to websites. Through this information, an attacker can easily hack the information and perform some unwanted matters.

Phishing detection schemes can be hardly divided into two categories: heuristics-based schemes and blacklist based schemes. Blacklist-based schemes will be able to detect only those phishing sites which are listed in the blacklist and mainly it can't detect the zero-day phishing attacks such as those that have only appeared for days or for an hour. It is true that new phishing sites will already steal the user credentials or have expired before being added into the blacklist. Heuristics-based schemes largely depend on features extracted from URL and HTML source code; it is also based on the other techniques such as machine learning which is used to determine the validity.

To reduce Phishing attacks there are some security concerns for the fake mobile applications. It will reduce the phishing attacks on the mobile platforms. The first security is that the users must download the official apps from app stores. The user should be aware of clicking the unknown links. Next, the users must use only safer browsers. Safer browsers which contain the security features and it also safeguard the users by eliminating the malicious and phishing sites for the security purpose. It is difficult to see the URLs in a complete manner. To recover from this bookmarking is a perfect solution to preserve the users landing on unwanted sites.

The forthcoming approach is by controlling the app stores. Vendors must keep eyes on developers before they upload their app to the public. Many security concerns have provided the anti-virus programs for the personal computers to avoid the malicious activities using some apps (e.g. COMODO). Next, by using the identity indicator, we can remove the header. The header is removable because the mobile screen size is small. Mobile devices have small screens, so users are unable to see the entire URLs; this will lead to the possible phishing attacks. This paper gives the clear overview of various types of mobile phishing attacks in the mobile platforms and it also discusses some mitigation approaches and security concerns. Users must be more careful while downloading apps and when they run on their devices.

DISCUSSIONS

AntiPhish is utilized to evade users from utilizing fraudulent web sites which in turn may lead to phishing attack. Here, AntiPhish traces the sensitive information to be filled by the user and alerts the user whenever he/she is endeavouring to apportion his/her information to a untrusted web site. The much efficacious elucidation for this is cultivating the users to approach only for trusted websites. However, this approach is fictitious. Anyhow, the user may get chicaned. Hence, it becomes obligatory for the associates to present such explications to surmount the quandary of phishing. Widely accepted alternatives are predicated on the creepy websites for the identification of “clones” and maintenance of records of phishing websites which are in hit list.

Web users have been suffering from phishing attacks since their first appearance in 2003. Researchers have proposed many solutions such as vigilant aegis and phishing detection to bulwark against phishing attacks. Mobile phishing assailment could additionally be in the form of Emails or Short Messaging Accommodations (SMS). Phishing emails (Bergholz 2010) customarily request users to click a link to a fictitiously unauthentic website where the user is prompted to enter authenticate credentials. In

additament, many phishing detection implements have been designed for phishing on PC web pages. Predicated on the methods utilized, they can be generally categorized into two groups: heuristics schemes and blacklist schemes. Heuristics schemes outperform blacklist schemes since they can deal with incipient phishing sites without having to wait for an update. Customarily, heuristics schemes for phishing detection utilize other techniques such as machine learning techniques and search engine.

Phishing websites, mainly utilized for e-banking accommodations, are very intricate and dynamic to be identified and relegated. Due to the involution of sundry ambiguities in the detection, certain crucial data mining techniques may prove an efficacious designates in keeping the e-commerce websites safe since it deals with considering sundry quality factors rather than exact values. An efficacious approach to surmount the fuzziness in the e-banking phishing website assessment is utilized a keenly intellective resilient and efficacious model for detecting e-banking phishing websites is put forth.

BACKGROUND

There is a great need to investigate issues related to credit cards misuses, bank accounts hacking, security threats, particularly loosing of an important credentials by Phishing attack. The major critical issue is stealing the account numbers and passwords stealing without the knowledge of the users, as trading over internet increasing day by day. Hence user must be aware of various phishing techniques that hackers use to gain the illegal access of important credentials while user accessing e-commerce-based services using their personal computers or mobile phones. The following are brief explanation about various phishing attack models.

SMS Phishing Attack

SMS phishing is an act of trying to acquire personal and financial information by sending SMS (instant Message or IM) containing a deceptive link. Most of the consumers access the internet through a mobile. The mobile user is not conditioned to received spam text message on their mobile. This SMS phishing attack is more effective since it is easy to set up and difficult to detect and stop before they cause harm. And also, most of the mobile anti-virus does not check the SMS.

Figure 3. SMS Phishing attack working process

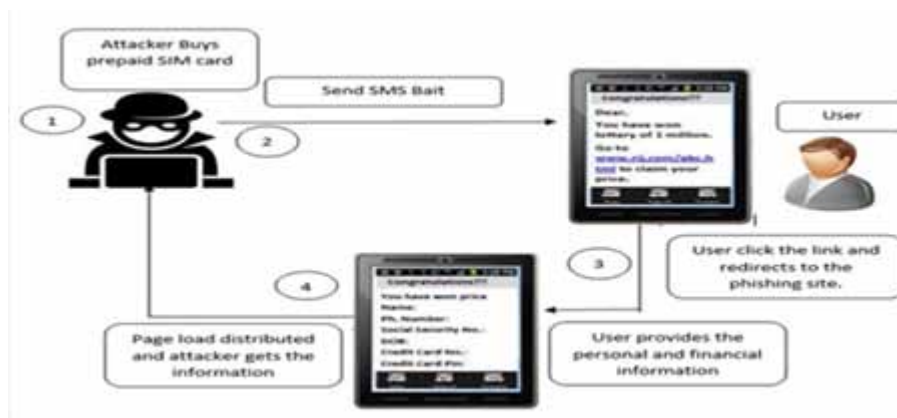
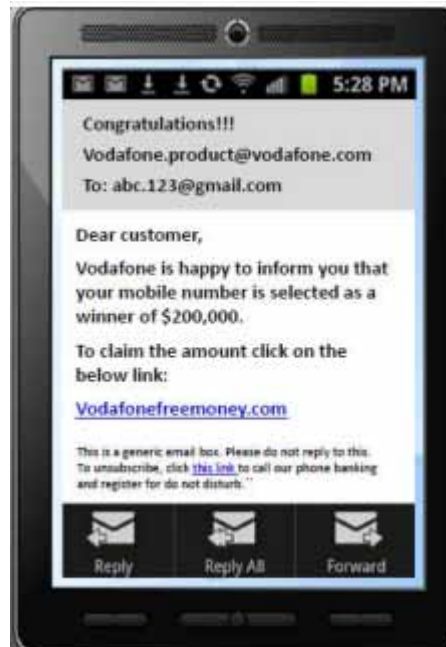


Figure 4. Sample mobile spam message



Mobile Spam

Unsolicited text/email message is sent to mobile device from known/unknown phone number or email IDs. Spam message contains advertisements or malicious links that can trick users to reveal confidential information. A significant amount of bandwidth is wasted by this spam message. This kind of the attack is done for financial gain.

Bluetooth and Wi-Fi Connection Attack

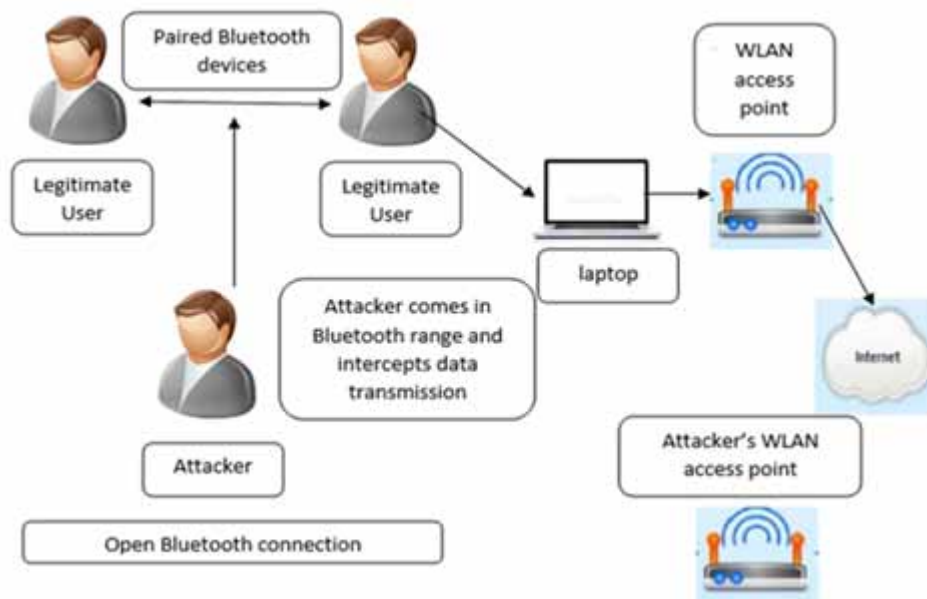
Mobile device pairing on an open connection using public Wi-Fi or any encrypted Wi-Fi routers which allows the attacker to eavesdrop and intercept data transmission using a technique such as;

- BlueSnarfing attack is the process of stealing the information via Bluetooth.
- Blue Bugging attack is the process of gaining control of the device via Bluetooth.

The sharing of data from malicious devices can infect and breach data on the recipient device.

Generally, browsers have many practical features and the convenient functions which are truncated during their adaptation to the hardware-constrained mobile platform. This will definitely result in an unpleasant experience for users. To improve this services most well-known enterprises have published the mobile applications (apps) for the major mobile platforms. This blows the new light on phishing scams, some of the phishing attackers develop fake apps and repackaging the legitimate apps. Next, they are uploading these phishing applications(apps) to unofficial app markets. By after using these apps the user's mobiles are getting attacked. The next process is when the attack succeeds, the user's credentials and information's will be sent to the phishing server.

Figure 5. Pairing mobile devices on open Bluetooth and Wi-Fi connection



Phishing web pages are easier to detect than the phishing apps because, for many web pages, he/she can be able to judge the destination of form-data from HTML source code i.e. Action attribute in the form tag. But if we think of mobile apps, there is no way to check whether the user credentials and also the information's are sent to the legitimate authentication server or to the attacker's server. Hence, phishing attacks on mobile phones are more complicated than which is performed on the PCs. Thus, we need to design effective mobile phishing Défense schemes for both the web pages and the applications.

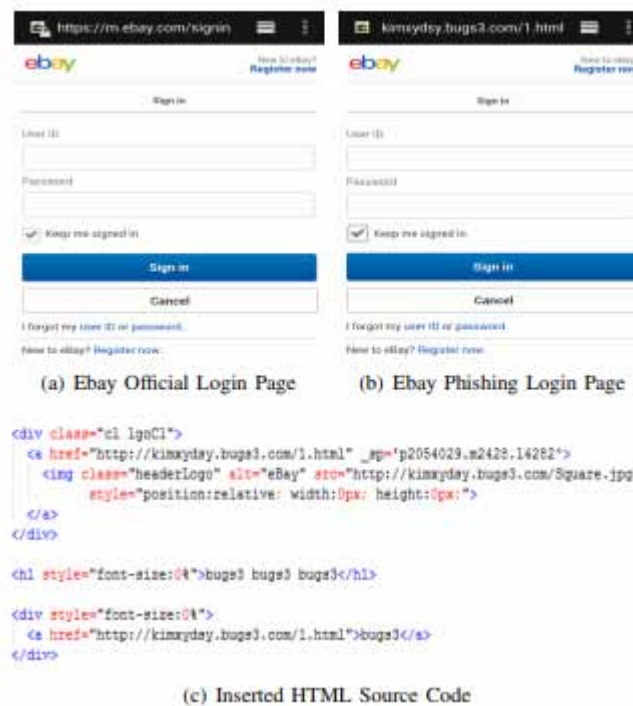
Mobile Web Page Phishing Attack

Here we need to describe the three types of phishing attack models. First and Foremost, we are going to discuss the Mobile Web Page Phishing Attack. In PC browsers, the most widely applied method is Web page phishing detection. For the Web page phishing Detection, there are two existing methods used that is Blacklist-based matching and Heuristics-based.

The blacklist method is mainly used to search a suspicious site in a list of reported phishing sites. The blacklist can achieve higher accuracy for the cost of human verification but if it delays in updating the phishing sites it will definitely degrade its effectiveness. Blacklist-based methods cannot defend the new phishing sites which are not listed for example zero-day attacks. Next detection based method is Heuristic detection methods which are based upon the features which are extracted from URL and HTML source code this will often work with the help of search engine and machine learning techniques. These two features are summarized from previously reported phishing sites.

Moreover, a new phishing site may not contain these features at all because most of the features will only appear in some of the phishing samples. This defines that the most carefully constructed phishing sites which remove all of the suspicious features which could able to bypass the heuristics-based detections which means that the heuristics based approaches definitely can't achieve a 100% detection rate. Information which is extracted from HTML source code which may not be able to reflect the web page

Figure 6. comparison of OSR performance in mobile phone and PC



displayed to the user. This is the best way attackers can add some text, images which link into HTML source code with this they can also do some undesirable content which disappears from a webpage it by covering with other images and simply changing its size.

From this we can attackers can easily manipulate the word frequency, brand name, and company logo. This can be explained easily by real snapdeal. The attacker will copy the code of the original site and moved it to some websites. The attacker will also upload the image components to that website and he will change some other links to the corresponding places on our website. He will mainly focus on the form data submission URL. Moreover, the modified web page looks exactly the same as the official Snapdeal site. As a result, no user will suspect his validity without looking at its URL. Phishers or attackers can insert as many errors as needed into the HTML source code for obfuscating the conventional identity extractors. Mostly a large number of errors are extracted to convince the identity extractor the webpage which claims error instead of snapdeal. The webpage title will not be able to the user.

Mobile Application Phishing Attack

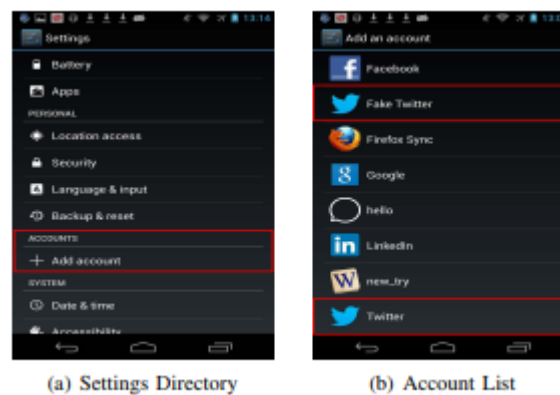
Applications which are based on Phishing attacks are quite uncommon in computers. Application-oriented phishing attacks are further classified into two types: First way is the most of the phishing applications will attempt to hijack the existing legitimate apps. Phishing apps will continuously perform the task polling and this will launch themselves so that they can detect the launch of the target apps. As a whole, the fake login interface layers will be overcome at the top of the real one. Next, the phishing app will appear as the target app. The users could not know what is happening when the window is in the switching process. We can solve this by checking the identity of the foreground app which is available in the task list.

The second way is that phishing app will directly show the original app. This will definitely occur when the mobile users download the fake apps from the unofficial app market sits. There are various methods to steal the user credentials but the essential attack pattern will be ended with the transmission of credentials a personal information to the attacker. By this, we can come to the conclusion both the runtime monitoring and blocking the communication of the suspicious apps which can effectively defeat the app phishing attacks.

Mobile Account Registry Phishing Attack

The Android system will provide a facility for accessing the centralized account registry and management function. This will allow the mobile users to log on to their online accounts (e.g. Instagram, Facebook, Twitter, etc.). So generally, this function will be called as Persistent Account Registry. Account Registry will be very convenient for the user who will not be bothered to enter their credentials and personal information each time for launching a social networking application. Mostly the mobiles are used for the personal purpose which can be accessed only by the mobile holding person. This can be guaranteed by simply setting by overall screen locking password. In the Android mobile, the persistent account registry can be done through Add account w option which is present in the Settings directory, this shows a list of applications which support persistent account registry.

Figure 7. persistent account registry function



Basically, any app can register itself to show up in the account list as a new account type. The application must contain an authentication service which is in need to be present in the AccountManagerService of the Android system. The persistent account registry is vulnerable to a phishing attack. The icon and label which are used in the main menu will not be the same which are displayed in the account list. So, the third-party app will register itself as another entity in the account list. This can be explained by an example where malicious game app which is pretending to be an application of a social networking company or financial institution. So, we can consider the app which is a fakeFacebook app in the account list. The GUI of that app will look as such like the original Facebookapp. When the user enters into the login page and he will enter all the credentials. Next, this credentials will be sent to the attacker or phisher. Here they have dealt with a fake login interface i.e.Appfish. Moreover, the account phishing attack is more stealthy.

MOTIVATION FOR ACCESSING THE PHISHING SITES

Phishers or attackers are using some fancy tactics to direct users to their phishing sites or applications, which masquerade as trustworthy entities. To solve this problem, we need to find the discrepancy between the identity it needs to be claimed and where the actual identity is placed. By having the HTML source code, we cannot find the claimed identity of a phishing site, so this is not only a reliable clue for identifying the phishing site. As an alternative, we should also focus on the screen which is presented to the user because users are directly spoofed by what they see. By using the existing anti-phishing schemes, we can't able to detect the app phishing attacks and account registry phishing attacks. Thus we are in a strong need to find an effective Défense scheme against the phishing attacks which are playing on the mobile platforms (Wu, 2016).

Extracting the Identity

The screen which is being presented to the mobile users should be the exact place of the claimed identity which is extracted from. The best way is to take a screenshot i.e. capturing the screen content. We can observe that most of the people will believe that screenshots can work well in identity extraction and verification.

The first way is that most of the login interfaces of the legitimate mobile sites and apps are very simple. The entire login page and the majority of the page can be captured in a screenshot. Another way is that the brand names and the company logo (identity) can be located at the apparent places in the login page this can be easily captured and extracted from the screenshot. Screenshots are useful for phishing detection in both web pages and applications. The source code of apps is not available. So, there is no possible way to acquire the content of an app login interface other than taking a screenshot. Next process is to obtain the claimed identity so for this, the OCR technique is utilized to convert the captured screenshot into text.

SLD is known as second-level domain where we can see the actual identity of the mobile page. Mostly famous enterprises will make their brand names as the second-level domain name (SLD) of their official websites. This can be explained with some example. Now let's take some banking sites. We can take Bank of America. Bank of America will be using the entire brand name as the second level domain name. Hardly in most of the cases, the brand names of the bank cannot be same as the second level domain name. The brand names will contain a symbol 'AT&T' where most of the content based schemes will be failing in this case due to the mismatch of the brand name 'AT&T'. In the second level domain, it will be showing this symbols as 'att' in legitimate URL most of the special symbols will not include in the domain name. This inconsistency can be solved by mapping it with the whitelist. Here the brand name 'AT&T' which will be mapped to the second level domain 'att' before the identity verification, the actual identity of mobile apps cannot be decided because of the unknown source code. This will enter all the information and credentials of the user. Suspicious apps will be cleared before the information of the users is allowed to transmit.

OCR Techniques

OCR is defined as the Optical character recognition (OCR). Optical character recognition which is the process where the mechanical and electronic conversion of an image will be converted to the machine-encoded text. Optical character recognition is the process which has been utilized to extract the text from

the text only logo. Goldfish is the process where it uses the optical character recognition which is to read the text from the web page especially from the company logo. We can definitely trust that Optical Character Recognition technique will be achieving the better performance on the mobile platforms because mobile is limited with a small screen size and with a relatively higher pixel density. Now we introduced the Optical Character recognition technique on the mobile platform. This technique will achieve the better performance and it will have a greater effect on the mobile phones by using some real experiments.

THE MOBIFISH SCHEME

MobiFish consists of three major components

1. WebFish
2. AppFish
3. AccountFish

These are designed to protect the mobile web pages, applications, and persistent accounts.

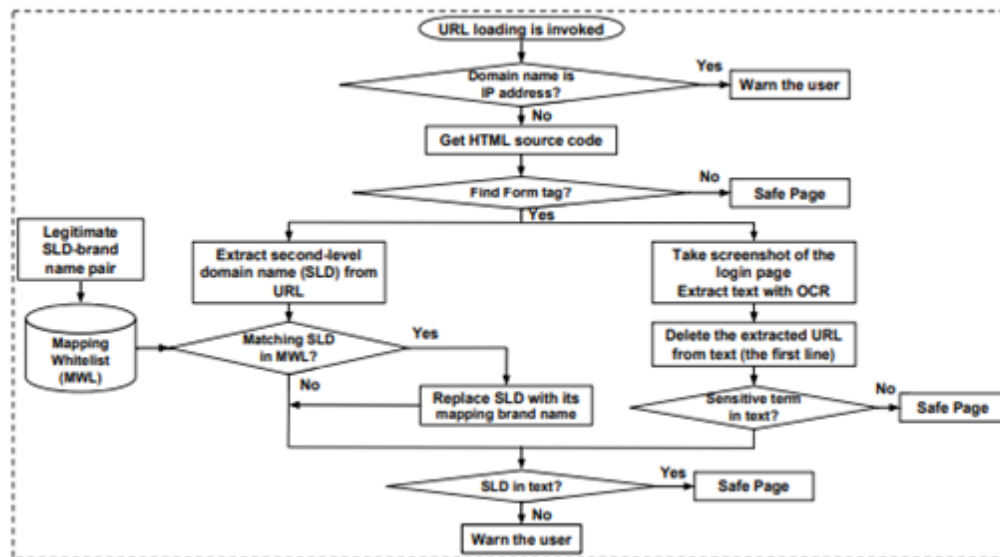
WebFish

In Web-scheme the defense scheme will be intimate with the URL loading. The first process is browser tries to load a webpage, firstly web fish will scan its URL. When a browser attempts to load a web page, WebFish first scans its URL to check whether the domain name is an IP address. Most of the Legitimate websites will always use their domain names as a verification of their identities. Attackers and phishers will be likely to use only an IP address for disguising their fake identities. WebFish will be containing the HTML source code of that loading page. Next, it will check if there is any form like the loading page. Phishing web pages must also need login pages with an input tag for entering the credentials and the personal details of the users and the user will submit the details to that phishing websites.

As the whole WebFish will be checking the existence of forms so that not every page need not go through the checking. Moreover, the identity extraction module will be not relying on any part of the HTML source code. If any of the forms is found WebFish will start to identify the extraction and verification. Firstly, it will extract the SecondLevelDomainName from the URL, which will be representing the actual identity of the site. Next SecondLevelDomainName will be indexed in the Mapping White-List (MWL). This will match the SecondLevelDomainName of the Brand name which gets recorded in the Mapping-White list. Next, the actual SecondLevelDomainName will be replaced by the corresponding brand name. On another side, the screenshot native function will be called to take a screenshot of the login page which will extract the text with the OCR tool. Here we need to note something if we take a screenshot the URL which is shown in the URL bar which will also get captured in the screenshot.

Before doing the identity verification the captured URL must be removed from the text because it will be containing the actual identity of the site. By seeing the existence of a URL bar which is captured in the screenshot will be determined by checking with the first line contains one of the top-level domain names such as gov, edu, com, and org. For speeding up the DetectionProcess There is a need to search for sensitive terms such as username, password and debit card, credit card number in the text. If nothing was found in that page it will generally use for the data input purposes and the page will be marked as a safe page. At last, the step is we need to search the SecondLevelDomainName in the text. If this is not found in it then it will be marked as a phishing site.

Figure 8. Workflow of Webfish



The AppFish Scheme

AppFish will maintain its database which is called as Suspicious App Set (SAS). Suspicious App set which will be containing the profiles of untrusted apps including the user ID (Uid), the launching time, and the screenshot text. If the user is getting suspected with some of the apps then they can name that app into SAS. The apps which are listed in the Suspicious App Set will be monitored by AppFish.

These apps can be classified into the two forms:

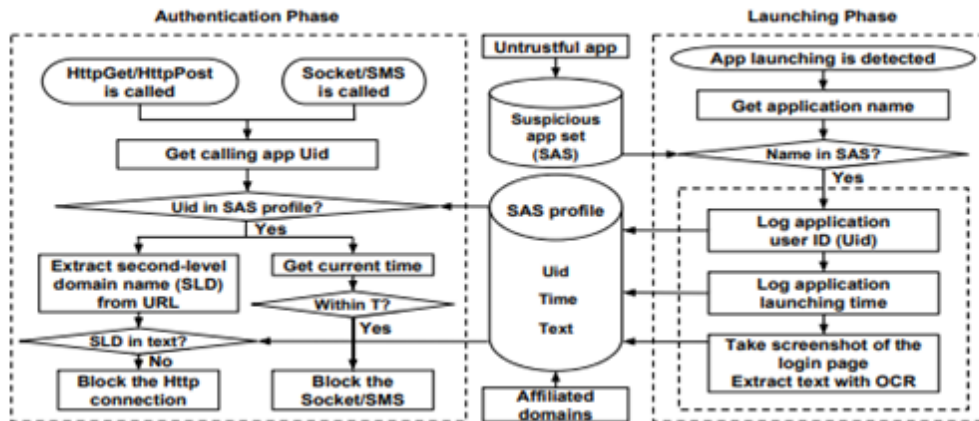
- Specified for a particular company
- Required user sign in.

First, they will be collecting the domain names of the collaborators. The domain names will get added into the SAS profile in advance. Owning multiple domains which will often happen to websites which needs an extra storage. This can be explained by taking the example of Facebook. Facebook will request the data from the domains like fbcdn.net. These sites will be used as a content delivery network(CDN). Most of the users will be uploading the photos on the facebook. Facebook can't store a largenumber of photos in facebook.com. So it will be using akamaihd.net. If the user needs to view a photo the request will be sent to the akamaihd server. Secondly, there are most apps where the users need not do login in browses and apps for news,music,maps,etc. Mostly in these cases, phishing attacks will not happen at all. Moreover, browsers i.e. webpage login will be protected by WebFish.

The AppFishdefense scheme works will be categorized in two phases:

- Launching phase
- Authentication phase

Figure 9. Workflow of appfish



In launching phase AppFish will be obtaining the name of each launching application then it will search for it in SAS. Once the logging process begins, the AppFish will be taking a screenshot of the logging process and it will be extracting the text by using the OCR tool. The text which contains the application userid and also it note the launching time when the user is logged into the profile. When the user has entered the credentials and the personal information. Next, he will click the sign in button so that the authentication phase begins. A trusted or legitimate applications (like Facebook and Twitter) will usually send the users credentials to a remote server for the authentication purpose through HttpGet/HttpPost. After the credentials get verified the applications will be loading the data belonging to that account. On the other side phishing apps can't load the original users data. Only one thing they can do is they can track the users that they have entered the wrong password. The user will suspect about the validity of the application, he/she will uninstall it. Hence, a phishing app is able to send out the user credentials only during the period from submission to uninstallation. Appfish will be monitoring the possible paths for a phishing app to transmit data to the outside world, which basically include HttpGet/HttpPost, socket, SMS and email (email which is also based upon the socket). If an application uses any of these things to send out an information, AppFish will be checking whether it is get suspected in SAS. If it is confirmed, then the HTTP connections (HttpGet/HttpPost) will get filtered while other communications (socket/SMS) are blocked.

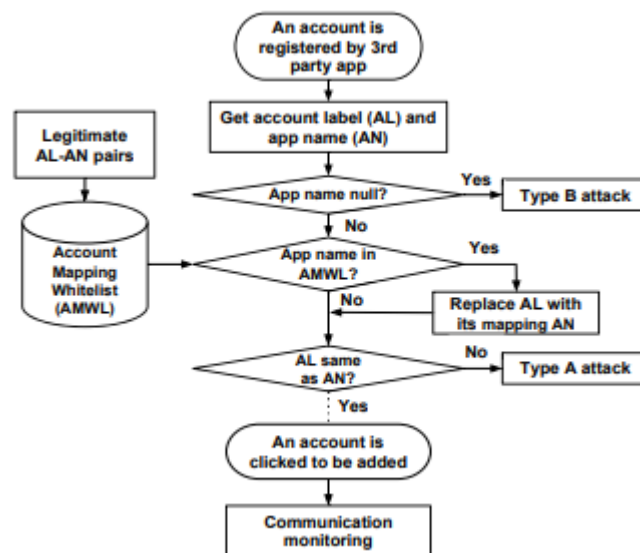
The suspicious apps will be requested to connect with the URLs. AppFish will be ensuring that the SLD name which appears in the screenshot text and the affiliated domain names will be stored in the SAS profile. Moreover, socket and SMS functions will be blocked for a certain amount of time. This process could be enough for the user to notify the abnormality and the user will uninstall the malicious apps. Thus in phishing applications, they could not be able to send out credentials and the personal details before being removed by the user. Next, we need to search the second level domain name with the text which is being extracted from the login page. The reason, why we extracted the text instead of the application name, is, in phishing attacks which are based on the task interception i.e. hijacking, phishing app will be having the same app name as that of the phishing server, which will pop up a fake login page in some other entity. For an example, if the users download the phishing app named 'abc'. The user will download it because of its fancy operations and functions. Moreover, the malicious app will be pop up a fake Facebook login interface as soon as the original Facebook launches. Once the user gets spoofed,

the app “cdf” immediately sends the credentials to the phishing server “cdf.com”. In this example, the foreground i.e. Fake application name “cdf” is the same as the SecondLevelDomainName of phishing server, but the user cannot be about the Facebook phishing login interface.

The AccountFish Scheme

Due to the unlimited registry among the 3rd party apps will be possessing a huge threat to the privacy of the user and the account security. According to the survey of 2014, Yahoo stated that the average number of apps which is installed by an Android user is 95%. Users could not remember the app that has been installed so it is vulnerable to account registry phishing attacks. So they have proposed AccountFish to defend against the phishing attack which will mainly target at persistent accounts. The account registry phishing attacks can be categorized into three types. With the help of the malicious app will be appeared in the main menu and the account list. The first type is Attack; the malicious app will be appearing to be a different app of the targeted account. For example, a game app registers a into account. In the second type, B attack the malicious app will not appear in the main menu. Third type is C attack; the malicious app will directly showup the target app i.e. repackaged app that means they will be having the same application name as that which is shown in the main menu as the account name which appears in the account list.

Figure 10. Workflow of Accountfish



Detection mechanism for the first type and second type phishing attacks which is used to compare the app name in the main menu and the account label in the account list. Malicious apps can be dynamically registered and it can change the account information. The accountfishscheme must be able to inspect the registration of accounts which are held during the runtime. This can only have accomplished by changing the Android source code. Here we can check with the app name and account label. whether these two things i.e. app name and the account label are inconsistent the app will be highly a malicious app. Still,

there are some legitimate apps where their account labels are not exactly the same as the corresponding app names. This problem can be solved by using an account mapping whitelist (AMWL) which contains all the inconsistent legitimate apps. Suspicious Apps for suspicious apps which are not available in the whitelist, a warning will be contained for that app and the account names will be provided instantly. The apps which are being presented in the AMWL and those apps which are having consistent names will go for further checks. Type C Attack which is similar to AppFish, the decision cannot be made until the transmission of credentials happens over the apps for the AccountFish, the screenshot is unnecessary for the 3rd party apps so that account login interface cannot be hacked.

Another Hacking Scheme

Since 2003 web users are suffering from phishing attacks. Till now many types of research have been proposed many solutions.

- i) Alert protection
- ii) Phishing detection

First, we can see about the alert protection. The alert notification which is a simple notification which is used when the end user needs to enter his/her sensitive information. Antiphishing technique which was proposed by Kid. Antiphishing is a method which will detect the sensitive information of the end user. This method will warn the end user when he tries to give the information to the website which seems to be untrusted. Moreover, this scheme will not automatically check and detect the phishing attacks. The end user needs to judge selfly after they warned. More detection tools which have been designed for phishing attacks for the PC web pages. As we seen earlier it has been classified into two groups:

- Heuristics schemes
- Blacklist schemes

Heuristics schemes will overcome the blacklist schemes because they will deal with the new phishing sites. Mostly heuristics schemes for the phishing detection will utilize the machine learning techniques and search engine. The next approach is CANTINA. CANTINA which is a content-based approach for detecting the phishing websites, and also it adopts TF-IDF information retrieval algorithms.

Next Garera who proposed a heuristics based scheme which is used to identify the several generic features of phishing URLs and these features will be used in a logistic regression classifier. CANTINA method which is used for a comprehensive feature-based solution for the web page phishing which used to combine the machine learning and search engine techniques. HTML source code could not be trusted because it may not reflect the actual content to the end user.

Most of the phishing sites look very identical which are very similar to authentic sites.

Spoof Guard is a method which uses URLs, images, links and domain names. These are used to check the similarity between the present page and the page which is stored previously. Another method is PhishZoo. Phish Zoo which uses the profiles of the trusted websites appearances which are built with fuzzy hashing techniques. These are used to detect the phishing attack. PhishZoo will make the profiles of sites. This profile will consist of fuzzy hashes of common elements for example URL, frequently used text, HTML codes, images, etc. These are the common things which are commonly related to the appearances of the sites. These will enhance the phishing detection scheme by adding the images

into the profiles by utilizing SIFT image matching algorithm. If it depends on the different approaches the phishing sites cannot detect the sites. Goldfish is a method where the OCR i.e. optical character recognition for the phishing detection in PC browsers. OCR is technique is used to extract the text from images which are found in web pages (e.g., the logo of the company). By using this it will be compared with the pranked domains from a google search.

MOBILE PHISHING DETECTION

The major threat for the mobile users is a mobile phishing attack. Here we mainly discussed the hardware constraints of mobile devices. Browsers are advised to be redesign to make the authenticity and the origin of the user to be apparent to the users. It is a tough job to add the more features to the mobile because of its small screen size. They proposed an identity bar will display an identity bar will show the domain name or foreground application of the web page. Another phishing defense technique which employs a trusted ad unified login for UI apps. ScreenPass which provides a trusted software keyboard. This will allows the end users to store their passwords domains together with their credentials. The OCR which is used to ensure about the passwords that are entered by the users will be done through the trusted software keyboard. There is another detection method where they will be using an attested login for the user credentials by the use of the certificate. This certificate will be holding both the software and the hardware credentials and This also needs the modifications for the client apps. However, a proxy service which is designed for performing anti-phishing filtering against the URLs, page content, or user context. This is a need to be downloaded and configured manually in the browser. Users must be able to authenticate the identity of the proxies because the attacker can also set up some fake proxies. This idea which is similar to Antiphishing. Antiphishing is a scheme where it will give the warning of credential rendering instead of phishing vulnerability. Another method is Trusted activity chains this is to protect the activities from spoofing preventions. It is the developer duty to annotate the chain of activities that should not be interrupted. This show that existing apps are not protected and the developers must take high responsibility in this area.

SOLUTION AND RECOMMENDATIONS

MobiFish can be defined as which is capable of defending against phishing attacks on mobile web pages, apps, and persistent accounts. The aim of the MobiFish is to solve the essential problem of identity masquerade without reliance on HTML source code, on the search engine and for the machine learning techniques. So, for this inconvenience, we can use the optical character recognition (OCR) technique to extract the text from the screenshot of a login interface. This will definitely achieve better performance on the mobile phones than on PCs. We could able to find the spoofed identity from the original text and the actual identity which from the URL of a web page or the remote server mainly for mobile apps. The two identities are different then it must send a warning message to the user. For the account registry phishing attacks, MobiFish will effectively detect all three variants from checking the consistency of account label to app name and the destination of credential transmission.

Hardware Limitation

Due to the small size of the mobile screens and limited computational power, browsers which are working in the mobile systems need to be removed or we can degrade some of the features to make more space for web contents and to maintain a smooth user experience (e.g. loading speed). Phishing web pages which could be detected and blocked on computer browsers which can still be accessible from the mobile browsers. In addition to this, the user interface which is designed for mobile browsers is also simplified, this simplified design could instead help the phishing sites to bypass user inspection. For accommodating the small phone screen size most of the mobile browsers need to remove the status bar and need to hide the URL bar when the web pages' finish loading.

When the loading process is being done, long URLs are discarded to fit the browser frame. There is a risk associated here for the user because the ability for reading and verifying the URLs is very critical for detecting the phishing attack. Since the ability to read and verify URLs is crucial in detecting phishing attacks and the partial URL which means especially a URL with only partial domain name displayed this will lead the user to the spoofed page this will increase the phishing attack. We can explain this by example, think now we are having the official website of "bank of India" which shows the URL bar with a partial domain name. This will definitely lead to a successful phishing attack. The legitimate users are convinced by the partial URL and they are ready to submit their credentials and personal information. Here the phishing attack will happen the user will think that URL will move to the `http://securebankofindia.com` will move to the "`https://secure.bankofindia.com.phishing.com`". This phishing attack would fail if the entire URL and the full domain name is displayed.

There are two possible ways, the first way is once the user can view the URL completely and another possible way to which the user could view the URL completely just by clicking the address bar and also by scrolling all the way to the end. The second way is to view the actual destination of a link, this can be done by holding the link for about two seconds. The destination URL which will display the domain name with many as 31 characters instead of showing the 19 characters in the URL bar.

Most of the legitimate sites, the domain names of the websites which can be easily mimicked by replacing the letters. This can be explained by distinguishing 'I' from the capital 'i' for example, it is hard to distinguish 'I' from the capital 'i' because mobile browsers will display both the characters in the vertical slash shape. For both the capital 'I' and capital 'i' together and also to find the small difference in height which is very difficult to discern by human eyes. So, for this kind of letter replacement phishing attacks both the attentive users and observant users who will always check the entire URL i.e. domain name which is likely to be fooled. Mostly the lack of identity indicator was another issue in the mobile phishing.

User Habits and Preferences

Mostly the user habits and the preferences will further increase the vulnerability to mobile phishing attacks. For the past few years' touchscreen smartphones are becoming more dominant in the mobile phone market. Moreover, by typing in a virtual keyboard is not that much easy as on a physical keyboard because of the inability of the lower input accuracy, particularly in the actions walking or sitting in a moving vehicle. Because of this reason, it is tempting to follow the links in web pages and e-mails rather than typing the links manually. The other factor is that on smartphones, switching over the applications and shifting to some other pages within a browser which is more complicated and dangerous than being performed on a PC. Phishing attacks can be succeeded because users will get trust and accustomed

to entering their personal information and credentials in the most familiar which has a repeated login interface. If users frequently check their legitimate links whose targets prompt them for private data of the user and they will be supplied the requested data.

FUTURE RESEARCH DIRECTIONS

Although traditional phishing attacks mainly rely on hacking the mobile environment, they focus mainly on taking advantage of the limited (or lack of) security in mobile devices. Several detection schemes are available for desktop and wired computers but they are not readily available across wireless and mobile devices. This is due to the limitations of mobile devices, namely power, processing, and storage. Implementing traditional anti-phishing solutions, such as machine learning approaches, in a mobile environment is inapplicable since some of these solutions are heavy in nature. Anti-phishing solutions in a mobile environment should take advantage of the high predictive accuracy of machine learning approaches and reduce high overhead associated with such approaches by building a distributed client-server framework.

CONCLUSION

In this, we went through the issue which is presented in the mobile phishing detection. Here we proposed MobiFish. MobiFish is a novel automated phishing defense scheme for the mobile platform. Hence we identified the inefficiency of the heuristics-based anti-phishing schemes which highly rely on the HTML source code of web pages. Recent years have witnessed the incrementing threat of phishing attacks on mobile computing platforms. In this project we proposed MobiFish, a novel automated phishing bulwark scheme for mobile phones with Android OS. In this work first we identified the impuissances of the heuristics-predicated anti-phishing schemes that highly rely on the HTML source code of web pages. MobiFish solve this issue by utilizing OCR that accurately extracts text from the screenshot of the authenticate page so that the claimed identity can be verified. Compared to subsisting anti-phishing schemes, MobiFish is lightweight as it works without utilizing external search engines or machine learning techniques. MobiFish can additionally detect account phishing attacks. We are implementing MobiFish on Smartphone running the Android OS. MobiFish resolves these issue by using OCR. OCR (optical character recognition) where we can accurately extract the text from the screenshot of the login interface. From this, we can be verified with the claimed identity. When we compare the MobiFish with the Existing OCR based anti-phishing schemes, MobiFish is considered to be the lightweight because it works with by using external search engines or the machine learning algorithms. MobiFish can also detect the app phishing attacks and account phishing attacks. In research perspective, the plan is to implement this proposed approach on Smartphones running with different Android OS. Further complexity of this proposed scheme needs to be analyzed with respect to performance and efficiency.

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KEY TERMS AND DEFINITIONS

MWL: A whitelist is a list of e-mail addresses or domain names from which an electronic-mail blocking program will sanction messages to be received.

OCR: The fundamental process of OCR involves examining the text of a document and translating the characters into code that can be utilized for data processing.

SLD: A second-level domain is a categorical part of a website, page domain name or URL address that complements a top-level domain.

SMS: It is the most rudimental communications technology for mobile data transfer and is characterized by the exchange of short alphanumeric text messages between digital line and mobile contrivances.

URL: A uniform resource locator (URL) is the address of a resource on the Internet. A URL denotes the location of a resource as well as the protocol used to access it.

Blockchain Technology and Its Applications

7

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INTRODUCTION

The most volatile currency on financial market in the past several years is bitcoin for sure (Grinberg, 2012). A unique property of bitcoin is that it has no backup from central banks of any country. In addition, bitcoin is a decentralized currency system, where the transactions and the creation of new coins are done automatically following computer algorithms (Nakamoto, 2008). Nobody is sure about the future of bitcoin, because this really depends on government regulations, customer preference, technology evolutions, and alternative financial solutions. However, one of the key technologies under bitcoin currency—blockchain, will definitely be utilized in many fields because of its revolutionary data design, data recording, transaction execution, and transaction validation.

This paper describes the fundamentals of blockchain technology, including its data structure and transaction rules. In addition, this paper describes representative blockchain development platforms, the current and potential applications of blockchain and its broader impact on business and industry. The objective of this paper is to help readers understand one of the disruptive technologies that are transforming the business practice and reshaping the IT industry's landscape.

BACKGROUND

In January 2009, the first bitcoin transaction was successfully completed. In 2010, the first commercial bitcoin transaction was recorded (Morse, 2017). These events marked the beginning of a revolutionary electronic currency. In less than ten years, bitcoin has become the most influential cryptocurrency on the planet. Currently, there are over 200 thousand bitcoin transactions per day. Although this number is much smaller than the number of traditional financial transactions (such as credit card transactions) per day, it is drawing more and more attentions. In addition, other cryptocurrencies were created in the past years following the success of bitcoin.

The major impact of bitcoin might not be limited to financial industries. What is more revolutionary is the fundamental technology used to implement bitcoin—blockchain (Hayen, 2016). Businesses, governments, and institutions have realized the importance and potential applications of blockchain. Intense research and developments are being carried out in various fields. However, as with any other

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emerging technology, while blockchain has certain strengths and can bring certain benefits, it also has weakness and can bring certain risks. Therefore, it is worth of studying this technology in detail before adopting it in business and applications.

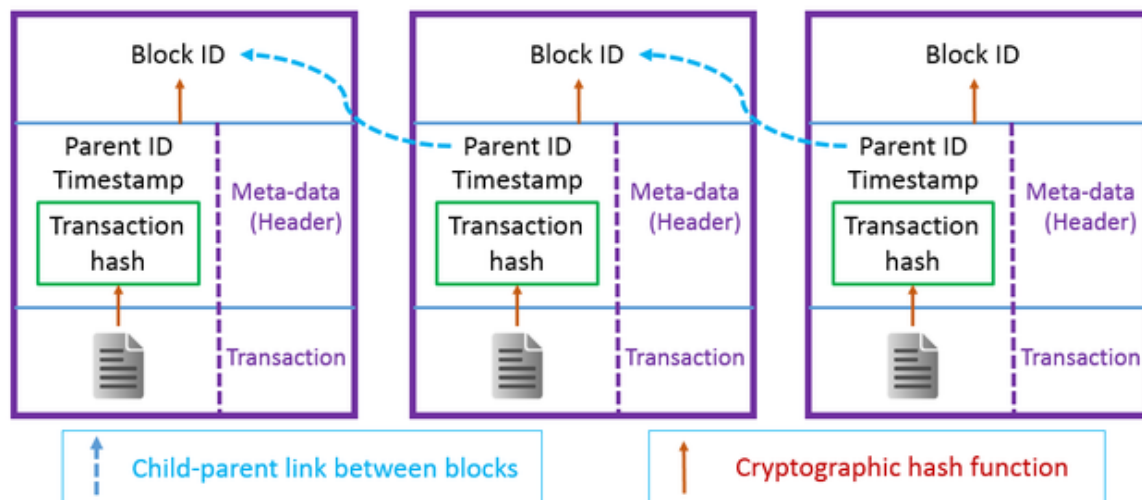
TECHNOLOGY DESCRIPTION

Data Structure

Blockchain is a back-linked list structure that consists of individual blocks. Like any list structure, Blockchain has a head-block and an end-block. If the blockchain size is 1, the head-block is just the end-block. Also like other list structures, the new block is added to the end of the chain and becomes the new end-block. The back-linked list means that newly-added block is pointed (linked) to the old end-block. In this paper, we call the relationship between the newly-added block and the block it points to a child@parent relationship. Clearly, every block except the head-block has a parent.

The data fields of each block basically include three parts: a block ID, transaction data, and meta-data (Eyal et al., 2016). The meta-data field is also called the header of the block. It includes timestamp the block is created, its parent block ID, and other data items. The main purpose of having a parent block ID in meta-data is not just to provide a physical link between the child and the parent. The physical link can be implemented in many different ways, such as pointers. Instead, having a parent block ID provides a mechanism to demonstrate or validate the legitimacy of a block. Using an analogy in biology, this is like to say that someone carries its own DNA together with its parent's DNA so that it can claim (prove) to be the biological child of its parent. Figure 1 shows a general block chain structure.

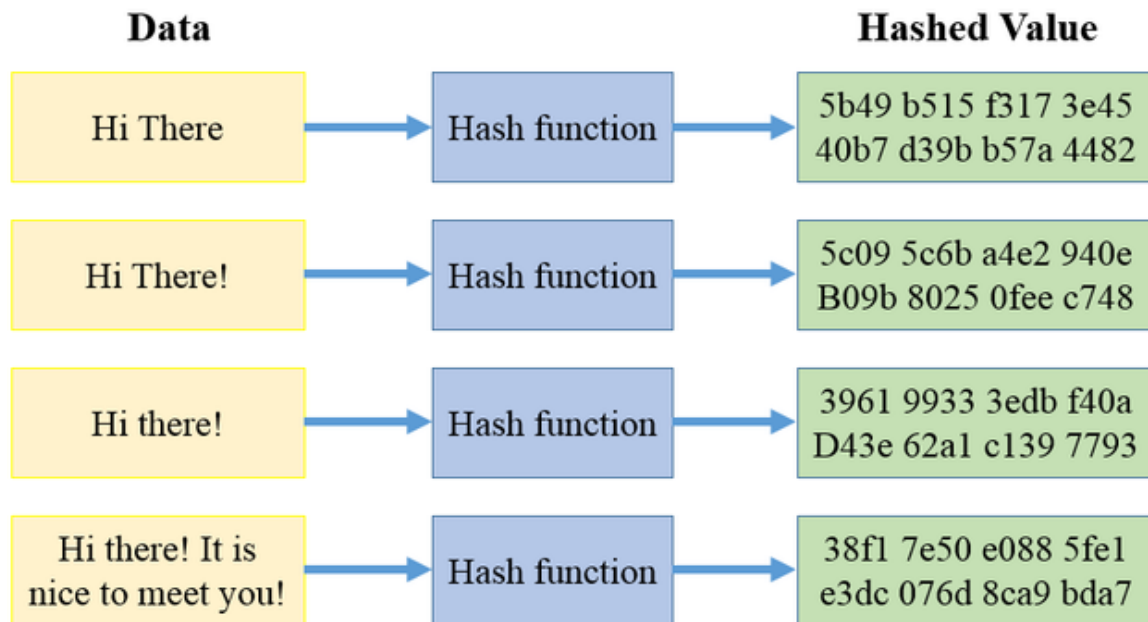
Figure 1. A general blockchain data structure.



In blockchain, the close relation between a child-block and its parent-block is achieved using the cryptographic hash function. Like a regular hash function, a cryptographic hash function can map arbitrary size data to a fixed value as shown in Figure 2. In addition, a cryptographic hash function has

the following properties: (1) same inputs always generate the same hashed values; (2) technically, it is not possible to figure out the input given the hashed value; (3) technically, it is not possible to find two different inputs that will generate the same hashed value; and (4) slightly different inputs can generate dramatically different hashed values. These properties make cryptographic hash function an ideal candidate to generate the block ID field of each chain block. The detailed process will be described below.

Figure 2. Demonstration of a hash function (MD5).



To ensure the integrity of the transaction data, the cryptographic hash function could be applied on it to generate a transaction hash (value), which could also be saved in the meta-data field, as shown in Figure 1. The block ID can then be generated by applying the cryptographic hash function on the meta-data field, which contains timestamp, parent block ID (except for the head-block, which does not have a parent), the transaction hash, and other data items. Therefore, each block ID is genetically coded with its parent block ID, linking them together forming a close and verifiable relation.

The data structure and implementation of blockchain make it impossible to modify the transaction data of a block without modifying its transaction hash, its block ID, its child's block ID, and its grand-child's block ID, and so on and so forth. This kind of hashed-chain data structure makes the transactions (records) stored in blockchain tamper-proof or secure.

Data Distribution, Communication Protocol, and Verification Mechanism

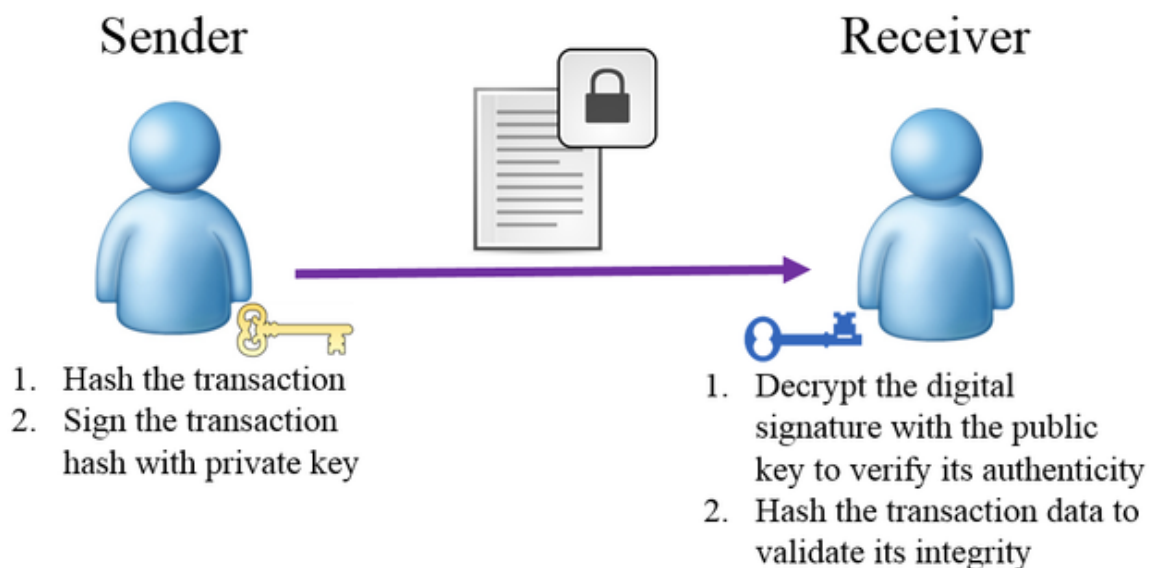
Unlike a traditional file or a traditional database, blockchain is stored in a distributed network (Croman et al., 2016). Usually, there is no central node that controls the network. Instead, all nodes are considered equal and have exactly the same blockchain data record. Decisions, such as overwrite a transaction or delete a block, can be made through a majority vote of the participating nodes.

Because blockchain is designed as a distributed and decentralized digital record storage, part or the entire copy of the blockchain is stored on each client's site. A reliable, fair, and convenient communication mechanism is needed to maintain the blockchain. One solution is to store a decentralized tracker, which contains the address of all current clients, in all sites. All trackers will be updated when new clients join the network. Communications among clients could be implemented with message passing or remote procedure call (Andrews, 1991).

When a new transaction needs to be recorded, a new block is created and added to the blockchain on one client site following the hashed-chain mechanism described in the previous subsection. The new block is then broadcast to the whole network so that all other clients on the network could validate the new block and add it to the chain.

The whole chain blocks are transparent to all clients, allowing anyone to verify the legitimacy of a transaction. This policy can be implemented with the public-key cryptography (Salomaa, 2013), where digital signature is used to prove the legitimacy of the transaction. Specifically, an authorized party signs (encrypts) the transaction with its own secret private key. The public key has been made available to all clients, allowing anyone to verify the authenticity of the transaction and validate the integrity of the transaction. Figure 3 shows the process to sign and validate a transaction using the public-key cryptography. Details about the blockchain transactions are given in the following subsections.

Figure 3. Sign and validate a transaction using public-key cryptography.



Transaction Execution

Many different types of transactions can be executed and recorded in a blockchain network. Examples of transaction types include record of e-commerce, package delivery, financial service, healthcare service, transportation service, etc. In most cases, each transaction is associated with two parties, such as a seller and a buyer, a payer and a payee, a service provider and a service receiver, and so on and so forth.

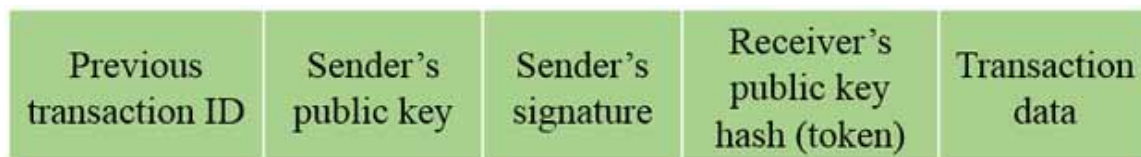
What is being transferred between the two parties can be virtualized as a token. Bitcoin is the best known example, where each bitcoin is an address (token). In fact, the bitcoin address is just an algorithm-

generated hash value, not a physical address. Other types of transactions could be modeled following similar mechanisms. For example, a product in an e-commerce transaction, a package in a delivery order, and a service in financial or healthcare sectors can all be virtualized as a token passing from one party to another party. Some other records, such as registration, identity, and certificate could also be modeled as a token, and anyone with a private key can claim to be the owner of the token.

When a transaction is conducted, the owner of the token needs to send the token to the receiver. This operation follows four steps.

1. Before the transaction, the token owner has a pair of keys (a private key and a public key) and the token receiver also has a pair of keys (a private key and a public key).
2. The receiver sends its hashed public key to the owner, which later will become the address of the new token.
3. The owner then creates a transaction message containing the following information: ID of the previous transaction where the token is saved; its own public key; its signature signed with its private key, the receiver's public key hash, and details of the transactions, such as amount in the case of currency. The general structure of a transaction message is shown in Figure 4.
4. The transaction message is then broadcast to the network, pending validation by other clients.

Figure 4. General structure of a transaction message.

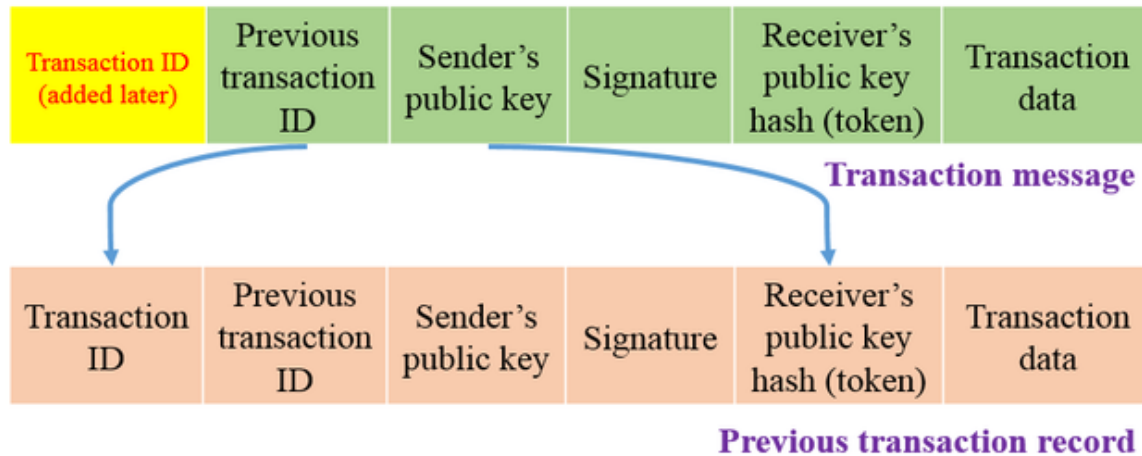


Transaction Verification

Transaction verification in blockchain is carried out through looking up past transactions to ensure the validity of the old token and to validate the sender's ownership. Generally speaking, transaction verification follows four steps.

1. Once a responsible node receives a transaction message, it will use the public key embedded in the message to verify the signature, proving the integrity of the transaction, which means the message has not been tampered.
2. Then, the responsible node will use ID of the previous transaction listed in the message to search the blockchain list to identify the previous transaction and compare it with the new transaction.
3. Next, the responsible node will need to hash the public key provided by the sender and compare the hash value with the public key hash stored on previous transaction. If these two values are same, it proves the sender owns the token (public key hash listed on the previous transaction) and it is legitimate for the sender to pass the token to others. This process is illustrated in Figure 5.
4. After Steps 1 to 3 are successfully completed, the transaction message will be converted to a transaction record with an assigned transaction ID. The transaction record is written permanently into the block recognizing the value (status) and ownership of the new token.

Figure 5. Cross-check a new transaction message with its previous transaction record.



After the new token is passed to the new owner, the old token carries no values. In the case of bit-coin transaction, the remaining balance after a transaction will be carried on to another new token and assigned to the owner itself. Since the new owner's public key hash (token) is saved in the transaction, only the person having the corresponding private key can claim to be the owner of the token.

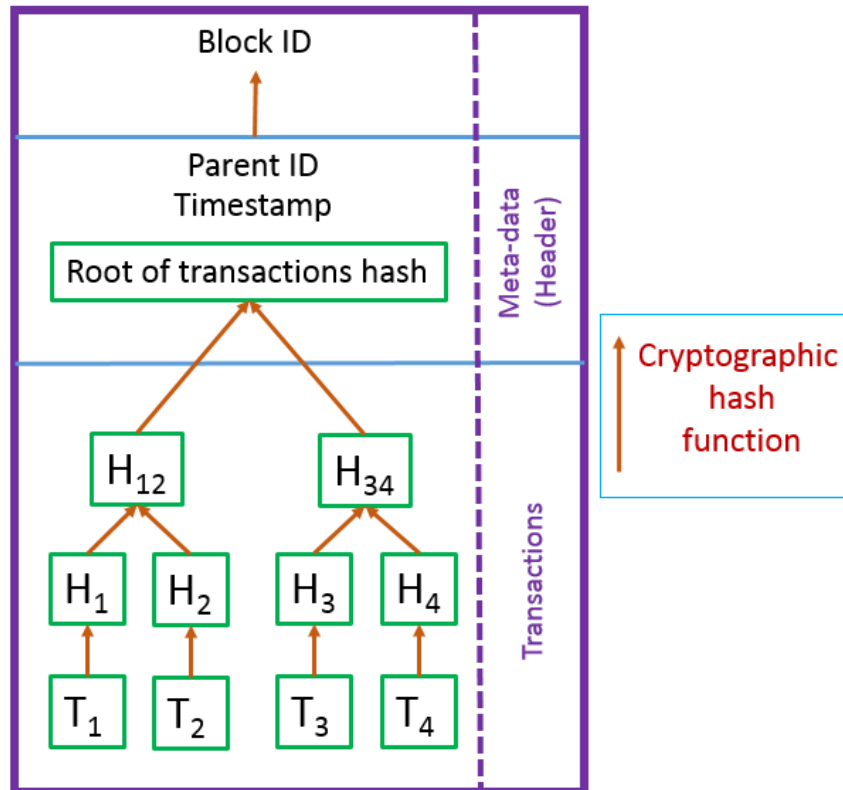
Blocks Creation

In applications with less frequency of transactions, a new block can be created and added to the block-chain for every transaction. This is a simple design for small applications. For applications with frequent and concurrent transactions, a block could be designed to store more than one transactions, and a new block is needed only if its parent block is “full of transactions”. There could be different mechanisms to define the “fullness” of a block. In Bitcoin, a new block is generated about every 10 minutes, which is controlled by some algorithms; all confirmed transactions within that 10 minutes period will be stored in the same block.

If more than one transactions need to be stored in a block, a binary tree is a best solution for large number of transactions, which can make it more efficient to search the transaction records and validate a new transaction. Because transactions need to be hashed to ensure their data integrity, Merkle tree could be used (Buchmann et al., 2008). Figure 6 shows the structure of a chain block with multiple transactions hashed as a Merkle tree.

To validate a transaction in a block as shown in Figure 6, a binary search can be conducted to locate the transaction and then validate the parent hash values, recursively. For example, to validate a transaction, say T_4 , we need Hash H_3 , Hash H_{12} , then we can carry out hash operations to validate Hash H_4 , Hash H_{34} , root hash, Block ID, and so on.

Figure 6. A chain block with multiple transactions hashed as a Merkle tree: *T* represents a transaction; *H* represents a hashed value.



PROTOCOLS AND PLATFORMS

Blockchain is a technology prototype. To implement blockchain, specific technology and protocols should be standardized. Many platforms have been established in the past 10 years. Among them, Bitcoin, Ethereum, and Hyperledger are considered outstanding, which are described below.

Bitcoin

Bitcoin is a blockchain protocol designed in 2008 and launched in 2009. It is open source software, implemented as an ad hoc decentralized network and messages are broadcast on a best effort basis. Bitcoin is now the world's largest digital currency trading system. Over 100 companies accept bitcoin payment, including *Subway*, *KFC Canada*, *Microsoft*, *Expedia*, and *Dish*.

Ethereum

Ethereum is an open-source distributed computing platform employing blockchain technology. This platform features smart contracts and decentralized applications. More than 100 companies, institutions, and organizations have joined the *Enterprise Ethereum Alliance* to define a standard blockchain protocol to govern the industry. These members include *Toyota*, *Samsung*, *Microsoft*, *Intel*, *J.P. Morgan*, *Merck*, *Deloitte*, *Accenture*, *MasterCard*, *Cisco*, and more.

Hyperledger

Hyperledger is an open source blockchain platform created in 2015 by the Linux Foundation. The objective of Hyperledger project is to provide a platform supporting the development of blockchain-based distributed ledgers. Supporting companies of the project include *Cisco, Hitachi, IBM, Intel, NEC, Red Hat, J.P. Morgan, SWIFT, Wells Fargo, Accenture*, and others. Currently, *IBM's* blockchain solutions are built on top of Hyperledger platform.

APPLICATIONS

As described in Section 2, the most important properties of the blockchain technology are the traceability and integrity of all records. These properties make blockchain a promising solution in financial services, healthcare services, identity services, delivery services, and so on. These potential applications are described below.

Financial Services

Traditionally, financial transactions are stored in database. With blockchain, any type of financial transaction, such as sale, purchase, receipt, and payment can all be recorded in blockchains (Peters & Panayi, 2016). This implementation will make it easy to avoid errors, resolve conflicts, and track every transaction. For example, the purchase and sell of a stock, mutual fund, and ETF can all be converted as blockchain transactions. *J.P. Morgan*, in partnership with *Royal Bank of Canada* and *Australia and New Zealand Banking Group*, has launched a new payment processing network using blockchain technology. Other global banks, including *UBS, Goldman Sachs*, and *Morgan Stanley*, are evaluating and optimistic about this technology.

International business, such as cross-border trading and cross-border payment, can be improved with blockchains (Guo & Liang, 2016). Traceable order status, delivery status, and payment status can reduce the complexity and improve the efficiencies of business operations. Other financial services that blockchain could be used include insurance claim processing, credit rating, and loan payment recording. *IBM* and *Accenture* are in leading positions in providing a broad range of blockchain-based financial services.

Charity, especially targeted donation is another area that blockchain can play an important role (Swan, 2015). Currently, if a donor wants to donate to a specific needed person through a philanthropic organization, it is not easy to verify the delivery of the money, especially if this is an anonymous donation. With blockchain, the transaction of the donation can be made traceable to the donor. Even for general donations, applying blockchain technology, we can make the distribution of donations more transparent to the public. *Alice* and *Giveth* are two blockchain-based charity and fundraising platforms that support traceable and transparent donations.

Identity Services

Currently, if you apply for a credit card online, file a tax return online, or conduct a financial transaction online, you will need to provide different kinds of data to prove your identity. With blockchain, a digital online ID could be created and stored in blockchain-based authentication services. The hashed online ID, just like bitcoin transactions, is transparent to all parties. But, only the one that possesses the private key

used to generate the online ID, can prove to be the owner (Shrier et al., 2016). *IBM* is currently working on this field. Many startups, including *civic*, have begun to provide secure, verified identity services.

For offline applications, blockchain could also be used to store IDs, such as driver's license and passport (Biggs, 2014). To create a digital driver's license or passport, a picture should be taken first. The owner then signs the digital passport or driver's license with a private key. The digital ID can be saved in a blockchain-based system. When an ID is needed offline, the owner can provide the private key to retrieve the ID online and show it to the interested officials. *Shocard*, a startup founded in 2015 and headquartered in Palo Alto, California, provides enterprise identity authentication services.

Intellectual Property and Physical Goods

Store the authorship and ownership of an intellectual property, such as patent, book, film, and music in a blockchain will make these information transparent to the public (Ha, 2016). Transfers of ownership can also be recorded. *Bernstein Technologies GmbH*, a German company based in Munich offers blockchain solutions for intellectual property management.

Certificate of luxury goods can also be stored in blockchain. The certificate can include detailed description of the item including pictures. It works like a digital ID of the luxury good (Fanning & Centers, 2016). *Everledger*, a London-based company, is an industry leader in this field. It has registered more than 1.6 million diamonds using blockchain.

Blockchain can also be used to trace the path of a physical good in the supply chain from producer to end consumer. The main purpose of this application is to protect the consumer from buying fake goods. This objective can be achieved through storing the product's auditable journey records from production to consumption. Recently, China's e-commerce giant *Alibaba* announced to create a blockchain-based food security system (Ngo, 2017).

Property Registration

Ownership of land, real estate, and vehicles are currently documented offline and kept in a centralized government agency or an organization. To verify or transfer the ownership is a tedious process. With the support of blockchain, these registrations can be made public available to allow a permitted party to access (Underwood, 2016). Storing registrations on the blockchain will make it impossible to forge a faked ownership. This practice can improve business efficiency, decrease operating cost, avoid personal lost, and increase trust. Some European countries, including Georgia, Sweden, and the Ukraine have begun to register land titles in blockchain. Other countries, such as Russia and America are testing this idea.

Package Delivery

Package tracking now days is available for some services within a carrier. However, cross-carrier and cross-border tracking is hard. Using blockchain, we can integrate individual centralized tracking systems, such as FedEx, UPS, USPS, DHL, into a decentralized and transparent system (Shah, 2017). *Microsoft*, *IBM*, and *Maersk* of Denmark are working in this field to digitize, manage, and track shipping transactions using blockchain technology.

Healthcare

There are two major applications of blockchain in healthcare. First, the supply, prescription, and usage of certain drugs could be recorded on the blockchain making these records transparent to physicians and regulators. Second, patients' medical history and treatment history could also be stored in blockchain making them available to healthcare providers and insurance companies, which can help avoid mistakes and reduce healthcare cost (Kuzmeskas, 2017). *Hashed Health*, based in Nashville, Tennessee, is a leading company focusing on applying blockchain and distributed ledger technologies in healthcare field.

Voting

Voting is the basic right of our citizens. For security and integrity reasons, voting has been done offline. As many other businesses and social activities are moving online, there is a demand to allow vote online. Blockchain technology can support this transition. Before the election, every eligible voter could receive a private key, which will be used to cast a vote on the election day. The vote is traceable, and the result is unchangeable and open to the public (Omohundro, 2014). *Follow My Vote* is a nonpartisan public corporation currently designing an online voting platform with blockchain technology. Their objective is to improve the integrity standards of voting systems worldwide.

FUTURE RESEARCH DIRECTIONS

Implication of Work

In the previous section, we discussed the potential applications of blockchain in various business fields. It is no doubt that blockchain is a disturbing technology and its impact on business and society has not been fully investigated.

First, blockchain applications can surely increase productivity, improve government efficiency, and reduce business operational cost. For example, the usage of blockchain on identity verification can reduce the workforce of security screenings at airports and government buildings. Second, like many new technologies, the usages of blockchain in certain areas will result in job loss. Keep in mind, technology is never the sole cause of business failure. Governments are held responsible to take actions to assist business transformation and make sure our society could smoothly adapt to changes.

Limitation of Work

As with any studies, there are some limitations to our work. First, blockchain is an emerging technology. It is not mature yet. Especially, we do not have long enough experience of using this technology. There could be other potential risks about this technology that have not been fully realized yet. Second, although there are many potential applications of blockchain, they are all in their early stages of development. The full adoption of blockchain technology may take years. Finally, the adoption of any technology, including blockchain, that might have impact on individuals and society, must be regulated. Currently, the legislature on blockchain technology is no doubt legged behind.

Future Work

The future research in this area can be described in the following directions. First, the impact of cryptocurrencies on our current financial systems and central banks should be studied. Second, the impact of blockchain technology on privacy protection should also be investigated. For example, if our computer that contains various private keys are hacked, our financial transactions, online identifications, ownership of properties could be exposed and stolen. Third, the social impact of blockchain should also be studied. Whenever new technologies are adopted, we need to make sure the technology-disadvantaged groups, such as elderly citizens, are still able to access all services using conventional mechanisms. For example, blockchain-based electronic ID should be a complement instead of a replacement of a hard copy ID; cryptocurrencies should never replace cash as the sole payment method in local stores, clinics, restaurants, and transportation services.

CONCLUSIONS

This paper described blockchain, its data structure and operation mechanism. It showed how transactions can be securely recorded in blockchain, making them traceable and transparent to the public. In addition, the development platform, the applications of blockchain in various fields are also described.

As with any emerging technologies, blockchain also has its drawbacks and barriers to industry. Ignoring its weakness may result in business losses, property damages, or operational failure. Below summarizes the risks of adopting blockchain technology.

- Blockchain transactions are recorded with public keys. To claim the ownership of a cryptocurrency, an identification, or a property, you must present your private key. If you lost your private key, you lost the ownership of the transaction. For identifications, such as passport, and some properties, such as a land, we might have other mechanisms to recover your ownership. However, for decentralized cryptocurrency, there is no way to recover a lost ownership.
- Blockchain records are closely related with hash functions. Loss of transaction records could result in failure of verifying subsequent transactions. This could happen if physical damage occurred to record storage due to natural disasters, war, or fire.
- Small scale blockchain records are more susceptible to hacker attacks. Although it is technically difficult for hackers to modify all the transaction records, it is still possible for hackers to modify these transactions if the data is small and stored centralized.
- Cost to maintain blockchain-based application could go higher as more and more transactions are recorded. Especially, some expired transactions cannot be removed. Instead they must be kept forever to verify some previous unexpired transactions. Therefore, record storage and record maintenance could be a headache for business in the long run.

Blockchain, as a disruptive technology, could have great impact on IT industry, business, and government organizations. Economically, blockchain is expected to revolutionize our business practices and reduce operating cost. Politically, blockchain could bring trust to society, democratize the global economy, and improve social relations. However, none of these goals could be achieved easily. It requires the collaborative work of governments, business, and other institutions. More and more leading companies in

various business and industry have strongly stated their positions in adopting blockchain technology. Their stance and white papers can be found in Section “Additional Readings.”

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KEY TERMS AND DEFINITIONS

Binary Tree: A data structure in computer programs to store large amount of data. Compared with other data structures, binary tree provides the fastest access to a data item, in general.

Bitcoin: A decentralized digital currency system implemented with blockchain technology.

Blockchain: A distributed secured record-keeping system with a list structure.

Cryptographic Hash: A hash function used in computer security that takes input data and returns a fixed-size alphanumeric string.

Decentralized Network: A computer network that all nodes are equal and no single node controls the entire network.

List: A data structure used in computer programs to store data. List is composed of individual data blocks.

Public-Key Cryptography: A cryptographic technique that uses two asymmetric keys: a public key and a private key.

Cyber Crime Threats, Strategies to Overcome, and Future Trends in the Banking Industry

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INTRODUCTION

Cybercrime is a near and present threat for all organizations today. While primarily focused on the consumer and financial services industry for many years, cybercrime definitively made the shift into the enterprises. Cybercriminals are working everyday to create better technology that will lead to larger payoffs (Brown, 2015; Byrne et al., 2002; Broadhurst et al., 2014). They are switching their methods and hitting diversified targets to yield better information. As experienced by one organization: It took cybercriminals just four hours to overcome a countermeasure that had taken them four months to develop. Managing risk against the threat of cybercrime is certainly not easy an easy task (Taylor et al., 2014; Yuan et al., 2016). One of the most important lines of defense is intelligence and awareness of the potential risks and governments have been making great strides to embrace information sharing among competitors and partners, but most importantly, the general public (Bauer et al., 2017).

BACKGROUND

Strategies to Overcome Cyber Threats

When a bank's system is connected to the internet or intranet, an attack could originate anytime, anywhere. Some acceptable level of security must be established before business on the internet can be reliably conducted (Byrne et al., 2002; Bossler et al., 2012; Aboobucker et al., 2018). An attack could be any form like:

- The intruder may gain unauthorized access
- The intruder can destroy, corrupt or otherwise alter data
- The intruder does not gain access, but instead forges messages from user system
- The intruder does not gain access, but instead implements malicious procedures that cause the network to fail, reboot or hang

Modern security techniques have made cracking very difficult but not impossible. Furthermore, if the system is not configured properly or the updated patches are not installed then hackers may crack the system using security hole. A wide range of information regarding security hole and their fixes is freely available on the internet.

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1. AUTHENTICATION TECHNIQUES

Authentication is the act of establishing genuineness or originality of a subject. It can be divided into many types depending on how it is performed. Authentication techniques evolved and got strengthened by continuous refinements so as to lessen attacks on private domains (Raza et al., 2011).

1.1 Single Factor Authentication

A well-known and trusted solution in the initial days of computerization was validation by a single attribute. It was effective in the days of localized processing and single user environments. But as networking and Internet based applications spread everywhere, and users were required to maintain passwords for many sites and different applications, they tended to use a single password for all applications on different websites (Fernando et al., nd; Shareef et al., 2018). There are several reported cases where attackers broke into low security websites and retrieved thousands of username/password pairs and directly try to use them by trial and error methods to enter high security e-commerce sites such as eBay with the intention of committing frauds.

1.2 Web Password Hashing

PwdHash is a browser extension that transparently converts a user's password into a domain-specific password (Simmons et al., 2006; Frankel et al., 2011). PwdHash automatically replaces the contents of these password fields with a one-way hash of the pair (password, domain-name). This makes the program on the website process only the domain-specific hash of the password, and not the password itself. A break-in at a low security website exposes password hashes rather than an actual password. Though this was a very effective technique, it required extensions to be added to the browsers. This feature if embedded into every browser will avoid the need to install any extensions.

1.3 Two Stage Authentication

All users cannot be expected to load extensions to their passwords as it requires some knowledge of processing and also as password-stealing attacks have become so common that the software industry observed that the two stage authentication may control the ID theft only to some extent (Subsorn et al., 2012). Businesses chose different methods for second stage authentication apart from passwords. The second input for authentication should preferably be dynamic and possessed by the authorized user. One-time passwords given through tokens, transaction numbers over mobile telephones, grids printed on the back of cards, dynamic digits from ATM card numbers, etc., all are entered as a second input for authentication and come in the increasing order of complexity and cost. Though these methods are loosely termed as second-factor authentication in reality these get used as knowledge based inputs and thus can be stolen or shared (Brown, 2015).

1.4 Multifactor Authentication

The FFIEC – Federal Financial Institutions Examination Council, issued supplemental guidance on authentication in August 2006, in which they clarified, “By definition true multifactor authentication

requires the use of solutions from two or more of the three categories of factors” (Shareef et al., 2018). Using multiple solutions of the same category, would not qualify as a multifactor authentication.

1.5 Multi Channel Authentication

One time transaction password sent by a bank to its customer on mobile telephone before the transaction is put through has become very popular. On the assumption that security over the Internet channel could be breached and mobile telephone channel is safer this additional stage was introduced (Raza et al., 2011). However, with convergence of different communication channels (Internet on mobile) and device convergence (iPod) implemented these solutions need to be continuously reviewed and more layers built in. Authentication process always uses authentication servers and the most common type of authentication servers include-

1.2.1 RADIUS (Remote Authentication Dial in User Service)

Remote Authentication Dial in User Service (RADIUS) is a networking protocol that provides centralized Authentication, Authorization, and Accounting (AAA) management for computers to connect and use a network service. RADIUS was developed by Livingston Enterprises, Inc., in 1991 as an access server authentication and accounting protocol and later brought into the Internet Engineering Task Force (IETF) standards (Simmons et al., 2006; Frankel et al., 2011). Because of the broad support and the ubiquitous nature of the RADIUS protocol, it is often used by ISPs and enterprises to manage access to the Internet or internal networks, wireless networks, and integrated e-mail services. These networks may incorporate modems, DSL, access points, VPNs, network ports, web servers etc. It is a client/server protocol that runs in the application layer, using UDP as transport. The Remote Access Server, the Virtual Private Network server, the Network switch with port-based authentication, and the Network Access Server (NAS), are all gateways that control access to the network, and all have a RADIUS client component that communicates with the RADIUS server. The RADIUS server is usually a background process running on a UNIX or Windows NT machine (Subsorn et al., 2012). RADIUS serves three functions-

1. To authenticate users or devices before granting them access to a network,
2. To authorize those users or devices for certain network services and
3. To account for usage of those services.

1.2.2 Kerberos

Kerberos is a computer network authentication protocol, which allows nodes communicating over a non-secure network to prove their identity to one another in a secure manner. Its designers aimed primarily at a client-server model, and it provides mutual authentication, both the user and the server verify each other's identity (Susborn et al., 2016). Kerberos protocol messages are protected against eavesdropping and replay attacks. Kerberos builds on symmetric key cryptography and requires a trusted third party, and optionally may use public-key cryptography by utilizing asymmetric key cryptography during certain phases of authentication. Kerberos uses as its basis the symmetric Needham-Schroeder protocol. It makes use of a trusted third party, termed a key distribution center (KDC), which consists of two logically separate parts: an Authentication Server (AS) and a Ticket Granting Server (TGS). Kerberos works on the basis of “tickets” which serve to prove the identity of users (Samaddar, 2009).

The KDC maintains a database of secret keys; each entity on the network — whether a client or a server — shares a secret key known only to itself and to the KDC. Knowledge of this key serves to prove an entity's identity. For communication between two entities, the KDC generates a session key which they can use to secure their interactions. The security of the protocol relies heavily on participants maintaining loosely synchronized time and on short-lived assertions of authenticity called Kerberos tickets. The client authenticates itself to the Authentication Server and receives a ticket (Yuan et al., 2016). It then contacts the Ticket Granting Server, and using the ticket it demonstrates its identity and asks for a service. If the client is eligible for the service, then the Ticket Granting Server sends another ticket to the client. The client then contacts the Service Server, and using this ticket it proves that it has been approved to receive the service. A simplified and more detailed description of the protocol follows. The following abbreviations are used:

- AS = Authentication Server
- SS = Service Server
- TGS = Ticket-Granting Server
- TGT = Ticket Granting Ticket

The client authenticates to the AS once using a long-term shared secret (e.g. a password) and receives a TGT from the AS. Later, when the client wants to contact some SS, it can (re)use this ticket to get additional tickets from TGS, for SS, without resorting to using the shared secret. These tickets can be used to prove authentication to SS.

1.2.3 TACACS+

TACACS+ protocol provides access control for routers, network access servers and other networked computing devices via one or more centralized servers (Meyers, 2014; Mbelli et al., 2016). TACACS+ provides separate authentication, authorization and accounting services. TACACS allows a client to accept a username and password and send a query to a TACACS authentication server, sometimes called a TACACS daemon or simply TACACSD. This server was normally a program running on a host. The host would determine whether to accept or deny the request and sent a response back. The TIP would then allow access or not, based upon the response. In this way, the process of making the decision is “opened up” and the algorithms and data used to make the decision are under the complete control of whoever is running the TACACS daemon. The extensions to the protocol provide for more types of authentication requests and more types of response codes than were in the original specification.

1.2.4 Lightweight Directory Access Protocol

The Lightweight Directory Access Protocol (LDAP) is a directory service protocol that runs on a layer above the TCP/IP stack. It provides a mechanism used to connect to, search, and modify Internet directories. The LDAP directory service is based on a client-server model (Mahmadi et al., 2016; Li et al., 2016). The function of LDAP is to enable access to an existing directory. The data model (data and namespace) of LDAP is similar to that of the X.500 OSI directory service, but with lower resource requirements. The associated LDAP API simplifies writing Internet directory service applications

1.3 Cryptography

Cryptography is the science of writing in secret code and is an ancient art; the first documented use of cryptography in writing dates back to circa 1900 B.C. when an Egyptian scribe used non-standard hieroglyphs in an inscription. Some experts argue that cryptography appeared spontaneously sometime after writing was invented, with applications ranging from diplomatic missives to war-time battle plans. It is no surprise, then, that new forms of cryptography came soon after the widespread development of computer communications (Kessler, 2011). In data and telecommunications, cryptography is necessary when communicating over any insecure medium, which includes just about any network, particularly the Internet. A variety of cryptographic methods may include Secret Key Cryptography, Public Key Cryptography or Hash Functions.

1.4 Database Security

Data base Management Systems are increasingly being used to store information about all aspects of an enterprise (Mahmadi et al., 2016; Mbelli et al., 2016). The data stored in a DBMS is often vital to the business interests of the organization and is regarded as a corporate asset. In addition to protecting the intrinsic value of the data, bank must consider ways to ensure privacy and to control access to data that must not be revealed to certain group of users for various reasons (Tham, 2017). A database of the bank contains a great deal of information and usually has several groups of users. Most users need to access only a small part of the database to carry out their tasks. Allowing users unrestricted access to all the data can be undesirable and a DBMS should provide mechanisms to control access to data. A DBMS uses two main approaches to access control.

1.4.1 Discretionary Access Control

Discretionary access control is the principle of restricting access to objects based on the identity of the subject (the user or the group to which the user belongs). Discretionary access control is implemented using access control lists. A resource profile contains an access control list that identifies the users who can access the resource and the authority (such as read or update) the user is allowed in referencing the resource. The security administrator defines a profile for each object (a resource or group of resources), and updates the access control list for the profile (IEEE, 2011). This type of control is discretionary in the sense that subjects can manipulate it, because the owner of a resource, in addition to the security administrator, can identify who can access the resource and with what authority.

1.4.2 Mandatory Access Control

Mandatory Access Control (MAC) ensures that the enforcement of organizational security policy does not rely on voluntary web application user compliance (IEEE, 2011). MAC secures information by assigning sensitivity labels on information and comparing this to the level of sensitivity a user is operating at. In general, MAC access control mechanisms are more secure than DAC yet have tradeoffs in performance and convenience to users.

MAC mechanisms assign a security level to all information, assign a security clearance to each user, and ensure that all users only have access to that data for which they have a clearance (IEEE, 2011). MAC is usually appropriate for extremely secure systems including multilevel secure military applica-

tions or mission critical data applications. A MAC access control model often exhibits one or more of the following attributes:

- All users can read from a lower classification than the one they are granted (A “secret” user can read an unclassified document).
- All users are given read/write access to objects only of the same classification (a “secret” user can only read/write to a secret document).
- Only administrators, not data owners, make changes to a resource’s security label.
- All users can write to a higher classification (A “secret” user can post information to a Top Secret resource).
- All data is assigned security level that reflects its relative sensitivity, confidentiality, and protection value.
- Access is authorized or restricted to objects based on the security characteristics of the HTTP client (e.g. SSL bit length, version information, originating IP address or domain, etc.)
- Access is authorized or restricted to objects based on the time of day depending on the labeling on the resource and the user’s credentials (driven by policy).

1.5 Network Security

We say a network is secure if the connection obeys CIA property. To provide security in a network many security protocols are being designed by Internet Authority time to time. Web came into being in early 90s; researchers started thinking about to provide security to web and web transaction (Simmons et al., 2006).

1.5.1 IPSEC

Internet Protocol Security is a protocol suite for securing Internet Protocol (IP) communications by authenticating and encrypting each IP packet of a communication session (Frankel et al., 2011). It includes protocols for establishing mutual authentication between agents at the beginning of the session and negotiation of cryptographic keys to be used during the session. It is an end-to-end security scheme operating in the Internet Layer of the Internet Protocol Suite (Zhang et al., 2015). It can be used in protecting data flows between a pair of hosts (host-to-host), between a pair of security gateways (network-to-network), or between a security gateway and a host (network-to-host).

1.5.2 SSL

The Secure Sockets Layer (SSL) protocol was developed by Netscape Communications to provide application-independent secure communication over the Internet for protocols such as the Hypertext Transfer Protocol (HTTP). SSL employs RSA and X.509 certificates during an initial handshake used to authenticate the server (client authentication is optional). The client and server then agree upon an encryption scheme; SSL v2 supports RC2 and RC4 with 40-bit keys, while SSL v3 adds support for DES, RC4 with a 128-bit key and 3DES with a 168-bit key, all along with either MD5 or SHA-1 message hashes. SSL v3 is the commonly supported version on servers today, although some implementations of SSL v2 will still be found; both are supported by most common browsers

1.5.3 DNSSEC (DNS Security Extension)

DNSSEC was designed to protect the Internet from certain attacks, such as DNS cache poisoning. It is a set of extensions to DNS, which provide: a) origin authentication of DNS data, b) data integrity, and c) authenticated denial of existence (Meyers, 2004).

These mechanisms require changes to the . DNSSEC adds four new resource record types: Resource Record Signature (RRSIG), DNS Public Key (DNSKEY), Delegation Signer (DS), and Next Secure (NSEC).

1.5.4 WEP

Wired Equivalent Privacy (WEP) is the encryption algorithm built into the 802.11 (Wi-Fi) standard. WEP encryption uses the RC4 stream cipher with 40 or 104 bit keys and a 24 bit initialization vector. Most 802.11 devices allow WEP keys to be entered using an ASCII passphrase or in hexadecimal format. The conversion between these two formats is an industry standard which is shared by almost all vendors of 802.11 equipment.

1.5.5 WPA

Wi-Fi Protected Access (WPA) and Wi-Fi Protected Access II (WPA2) are two security protocols and security certification programs developed by the Wi-Fi Alliance to secure wireless computer networks (Subsorn et al., 2012). The Alliance defined these in response to serious weaknesses researchers had found in the previous system, WEP (Wired Equivalent Privacy). The WPA protocol implements the majority of the IEEE 802.11i standard. The Wi-Fi Alliance intended WPA as an intermediate measure to take the place of WEP pending the preparation of 802.11i. Specifically, the Temporal Key Integrity Protocol (TKIP), was brought into WPA. TKIP encryption replaces WEP's small 40-bit encryption key that must be manually entered on wireless access points and devices and does not change. TKIP is a 128-bit per-packet key, meaning that it dynamically generates a new key for each packet and thus prevents collisions.

1.5.6 RSN (ROBUST SECURITY NETWORK)

The RSN is a security network that only allows the creation of robust security network associations (RSNAs), which are a type of association used by a pair of stations (STAs) if the procedure to establish authentication or association between them includes the 4-Way Handshake. It also provides two RSNA data confidentiality and integrity protocols, TKIP and CCMP, with implementation of CCMP being mandatory.

1.6 Security Policy

Various information security policies have been developed by the organizations to overcome the attack of cyber threats. Information security means protection of the banks' data, applications, networks and computer systems from unauthorized access, alteration or destruction (Baeur et al., 2017; Broadhurst et al., 2014). The purpose of information security is-

- To establish an organization wide approach to information security.

- To prescribe mechanisms that help identify and prevent the compromise of information security and the misuse of banks' data, applications, networks and computer resources.
- To define mechanisms that protect the reputation of the bank and allow the bank to satisfy its legal and ethical responsibilities with regard to its networks' and computer resources' connectivity to worldwide networks.
- To prescribe an effective mechanism to external complaints and queries about real or perceived non compliance with this policy.

The bank uses a layered approach of overlapping controls, monitoring and authentication to ensure overall security.

1.6.1 Data Classification Policy

It is essential that the entire bank's data should be protected. These are however gradations that require different levels of security (Samaddar, 2009). All data should be reviewed on periodic basis and classified according to its use, sensitivity and importance. **High Risk** information assets for which there are legal requirements for preventing disclosure of financial penalties for disclosure. Data covered by federal and state legislation such as FERPA, HIPAA or the data protection Act are in this class. Payroll, personnel and financial information are also in this class because of privacy requirements. This policy recognizes that other data may need to be treated as high risk because it would cause severe damage to the bank if modified or disclosed. **Confidential** data that would not expose the bank to loss if disclosed, but that the data owner feels should be protected to prevent unauthorized disclosure. It is the data owner's responsibility to implement the necessary security requirements. **Public** information that be freely disseminated should be categorized and protected according to the requirements set for each classification. The data classification and its corresponding level of protection should be consistent when the data is replicated and as it flows through the banking environment.

1.6.2 Access Control Policy

The branches and top level management must have a standard policy that applies to user access rights. This will suffice for most instances (IEEE, 2011). Data owners or custodians may enact more restrictive policy for end user access to their data. There is a delicate balance between protecting the data and permitting access to those who need to use the data for authorized purposes. This balance should be recognized.

1.6.3 Virus Prevention Policy

The willful introduction of computer viruses or disruptive/ destructive program into the bank is prohibited and violators may be subject to prosecution. All servers and workstations that connect to the network and that are vulnerable to virus or worm attack must be protected with an approved, licensed antivirus software product that is kept updated according to the vendor's recommendations. Headers of all incoming data including electronic mail must be scanned for viruses by the email server where such products exist and are financially feasible to implement. Outgoing e-mail should be scanned where such capabilities exist (Samaddar, 2009; Mbelli et al., 2016).

1.6.4 Intrusion Detection Policy

Operating system and application software logging processes must be enabled on all host and server systems. Where possible, alarm and alert functions as well as logging and monitoring systems must be enabled. Server, firewall and critical system logs should be reviewed frequently. Where possible, automated review should be enabled and alerts should be transmitted to the administrators when serious security intrusion is detected.

1.6.5 System Security Policy

System integrity checks of host and server systems housing high risk data should be performed. All the systems connected to the internet must be updated with security patches.

1.6.6 Acceptable Use Policy

Bank's computer resources must be used in a manner that complies with bank's policies, state and federal laws and regulations. Use of computing and networking infrastructure must be limited in both time and resources and must not interface in any way with bank's functions or the employee's duties.

1.6.7 Government Policy

India's business, data and knowledge process outsourcing industries have been growing significantly in the last few years. However, various incidents of data theft and misuse of public and private information have raised concerns about outsourcing to India. Unlike the US or the European Union, India does not have a data protection law. Privacy rights are enforced under the Indian Constitution and the Information Technology Act 2000, whereas Indian Contract Act 1872, Copyright Act 1957 and the Indian Penal Code 1860 protect property rights.

Future Research Directions

The banking industry is undergoing an incredible amount of technological change as these firms release new and exciting features in the hopes of gaining a competitive edge in an ever-changing market. The banking industry experienced a critical change when clients were introduced to the concept of mobile banking. Millions of customers use their cell-phones every day to conduct important transactions, and this number is only increasing. But as open banking continues to accelerate, countless new threats are presented. Although this degree of innovation has an overall positive effect on the industry, it poses many new issues that tech experts will have to combat very quickly. Whether that be the use of third-party apps, unusual consumer behavior, or unsecured wifi networks, it is clear that these banks are constantly at risk. The security of digital communication and transactions is of critical importance and the management of risk to such information systems is considered fundamental to effective cyber security. In the context of such challenges, the need for effective cryptographic systems and the complex mathematics and logic that underpin them have become ever more important. The future of information security will be built around four pillars, namely, Blockchain technologies, artificial intelligence, crowd sourcing, and global cyber-security cooperation (Guo et al., 2016). Many organizations will utilize two or more

of those pillars. An enterprise may combine artificial intelligence to detect security vulnerabilities and crowd testing to confirm the detected vulnerabilities.

CONCLUSION

In the past, banks have been one of the primary investors in security, and this trend is likely to continue as the industry begins to explore this new landscape. As open banking grows, banks will hold data that is more and more interconnected, and they simply cannot afford to take risks. One leak could proceed to cause a chain reaction throughout the entire industry. The larger the problem gets, the harder it will be to control.

Combating these threats certainly will not be easy, but is possible if financial firms are willing to create an adaptive and flexible strategy of detecting, defending, and counter-attacking hackers. One of the many lessons learned during the last few years was that these banks need to find a better way to deal with risk. Although several of these companies are outsourcing their security services in order to ensure comprehensive coverage, the companies themselves need to mitigate these risks by developing software that is less prone to attacks in the first place. By beefing up their own cyber-security, they are not only investing in the future of banking, but also doing what they can to avoid another crisis.

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KEY TERMS AND DEFINITIONS

Brute Force: Brute force attacks use a trial and error approach to acquire information or rights. Instead of intellectual strategies, the attacker uses an exhaustive search technique.

Buffer Overflow: Buffer overflow occurs when a temporary storage area is filled with more data than it was designed to hold. The extraneous data can overflow into adjacent storage causing software failure or, if the data is carefully designed to behave as instructions that trigger unwanted actions.

Crafted Input: Crafted input is carefully designed to disrupt the normal execution of a system. For example, a JPG image can be designed to put the image decoder into an infinite loop.

Cross-Site Scripting: Cross-site scripting is another means of attacking a web server that provides dynamic pages to clients. Scripts embedded in HTML requests can trick an unsuspecting surfer into executing the scripts. These attacks normally are used for information acquisition leading to connection hijacking.

Direct Request to a Resource: Direct request to a resource accesses sensitive data through valid means. The access is allowed because of a limitation in the software or misconfiguration of the software and not because of cleverness on the part of the attacker.

Directory Traversal: Directory traversal attacks commonly target web servers that have the ability to present dynamic pages. Instead of a simple page name, a relative path name is requested which could lead to the acquisition of sensitive data.

Format String: Format string attacks take advantage of software that accepts unfiltered user input. If the input is passed to a formatting function such as `printf()` in C, then tokens such as `%s`, `%x`, and `%n` can be used to obtain information stored in the runtime stack.

Metacharacters: Metacharacters (such as `?` or `*`) are not properly checked before being passed to the underlying system in a system vulnerable to a metacharacter attack. These characters, interpreted by the underlying system, can be used to execute arbitrary commands.

PHP Remote File Inclusion: PHP remote file inclusion allows a remote user to upload to and possibly execute an arbitrary file on a web server. In the general case, a carefully constructed value is passed to the server which contains the name of the remote file to access.

Spoofing: Spoofing is an identity deception used to gain access to restricted resources. Example items to spoof are IP addresses, port numbers and usernames. Secure Shell programs are not even immune to spoofing.

SQL Injection: SQL injection vulnerabilities are exploited by placing database queries in the form of SQL statements into web server requests. The result is the execution of the SQL statement at the server and the return of the query results to the client.

Web Cache Poisoning: Web cache poisoning is accomplished by altering the contents of a web server's cache of pages. Instead of returning the requested page, the modified version in the cache is returned which may contain redirections or arbitrary scripts.

Cybersecurity Risks in Romanian Companies

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INTRODUCTION

Risk management process is proving to be an essential factor for the development and stability of an organization, it is the basis for developing a sustainable strategy for achieving organizational objectives and the basis for planning and decision making (Singh & Fhom, 2017).

At the same time, sophisticated attacks are expected directed to the staff users of the communication and information systems, such as social engineering attacks, correlation between office, ISP, and home computers or mobile device attacks. State-sponsored cyber terrorism is of great concern for state authorities, as this new form of terrorism is cheap and ready available to practically everyone, on each side of the world and it can lead to major disruptions in modern societies. The uncertainty may take the form of either threats or opportunities. Thereby, each manager must handle threats, because otherwise the organization's objectives cannot be met and capitalize the opportunities to the benefit of the organization, proving efficiency (McQuade, 2006; He, Chen, Chan, & Bu, 2012).

Among the most important factors of disruptive impact on the activities of an organization, risk factors are, by far the leading place.

Risk, as defined in the western socio-economic and military environments, can occur anywhere: within the organization, structure, and decision-making process, the relationship with the external environment, the management and policies of the organization (Ruževičius & Gedminaitė, 2007).

In order to identify, analyze and organize organizational risk assessment activities to reiterate the importance of the organizational concepts of systems theory perspective (Hjortdal, 2011; Chen, Ge, & Xie, 2015).

Risk treatment is the second important step in risk management organizational stage where management organization has the key role in the adoption of the most appropriate decision in terms of the balance between the need to fulfill the performance indicators proposed and costs (Hadžiosmanović, Bolzoni, & Hartel, 2012).

Stage security risk treatment is based entirely on the results of the risk analysis phase, the risks have been identified and ranked in terms of the impact that their implementation can have on the organiza-

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tion's mission. This is why, security mechanisms have to be properly designed and commensurate with the specific threats for the specific types of information (Tropina & Callanan, 2015).

Choosing an effective strategy development organization should consider the risks and vulnerabilities exposed to treatment solutions adapted to the needs of each organization's risk and reduce costs, both short and long term. Meanwhile, the adoption of certain measures that contribute to risk management is conditioned by the nature of the organization and the costs incurred for these measures.

As such, also in Romanian companies, concern continues to diminish the effect of unwanted influence involves a compulsory, dedication of resources which, if prolonged neglect can radically affect the overall level of resources of an organization and therefore, the quality of its task.

In order to achieve this aim, the chapter analyzes a number of problems of research. Firstly, this study explores the Romanian organizations' attitude towards information technology security. Secondly, the protection of this infrastructure represents a major concern of authorities all around the world. Information security has become a top of mind issue for the public, media and government. And last but not least, it investigates the necessity to develop a structured process of information security risk within the organization. It must be borne in mind that, regardless of the type of organization, the field of activity or form of organization, there is uncertainty both in organization and in the environment in which it operates. Given that uncertainty is a fact of life, then the uncertainty response should become a permanent managerial concern.

However, collective efforts are necessary, at both national authorities' level and managers of public and private organizations in order to ensure a safe and trusted cyber space. The awareness of potential threats and vulnerabilities is thus vital, as well as preoccupation towards cooperation in countering them by well-established rules and mechanisms created at national and organizational level.

BACKGROUND

Information technology security threats are most often defined as being "those circumstances or events that constitute potential danger to the normal state of a communication and information system, in which the confidentiality, integrity and availability of information, resources and services are ensured" (Ministry of Communications and Information Society, 2011).

Organizations have to expand and deepen their current information security risk frameworks to address these key threats (Andress, 2003; Hong, Kim, & Cho, 2010; Mittelman, 2011). This process implies a more profound understanding of the risks associated with each threat, and a better capacity of tailoring the security framework to align with the organization's identified risks, regulatory requirements and perhaps most important – the increasing dependencies on information technology (Willems, 2011; Stepchenko & Voronova, 2015; Malatras, Geneiatakis, & Vakalis, 2016; Lin, Lin, & Pei, 2017). In addition, as we pointed out previously, management vision must change radically, from a passive or reactive management style to a proactive style, ready at any moment to face the challenges of achieving the objectives of the organization (Tiago, Manoj, & Espadanal, 2014; Agrawal & Tapaswi, 2017).

Contrariwise, the allocation of material resources, human and too big for the risk management process can lead to non-completion of projects or even not starting them. This is where the organization's approach is to stop the progression of the project until the risk management process.

Another important aspect to note is that of a special form of risk, namely the risk of managerial behavior in the face of organizational changes: managers hoped that the change will solve the fundamental problems of the organization; there is insufficient time for planning the implementation of change;

sometimes ignore the importance of training and staff development in the context of change that will take place; change is successful only if the organization's staff change their attitude to adapt to new conditions created by the change; implementing a system with increased security personnel responsibilities (Yang, Wu, & Wang, 2014).

The key to harmonizing relations between manager and staff of the organization is to understand the thinking of the latter. Through this process of understanding and by developing and implementing coherent training policies, the management can complete the performances of the implemented security system (Kesan & Hayes, 2012; Arukonda & Sinha, 2015; Gandino, Celozzi, & Rebaudengo, 2017). Otherwise, it can be concluded that substantial resources have been allocated for the implementation of the security measures system and its efficiency cannot be determined.

Risk analysis is the first stage of risk management and is a crucial component of this process. It provides an assessment of the potential exposure to environmental threat, and the basis for the definition of the events -acceptable and unacceptable from the point of view of organization. The result of this process helps to identify appropriate measures to reduce or eliminate the identified risks. To determine the probability of an undesirable event, threats to the organization should be analyzed in conjunction with the potential vulnerabilities and security measures already implemented (Karim, 2007).

At the same time, Oncioiu (2016) agree that no matter the field of interest, no matter the dimension or type, almost every organization nowadays deals with a lot of sensitive information handled in computer systems: personal data related to their own personnel or customers, commercial data and analysis, industrial patents and so on. Regardless the complexity of the communication and information systems, starting from simple architectures of stand-alone systems to local area networks or wide area networks, managers should be aware of the need to implement proper information security policies in order to build trust in its network services, for both their own personnel and for partners (Smith, 2005; Winkler, 2010; Krombholz, Hobel, Huber, & Weippl, 2015; Broadbent & Schaffner, 2016; Kurosawa, Ohta, & Kakuta, 2017).

But then, communication and information systems are more and more widely used on a large scale in the process of command and control of national critical infrastructures, such as energetic, transportation, telecommunications and health (Wang & Hu, 2014). Each day the society becomes more and more dependent on these information infrastructures that become a backbone of vital information flow (Hiller & Russel, 2013; Gaidelys & Valodkiene, 2011; Okamoto & Takashima, 2015; Fischbacher-Smith, 2016).

In this context, it is of major interest that managers be aware of the importance of establishing correct information security policies, commensurate with the sensitivity of the data their companies process, transmit or store in electronic format (Liaudanskienel, Ustinovicius, & Bogdanovicius, 2009; Collins & McCombie, 2012; Singer & Friedman, 2014; Friedberg, McLaughlin, Smith, Lavery, & Sezer, 2016).

In the opinion of other specialists, such as Landoll (2010) risk analysis is defined as an objective analysis of the effectiveness of the security measures in place to protect the interests of the organization and a determination of the likelihood of prejudice to those interests. More specifically, risk analysis is defined by Peltier (2010) as a process of calculating risk. Algorithms for calculating the risk calculated risk as a function of the organization's assets, threats and vulnerabilities.

RESEARCH METHODOLOGY

In order to get an image of the Romanian organizations' attitude towards security of information they process, transmit or store using communication and information systems, the authors performed a detailed

survey using questionnaires. The research activity's aim was to study the information security policies and mechanisms implemented within the Romanian organizations and had the following objectives: determine the level of awareness regarding the necessity of information security policies and mechanisms; determine if the managerial decision-making is performed on the basis of information security risk management results; determine the dynamics of the security threats towards information handled in communication and information systems.

The survey was performed during the second trimester of 2017. The questionnaires were forwarded to 220 security practitioners, receiving back a number of 158 responses (72%). We choose to receive anonymous responses, in order to enhance the probability of getting more realistic responses. Responses were collected using questionnaires processed using the Scientific Package for Social Sciences (SPSS) 17.0 and the making of the database structure was achieved by defining variables in Variable View. It is also important to note that all completed questionnaires were checked in terms of background completeness and usefulness of data and using the statistical program previously mentioned, data analysis was materialized through frequency tables and histograms for each item, and the centralization of all items.

In addition to the related tables and histograms, data analysis led to an emphasis of statistical indicators for this study, namely: the mean, median, mode, standard deviation/standard error, variance, amplitude of variance, minimum, maximum, the sum of all observations, the coefficient of asymmetry Skewness, the coefficient of vaulting Kurtosis and the calculation of quartiles.

SOLUTIONS AND RECOMMENDATIONS

Following the results of this research, Table 1 presents the results of several regression analyses. Organizational performance was supported, as information security awareness programs was positively associated with organizational performance ($\beta = .25$, $p < .001$). The benefits of information security are weighed against their total cost was also supported as organizational performance was positively related to financial results ($\beta = .36$, $p < .001$). Finally, implementing security measures was supported as the partial regression coefficient of organizational performance reached statistically significant ($\beta = .27$, $p < .001$) after controlling the effect of information security awareness programs.

Table 1. The Linear Regression of information security awareness programs and organizational performance

	Organizational Performance	Benefits of information security are weighed against their total cost	Implementing security measures
	β (t value)	β (t value)	β (t value)
Information security awareness programs	0.25 (4.65***)	0.36 (6.15***)	0.27 (3.98***)
Organizational Performance	-	-	0.168 (2.72***)
ΔR^2	0.17	0.22	0.07
ΔF value	44.95***	73.11***	15.32***
Overall R^2	0.17	0.24	0.22
Overall F value	43.96***	76.10***	51.84***

Note: *** $p < .001$, β = standardized regression coefficient, t value = test statistics of β

As previously shown, the evaluation of the results of an awareness program is important from at least two perspectives. First is the program's objective itself. If the program does not achieve its objective of enlarging the user's knowledge regarding the threats and vulnerabilities that may affect information handled within their organization, the mission of the organization may be at risk. Second perspective is that the awareness program must be developed and improved in accordance with the organization's needs and target audience. A lack of effectiveness should trigger an improvement process of the program. Feed-back on the program should always be required from both the participants to the program and the managers that have responsibilities over the information systems within the organization.

In this context, experts recommend all users from the business, and the individual, pay increased attention in the next period the following:

- Dangers of Web 2.0. The popularity of Web 2.0 applications will continue to generate problems in the next period. Hackers will use attack techniques portions of code and will continue to use Internet browsers and other software (such as Flash or media players) as vectors of spread of infection. Launch Google Chrome, Internet Explorer 8 and the advent of the new software type web platform (such as Microsoft Silverlight and Adobe Integrated Runtime) are potential launch pad for new attacks.
- Vulnerabilities in websites and web applications. Companies operating in the online environment will have to pay extra attention this year web applications and web sites that we develop. Criminals will try to exploit any vulnerability in web applications present to take possession of information about users (name, accounts, passwords, email addresses) for later use in activities phishing or spam. Periodic auditing of websites and web applications will be essential for companies online.
- Policies multi- level security. The next period will be marked by a number of economic challenges that companies will have to face in a most professional and least cost. Securing IT infrastructure on all levels will be crucial to the smooth running of any company in the period ahead. Operational stability, secured by a security policy very well put together, it will be a competitive advantage for most organizations.

Nevertheless trust can be based both on objective and subjective factors. The objective elements underlying confidence building can be, for example, results of the IT & C products used or the security measures that convey information systems sensitive. Level of experience, stability is subjective elements which complete and sometimes even replace, the objective elements on which trust entity. In general, trust is associated with certain circumstances, such as the total amount transacted, sensitivity or criticality of information, the potential loss of property or life, etc. Confidence in an entity is not transitive and gaining general experience and measurements.

Between the concepts of risk, organizational culture and trust there is a direct relationship. Changing an organization's operational needs as determined for example by changing mission requirements and exchange information with other entities may involve changing risk tolerance level, above the level set by the management of the organization. These measures lead to building confidence in the organization long term.

FUTURE RESEARCH DIRECTIONS

As for the next period, it is expected that the main threats confronting the communication and information systems will be targeted to system hardware and software architecture, taking the form of attacks of the peer to peer architectures, attacks directed at application level or at operating system level (Choi et al., 2014; Khan, Gani, Wahab, Shiraz, & Ahmad, 2016). The competition between different networks of online criminals will intensify these gains as wanting to attract large cyber-attacks, both through viruses and worms, and especially by botnet structures. The most important networks of criminals currently come from Eastern Europe, including Russia and China. As a result, security specialists warn that these regions will be those that will generate a large number of exploits next years.

Withal, the interaction between trust in organization and organizational culture can also be observed when there is overlapping responsibility or uncovered areas between various parts of an organization may impact on the ability to undertake operative.

Demonstrating that the organization has structures and procedures to ensure effective protection of information that circulates determines both the organization's external partners (suppliers, customers, entities whose business depends on the organization in question) and to staff the faith that the organization operates in a consistent manner based on clear rules and procedures, which leaves no room for chaos and bias.

CONCLUSION

Communication and information security incidents record a significant growth during the last years, both in number and complexity (Yar, 2006). The main motivations of large scales attacks are financial profit or political supremacy. The complex cyber-attacks in 2007 on Estonia, Lithuania and Georgia are the most widely covered examples of a general trend. The huge number of viruses, worms and other forms of malware, the expansion of botnets and the continuous rise of spam confirm the severity of the problem (Ministry of Defense Estonia, 2008).

The goal of information security is to be able not just to put in place measures to detect and mitigate attacks but also to preemptively predict attacks, deter attackers from attacking and thus defend the systems from attack in the first place. A superficial evaluation of the information security assembly, including security awareness, leads to the lack of feed-back necessary for the decision-making process with regard to the necessity of implementing adequate corrective measures for improving the information security management. In this context, information security policies are adopted on empirical criteria, without being based on a critical assessment of the internal and external factors characteristic to the organization.

According with the results of this research, in order to consolidate and improve the information security posture, efforts should be based on a series of few principles that we consider to be essential bricks towards a building trust and credibility: coordination, meaning that all policies approved and actions taken to be circumscribed to a unitary concept, according to convergent plans of action towards attaining information security, according to responsibilities and competencies of each organizational department within the organization; a team-oriented approach is vital in fighting against information security threats; cooperation, meaning that all entities having responsibilities (either public institutions or private companies or non-governmental organizations) should collaborate at international, national and organizational level, in order to ensure an adequate response to information technology threats and to possible successful information security attacks; efficiency, meaning that all resources, either

financial, human, material, have to be correctly allocated and managed in order to address the primary needs and priorities; prioritization, meaning that the efforts have to be focused on the protection of those communication and information systems supporting critical functions of the society and, respectively, of the organization; dissemination, meaning that a proper transfer and sharing of information, expertise and best practices have to be ensured among persons with responsibilities in the field of protecting communication and information systems handling sensitive information or supporting critical functions.

Romania made positive steps in enforcing an information security management framework and it is continuously striving to improve it, in cooperation with its European and Euro-Atlantic partners. Still, there are steps to be made in order to improve the attitude of Romanian organizations towards security of information handled in communication and information systems. That is why government organizations are developing information security awareness programs targeting both public and private organization security practitioners. The primary objective of these programs is to raise the information security awareness of this category of personnel, with a view to improve the general public understanding and attitude towards information security.

As an overall conclusion following the processing of the data gathered through this survey, we appreciate that at the level of Romanian organizations, both public and private, there is a relative high level of awareness regarding the necessity to implement policies and mechanisms to ensure the security of information handled in communication and information systems. For all that, almost half of these policies and mechanisms are not developed on an assessment of the organization's operational environment, to include information security risk assessment to organization's mission and interests.

More than that, on one hand, managers are aware of the necessity of establishing measures for the protection of the information they handle in communication and information systems while, on the other hand, the decision making regarding the selection and implementation of the most adequate measures to protect their information is not founded on objective considerations, specific to the activity and interests of their own organization. These measures are more like "implanted" in their own organizational environment.

Having in mind the conclusions outlined before, we consider that an improvement of attitude towards information security would be of benefit for the decision making process within the Romanian organizations. Awareness rising programs should be developed in order to promote the practice of building decisions upon objective assessments of the organization's realities. This kind of practices ensures a better balance between costs and benefices and a better allocation of resources. But then, a higher level of awareness for the personnel may allow the replacement of certain technical security measures with procedural measures, thus reducing the costs allocated to hardware, software, maintenance etc.

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KEY TERMS AND DEFINITIONS

Integrity: The prohibition amendment - by deleting or adding - or the unauthorized destruction of information; integrity refers to confidence in the data and resources of a system by which to manage information.

Prevention: Implementation of mechanisms that users not be able to counteract and are implemented correctly, unaltered, so the attacker cannot alter them.

Risk Management: The implementation and updating of methods and tools to minimize risks associated with the information system of an organization, such as the Information Security policies, procedures and practices associated formalized and adopted other means in order to bring these risks to acceptable levels.

Threats: The possibility of accidental or deliberate compromise of information security, the loss of confidentiality, integrity or availability or impaired functions that provide authenticity and non-repudiation of information.

Section 8

E-Business

Emerging E-Business Models and Their Impact

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INTRODUCTION

Nearly forty years ago, futurist Alvin Toffler published *The Third Wave* (Toffler, 1981). In this book, Toffler describes the evolution of human society as the concept of waves. Specifically, *the first wave* is the transition of hunter-gatherer society to an agricultural society, which occurred around 10,000 BC; *the second wave* is the transition of agricultural society to industrial society, which started 200 years ago; and *the third wave* is the transition of post-industry society to information age, which is happening right now.

Forty years ago, not too many people were using computers. The fastest computer in the world at that time is probably slower than the smartphone in your hand now. Forty years later, when we look around, we are amazed by the accurate predictions made by Toffler and impressed by how much we are dependent on information technology.

Information technology is transforming our society in every aspect, such as education, healthcare, entertainment, finance, transportation, engineering, and more. Information technology revolution can provide us new tools and new experiences, which are especially welcomed by new generations. However, besides the positive impacts, information technology revolution also brings challenges for traditional businesses, which are unfortunately classified as sunset industry. This impact could be massive. In the past twenty years, we have witnessed the rise and fall of various business models due to the revolution of information technology.

Undoubtedly, we are living in a critical era filled with ideas, opportunities, and conflicts, especially in the business field. Information technology-enabled business (e-business) is changing our lives, our society, and our world (Markoff, 2005). Generally speaking, e-business (electronic business) is the conduct of business processes on the Internet. These new business models include e-commerce, mobile payment, marketplace lending, social networking, digital advertisement, mobile-enabled transportation, virtual games, virtual entertainment, and distance education. Some of these e-business models are mature and well known, such as e-commerce. Others are relative new. This paper describes some of the emerging e-business models that are transforming our society, including marketplace lending, mobile-enabled transportation, peer-to-peer rental, and personalized marketing. The objective of this paper is to help readers understand the dynamic features of business activities, especially when they are under the influence of information technology, so that people can better adapt to the changing world.

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MARKETPLACE LENDING

Background

Lending is one of the oldest financial activities, in which money is borrowed by one party from another party. The borrower is obligated to pay back the money with accrued interest. A traditional peer-to-peer lending occurred between one borrower and one lender. This kind of model clearly put the lender in a risky position, because if the borrower cannot pay back the loan, the lender's business will not be able to sustain.

Banks are considered a better lending solution, because the money of individual investors is consolidated by the bank and then lent to borrowers. The risk of loan default of an individual borrower is averaged down to many lenders. Although this lending model takes a less risk, it has the disadvantage of low return rate (interest rate) on investment, because part of the lending profit goes to banks.

Banking business began about 2000 BC in Assyria and Babylonia. In the following 4000 years, bank-based lending business played significant roles in the evolution of human business activities and human society (Green, 1989). Especially in the past two centuries, financial institutions (like banks), were among the most influential factors to shape the modern world. The highest buildings in downtowns of most cities belong to banks; their branches are accessible anywhere in the world; their advertisements appear in major media all the time.

As the evolution of information technology has redefined many business models, the lending business is no exception. A new Internet-based peer-to-peer lending emerged. To distinguish this lending business from the traditional peer-to-peer lending, it is also referred as marketplace lending.

The idea of marketplace lending is that both the borrowers and the lenders come to an Internet-based platform (marketplace), where they are matched with the support of complex computer algorithms. In many platforms, the lenders have a choice to pick the category of borrowers, and the risk of loan default is known to the lender. Because the lending platform is Internet based and it can attract users everywhere, the business is easy to scale up. In addition, the lending process is supposed to be monitored by and conducted through computer programs, the business cost could be reduced. Therefore, it is a win-win solution for both the lender and the borrower: the lender is expected to receive a higher return rate than the bank interest and the borrower is expected to pay a lower interest rate than the regular bank rate (Moldow, 2014).

Status Quo

Lending Club is the leader of marketplace lending in the US. It was launched in 2007 (Mach et al., 2014). On *Lending Club*'s online platform, borrowers need to provide personal, financial, and loan information so that the computer program can decide whether to grant the loan. If the loan is granted, the interest rate will be determined by the borrowers' credit history and payback ability. Meanwhile, Individual lenders could invest on these loans through the *Lending Club* platform. Their investments could be subdivided into small chunks for different borrowers in order to average down the risk of loan default of individual borrowers. *Lending Club* profits from charging service fees to the lenders.

Because the loan demands grow faster than individual investment, *Lending Club* also bundle the loans and sell them to institutional investors, like banks. There are two important features of *Lending Club* business. First, the loan is not secured and it is not guaranteed that the lenders could always get

their investment back. Second, *Lending Club* does not directly invest in any loans, which prevent it from taking any risks of loan defaults.

Yirendai is a leading online lending marketplace in China. Its operation is supported by its parent company CreditEase, a financial institution that provides credit rating services. *Yirendai*'s borrowers and lenders could reach a deal through its online or mobile platform. The advantage of *Yirendai* over other competitors in China is that many high credited borrowers are referred from CreditEase's offline business network.

Similar to *Lending Club*, *Yirendai* generates revenues from service fees. Different from *Lending Club*, in *Yirendai*'s platform, borrowers' information, such as income, education, employment, loan amount, and loan purpose is openly available to investors. The investors can choose which loan to invest and how much to invest. In addition, *Yirendai* does not directly lend its own capital to borrowers. Instead, *Yirendai* uses its own capital as a reserve fund to pay out the default loans if needed. This kind of business practice can assure the confidence of the investors (Huang et al., 2016).

Lending Clubs' loan is basically unsecured; the investors take the default risk by themselves. *Yirendai*'s loan could be misunderstood as secured because of the reserve fund. However, during the time when the whole society is facing financial hardship and default rate is too high, it will not be possible for *Yirendai* to pay out all the default loans. Because *Lending Club* takes no risks of default loans, it might be easy for it to live through a financial crisis, while *Yirendai* could go bankrupt in a national or global economic turmoil.

Other marketplace lending companies in the US include *Prosper*, *SoFi*, *LendingRobot*, and *Stilt*. They operate on similar business models as *Lending Club*. However, their business grows fast. Especially, *Prosper*, which is America's first peer-to-peer lending marketplace, now becomes a major competitor of *Lending Club*. In 2017, *Prosper* had \$2.9 billion loan originations, while *Lending Club* had about \$9.0 billion loan originations.

Globally, marketplace lending is also growing. Representative platforms include *Zopa*, *Funding Circle*, and *RateSetter* in the UK, *Lendix* in France, *Auxmoney* in Germany, *Mintos* in Latvia, *Bondora* in Estonia, *Funding Societies* in Singapore, *WeLab* in HongKong, and *Maneo* in Japan.

Impact

In the United States, marketplace lending is growing, but with many conflicts. *Lending Club*, *Prosper*, and other platforms all have different issues, like management and marketing. On the other side, feeling the competitions from marketplace lending, some traditional financial institutions begin to shift their business models to peer-to-peer lending. For example, at the end of 2016, Goldman Sachs launched *Marcus*, a peer-to-peer online lending platform. This movement signaled the beginning of the transitions of the traditional banking industry.

Unlike in the United States, where marketplace lending is closely regulated by the government, China's marketplace lending is growing with less regulations, at least until now. A lot of fake marketplace lending platforms operated like Ponzi-like scheme were out of business in the past several years. This caused millions of investors losing their money. Therefore, the Chinese government is working to establish regulations for marketplace lending. Currently there are still hundreds of marketplace lending platforms in China. It is expected that most of them will lose their operating licenses after the regulations take effect. The ones that could survive will grow stronger and bigger.

MOBILE-ENABLED TRANSPORTATION

Background

Taxi service has been around for 300 years. These services appeared first in Paris and London, and later in New York City. After gas-powered taxicabs were introduced in the 1890s, taxi service gradually became popular in big cities worldwide. In contrast, car-sharing business began in 1940s in Zurich Switzerland. The first official car sharing business in the United States appeared in Portland.

Mobile-enabled transportation applications include mobile taxi service and mobile car-sharing service. Traditionally, a taxi service is established through a moderator in the taxi company. A service needs to be reserved in advance and usually not many choices are available for the passenger. Similarly, traditional car sharing is rare; it might only happen between friends and relatives. However, with the advancement of mobile computing technologies, new transportation business models appear (Zhang et al., 2017).

Mobile-enabled taxi service is a platform that connects taxi drivers and passengers. The locations of both the drivers and the passengers are visible, allowing them to contact each other. In addition, the passenger's detailed request can be sent to the driver in real time, allowing them to reach an agreement in a short period of time. Generally speaking, the service platform does not own any taxi. Instead, contracted taxi drivers should pay the service fees to the platform.

Mobile-enabled car-sharing service is a platform that allows car owners and car renters to communicate and negotiate. Again, the platform does not own any cars. It is mainly used to connect car owners and car renters and facilitate them reaching a deal. Afterwards, a service fee could be collected.

Status Quo

The most important player in this business field is *Uber*, which is founded in 2009 and headquartered in San Francisco of the US. It operates its business in over 6 hundred cities worldwide. Contracted *Uber* drivers use their own cars to provide taxi services. The supporting platform is a mobile app. By the end of 2017, *Uber* has about 7 million drivers and over 50 million riders worldwide. In the US, *Uber* has about 74% ride-sharing market share.

In China, the business leader is *Didi Chuxing*, which is founded in 2012 and headquartered in Beijing. It acquired *Uber*'s China business in 2016 and became the market dominator. *Didi Chuxing* is invested by China's internet giants Tencent, Alibaba, and Baidu. *Didi Chuxing* provides mobile services for taxi, express carpool, social ridesharing, designated driving, car rental, etc. Because of the large population base, *Didi Chuxing* has about 450 million riders. *Didi Chuxing* has about 87% market share in China. However, *Didi Chuxing* is behind *Uber* in international expansion.

Globally speaking, there are several other competitive mobile-enabled transportation service platforms. They include *Careem* of the Middle East, *Grab* of the Southeast Asia, *Ola* of India, *Yandex.Taxi* of Russia, *Taxify* of Europe and Africa, *Easy Taxi* of the South and Central America, and *Gett* of Israel.

Impact

Apparently, the mobile-enabled transportation apps improve the efficiencies of taxi industry and car-sharing industry. However, the benefits could be tilted to those who adapts quickly to the new business models. For traditional drivers and car owners, who are reluctant to switch to these new platforms, they could see their loss of business and decrease of income. In the US, China, and some other countries, we

have seen mobile-enabled taxi apps and car-sharing apps were banned in some cities before agreements were reached between traditional business unions and the new service providers.

For consumers, the mobile-enabled transportations are beneficial to and favored by new generations. However, for old generations who do not know how to use these services or who do not own a smart-phone, they might have found out that now days, it is more difficult to book a taxi or rent a car because of reduced traditional service providers. For them, technology evolution is detrimental to their lives.

PEER-TO-PEER RENTAL

Background

Hotel business has the same history as human civilization (Levy-Bonvin, 2003). It appeared as early as 2000 years ago. Clearly, booking was not needed in this business until telephone is invented 100 years ago. After the introduction of the Internet into this business, reservations can be made through the website of the hotel or a third party. Hotel business has been the major accommodation and lodging provider for tourists and short-term visitors, until recently it begins to feel the competitions from online peer-to-peer rental services.

Peer-to-peer rental refers to the process of one person renting an owned good, service, or property to another person. It is another example of sharing-economy business model innovated through the Internet. The most popular form of peer-to-peer rental is property rental (Fraiberger & Sundararajan, 2015).

The foundations behind peer-to-peer rental are twofold. First, if someone has a property and they rarely use it, it makes sense to rent the property out to make some profit to cover the cost of utility, maintenance, and tax. On the other side, if someone has a unique request for a short-term vacation home, regular apartments and hotels might not be able to satisfy this requirement. Instead, peer-to-peer rental could be the best solution. Second, with the support of the Internet, property owners and property renters could be connected together in the virtual space even they might live far away. A business contract could then be established and executed through a third-party service.

The online service website that hosts owner's property information and allows renters to search and browse the property and contact the owner is the emerging peer-to-peer rental business. Again, this is an Internet-based new business model.

Status Quo

Airbnb is a leading marketplace of peer-to-peer rental in the world (Zervas et al., 2014). It is founded in 2008 and headquartered in San Francisco. *Airbnb* hosts individual's rental information for vacation homes, apartment rooms, homestays, hostels, and hotels. Like other forms of online marketplace, *Airbnb* does not own any property. Instead, it is a broker between the owner and the renter and receives service fees from them for every booking. In January 2018, the company had over 3 million lodging listings in 65 thousand cities of 191 countries. In the third quarter of 2017, *Airbnb*'s revenue reaches US \$1 billion, which represents a 50 percent year-to-year growth. In the entire hotel industry, *Airbnb* has about 10% market share in some regions, such as the Western Europe. This number is impressive, because worldwide, *Airbnb* is competing with over 180 thousand hotels.

Besides *Airbnb*, other peer-to-peer rental marketplaces include *VRBO*, *Flipkey*, *RentalsCombined*, *Wimdu*, and *Go With Oh*. Some of them are operating their business globally; some of them focus on a specific area. For example, *Wimdu* and *Go With Oh* mainly list properties in Europe.

Impact

One apparent benefit of peer-to-peer rental is to help customers make efficient usage of resources and reduce overall operating expenses. However, the traditional hotel business is feeling the disruptive effect (Guttentag, 2015). They have to lower their prices and provide better services in order to attract tourists or other short-term or long-term guests. This competing process eventually benefits the consumers.

On the other side, it is not surprising that traditional hotels are feeling the competitions from peer-to-peer rental business. For example, a campaign has been waged by the American Hotel and Lodging Association to lobby lawmakers passing tough regulations on peer-to-peer rental (Fingas, 2017). Like other e-business models, competition is only fair when similar standards are applied to both the traditional business and the new business.

In addition, research found that peer-to-peer rental could also promote social interactions. Business could be conducted between strangers never met. More close relation could be established between the owner and the renter, if they happen to live under the same roof.

PERSONALIZED MARKETING

Background

Personalized marketing is also called one-to-one marketing or individual marketing. It is a customized marketing technique targeted on a specific potential customer. It is another example of technology-supported and mainly Internet-based business model.

Traditionally, advertisement on newspaper, radio, TV, or billboard was designed to target a large group of people with little attention to their diverse needs. Accordingly, the traditional mass marketing is considered business inefficient, especially for unpopular products and services. This kind of marketing strategy has been used for nearly 200 years (Tedlow, 2014). With the evolution of information technology and the Internet, personalized marketing becomes both technically available and practically possible.

The idea behind personalized marketing is that potential customer data could be collected, including age, gender, education, location, and shopping habit. There are many ways that a customer's data could be collected, such as from credit card companies, emails, shopping websites, location visible apps, and so on. The data could then be analyzed with big-data techniques. Potential customers for a specific product or a specific service will be identified (Cheung et al., 2003). Relevant advertisement will be delivered to these customers' emails, appear on the banner of the websites they visit, or on the front page of the apps they use.

Status Quo

Currently, popular software tools and services in personalized marketing include *Adobe Audience Manager*, *Adobe Target*, Oracle's *BlueKai* and *Eloqua*, and *Sitecore*. These tools and services are described below.

- *Adobe Audience Manager* is a data management platform that helps build unique audience profiles, identify most valuable segments of a customer, and use them on different digital channels.
- *Adobe Target* is a customer-targeting tool, which can be used for making marketing offers and personalization, allowing marketers to analyze the efficiencies of different marketing techniques.
- *BlueKai* is Oracle's cloud-based platform that supports personalized online, offline, and mobile marketing. For example, *BlueKai* collects users' information on surfing the web and smartphone app usage to improve marketing efficiencies for their clients, which included Twitter and Facebook.
- *Eloqua* was founded in Toronto, Canada and is headquartered in London, UK. Its main product is a marketing automation system for businesses, especially for large enterprises. It was acquired by Oracle in 2012.
- *Sitecore* is a customer experience management platform that provides web content management and multichannel marketing automation services. It is headquartered in Copenhagen, Denmark.

To summarize, the major players in personalized marketing business are *Adobe Systems* and *Oracle Corporation*. Other players include *Microsoft* and *Sitecore*. These companies basically play two roles in this business: identify more interested target customers and disseminate the advertising information more efficiently.

Impact

For business, the most important impact of personalized marketing is that marketing activities become more efficient, due to on-purpose targeting and automated delivering. The personalized marketing cost could be increased compared with traditional mass marketing technique. However, this new strategy eventually lead to the most crucial benefit: an increase in revenue.

For customers, personalized marketing is, generally speaking, also welcomed. First, consumers now days have a vast variety of choices for products and services. Personalized marketing can save their time and reduce their frustrations in browsing and comparing these products and services. Second, new generations of customers are more willing to share their data with companies in exchange for personalized offers and discounts. This shopping attitude promotes the company to shift from traditional mass marketing to customized-marketing (Chen & Hsieh, 2012).

Like other e-business models, personalized marketing service also threatens traditional mass marketing business. Newspaper, television, billboard, advertising mail and other mass marketing business are losing customers and revenues. On the contrary, social media, social network, email, and other websites or apps that can be utilized as personalized marketing platforms are booming. One reason that Facebook can become the most valued social network in the world is due to its monetization strategy focusing on the implementation of personalized ad (Tran, 2017).

In spite of the benefits of personalized marketing, allowing service providers to access personal data also brings risks to customers. If data is misused, it could generate substantial effect. One example is Facebook's user data was misused by Cambridge Analytica in the 2016 US presidential election.

FUTURE TREND

As illustrated in the previous four representative emerging models, e-business is growing tremendously fast and has a magnificent effect on our economy and society. No one would say that offline traditional

business will disappear. That might not happen soon. However, e-business has more dimensions to grow. More new e-business models could emerge with the advancement of information technology. The potential of e-business is undefined yet.

One trend of e-business is that they are pro to grow internationally. Compared with traditional business, e-business has less distance barriers. However, conducting business internationally is always a complex task. It is affected by government policies, local cultures, religions, and geopolitics. Globalization of e-business is facing all forms of trade protectionism. Uber's failure in China and Ant Financial (China's mobile payment service provider)'s failure to acquire MoneyGram of the US are typical examples of global expansion difficulties facing e-businesses (Hook, 2016; Roumeliotis, 2018).

Another new trend in e-business is the usage of smartphones. In the past decade, we have witnessed that many business activities are moving to mobile devices. Mobile payment and mobile-enabled transportation are two representative applications. Other e-business activities, such as shopping and renting, are also moving from online platforms to mobile platforms. The adoption of mobile technologies is reshaping the business landscape.

As discussed in the four representative emerging e-business models, technology revolution and business transformation could result in workforce layoff, store closing, and unemployment increase. Therefore, responsible government officials and business leaders should work together to make these transitions smoothly. Regulations should be passed and cooperative practices should be promoted to reduce the disruptive effect of growing e-business.

A good e-business model should create jobs, not kill jobs. In addition, the reduced business cost and improved business service should be beneficial to the majority of the population. As we enjoy the benefits of e-business, we should also be aware of the damages, especially the damages to social stability (Seelos & Mair, 2005). When technology is utilized in business, the government and the responsible national and international influential personage should work together to make sure the new e-business is not counteract to social inclusion.

A social relation or social interaction is any relationship between two or more individuals in the society. In traditional business, the social relation is characterized by the direct interactions between the service provider and the consumer. In contrast, e-business might only provide a virtual interaction between them. Accordingly, e-business could also bring in negative impacts on the new generations. People are spending more and more time online and it is easy for them to forget the real world outside. E-business, together with other technology-enabled fields, such as social networking, virtual entertainment, and distance learning, are reshaping the social relations and social structures.

CONCLUSIONS

This paper described several Internet-based business models, their status and impacts on traditional business. Specifically, this paper discussed the effect of these new business models on society. Looking forward, with the advancement of information technology, we could expect the emergence of some new business models in the near future. Below lists some of them.

- Localized businesses. With the wide usage of smartphones, location data can be integrated into the apps, which can facilitate localized activities, such as dating, garage sale, gaming, sports, and entertainment.

- Crowd-funded projects. It might not be easy for a new project or a new initiative to get support locally or from a large venture capital. However, with information technology and social network, they might attract investors, big or small, around the world.
- Customized products and services. Information technology enables us to create customized products and services for customers. For example, a customized textbook with appropriate chapters could be created for a course of a school. Customized services could also be developed in restaurants, accommodations, and entertainment businesses.
- Driverless transportation. With the support of AI technology, driverless cars and lorries are being tested in the United States and some other countries. For example, it is expected that driverless trucks could be a regular presence on many roads within the next 10 years predicted by International Transport Forum in January 2018.

E-business not only changes the way we loan and lend, transport, rent, and advertise, but also changes social structures and social relations. It is the responsibility of the government to actively regulate these business activities so that the majority population can benefit from this digital revolution.

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KEY TERMS AND DEFINITIONS

E-Business: A business that part of its activities are conducted online or on mobile apps.

Marketplace Lending: An individual to individual lending that is conducted through a third-party online service (marketplace).

Mobile-Enabled Transportation: Taxi service reservation or car-sharing deal that are conducted through a mobile app.

Peer-to-Peer Rental: An individual property rental conducted through a third-party online service.

Personalized Marketing: A marketing strategy that delivers selective advertisement to potential customers.

Digital Technologies in Wholesaling and Retailing

8

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INTRODUCTION

The ever increasing intra/inter-competition, increased costs and a lower differentiation margin, have led to intense competitive pressures within the domains of the wholesale and retail industries. At the same time, the increasing digitization, due to technological innovation, will radically change the economical and procedural fundamentals. In addition, from an entrepreneurial point of view, it must also be considered that the complexity of decision-relevant framework conditions has increased. Therefore, digitalization should be viewed as an essential driver for optimizing business processes (Brynjolfsson et al., 2018), as well as the basis for a new understanding of products and services. The permanently emerging new technologies, all labeled as having huge impact on any industry, increasing the complexity even further. Many technologies have great impact, but only on limited industries and use cases. Adopting these technologies too early will certainly lead to frustration; just as the adopting of a technology too late can have a lasting impact which may put one out of business. A clear structure and assessment of upcoming technologies and trends is provided by the “Gartner Hype Cycle” (Walker, 2017), however, it is missing the retail industry specifics. Currently many studies about the application of technologies in retail and wholesale exist but are only limited to single technologies and their potential. Lot of scientific work exists regarding the role of big data and analytics (Bradlow et al., 2017), artificial intelligence (Krüger et al., 2011) or single task areas like pricing or marketing (Abels et al., 2018; Yeoman et al., 2017). But none of this work gathers all available technologies for all possible use-cases within the domain of retailing and wholesaling. This chapter will further elaborate the underlying technological trends, empowering the transformation processes within the domain of wholesaling and retailing. Starting with: the major technologies, the impact of technological advancements and opportunities, and the risks and constraints which are connected with it, are scrutinized. The results are finally summarized following the structure of a framework of the generic processes of trade companies.

A detailed overview of future technological trends that are relevant for retailing and wholesaling are provided. The structure allows scientist and practitioners to evaluate the impact and the potential areas of use, existing use-cases, and the overall potential for their processes of interest.

BACKGROUND

Value-adding Core Processes of a Trade Company

In order to reasonably structure the analysis of the purpose and potential relevance for the trade industry, this article orientates the main processes of a trade company. This structure will help practitioners, as well as researchers, to quickly find the relevant technologies for their area of interest.

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Trade comprises the activities of purchasing goods from manufacturers or suppliers; transporting, stocking, and combining the goods to form an assortment; and selling them to commercial (wholesaling) or non-commercial (retailing) customers without the goods being modified or processed. The “Handels-H” (or Retail-H) is a reference model for modeling business information systems in trade (Becker & Schütte, 2004). As a framework, it structures all of the main processes of a retailing or wholesaling company and offers both; the process view and the data view of the functional areas within a retailing company. In the following the terms retail and wholesaling are used as synonyms as the core processes and also the implication of technologies on both are quite similar as just the counterpart of the transaction (natural vs. legal person) differ.

The “H”-part of the framework lists the value-adding core processes of a retail company. The functional area of procurement, which is usually directed to the vendor, is located on the left-hand side of Retail-H, with the main processes of: Purchasing, Materials Planning, Goods Receipt, Invoice Verification and Accounts Payable. The main processes: Marketing, Sales, Goods Issue, Invoicing and Accounts Receivable Accounting, are located on the right-hand side of Retail-H, as the processes to be assigned to the functional area of sales. The linking and merchandise management bridging element, between the functional areas of procurement and sales, is the warehouse process. Thus, the warehouse is an essential part of the logistics process, from: receipt of goods, warehouse and issuing goods.

The management processes of a retail company, after structuring the Retail-H reference model, are reflected in the roof section. The decision makers of the retail company use the processes of: controlling business intelligence and corporate planning, in order to prepare the data from the operational systems to serve as a basis for decision making and planning.

The business administration tasks, and thus, the support processes of the reference model, are visualized as the H and the roof supporting base. The indispensable main processes of: general and asset accounting, cost accounting and human resources management, support the core and management processes of Retail-H, without offering direct customer benefit.

From Technologies to Digital Technologies

On the one hand, “digitization” is the transfer of previous, non-digital data, for example, in the case of music. On the other hand, digitization expresses the process of reinventing or adapting business models, products and processes, through the possibilities of (information) technology.

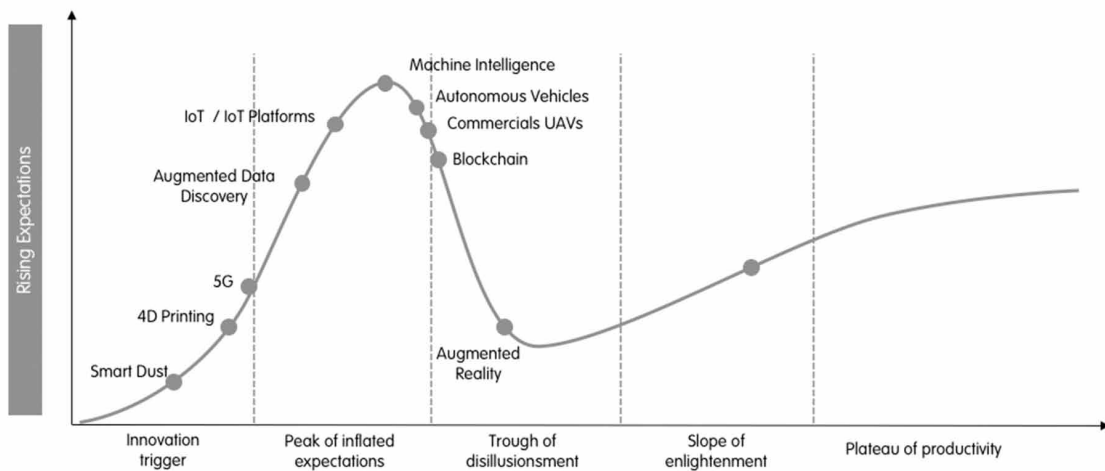
The concept of “technology” is well proposed by Abele (2006), amongst others, according to which technology is composed of skills, knowledge and resources for solving technical problems and for resources (facilities or equipment) which serve to put scientific findings into practice.

To define “digital technology”, we elaborate this definition further, as, “digital technology is composed of skills, knowledge and resources related to the domains of information and computer engineering, which serve to put scientific findings into practice”.

The never-ending stream of new and evolving technologies, is catalyzed by different frameworks. These frameworks are mainly proposed by research companies trying to offer guidance to their customers. The “Hype Cycle” by Gartner, is one of the most popular and well-known examples. It is a derivation of the technology life-cycle approach by Krubasik (1982), which describes the generic evolution of new technology and its usage during a fictional timeline. The term “hype cycle” was coined by Gartner Consultants (Fenn, 1995), and is used today to evaluate the introduction of new technologies.

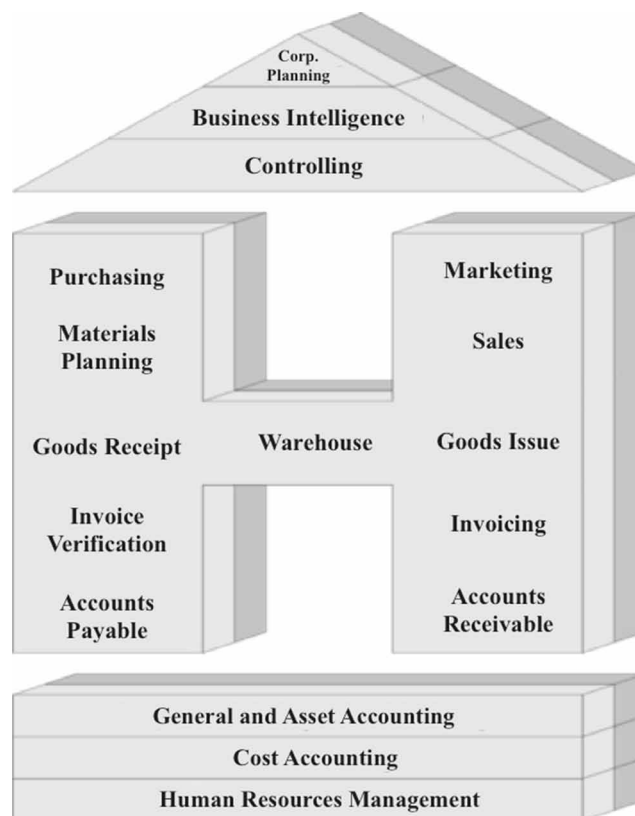
This is represented in a diagram (see Figure 2): on the Y-axis, the attention (expectations) for the new technology is plotted; on the X-axis, represents the time since announcement. The curve rises explosively

Figure 1. Retail-H Framework with the value-adding core processes (Becker & Schütte, 2004)



at the beginning, then falls just as strongly after reaching the peak. After an intermediate minimum, the curve rises again to a higher level of inertia. Mathematically, it is simply the decay after a jump excitation in the form of a strong, exponentially damped oscillation, with approximation to an equilibrium position around the jump, higher than at the beginning of the oscillation (Walker, 2017).

Figure 2. The Gartner Hype Cycle for 2017 (Walker, 2017) with the most relevant technologies for retailing



The Simple Hype Cycle is divided into five sections, according to this definition:

Innovation trigger:

The first phase is the technological trigger or breakthrough, is the start of the project or any other event that meets with considerable interest from the trade public. Free riders ascend to the new topic.

Summit of exaggerated expectations.

Peak of inflated expectations:

Technologies reach the valley of disappointments because they cannot meet all expectations and are quickly outdated. As a consequence, reporting is fading away.

Trough of disillusionment:

Although reporting on technology has declined sharply, realistic assessments are leading back to the path of enlightenment. The result, is an understanding of the advantages, the practical implementation, including the limits of new technology.

Slope of enlightenment:

A technology reaches a plateau of productivity when the benefits are generally accepted. The technology is becoming increasingly solid and is being developed further in the second or third generation. The final height of this plateau, strongly depends on whether the technology is adopted in mass or niche markets.

TECHNOLOGIES FOR RETAILING

The Hype Cycle is not industry specific and the given examples of application are randomly spread over all types of possible scenarios. The above outlined Handel-H-model is used to present the findings of the literature review regarding the existing applications of the proposed technologies for retailing. Each application is then matched with one or more value-adding core processes of a retail company.

Table 1. Upcoming technologies matched by area of use within retailing

Retail processes	Purchasing	Materials Planning	Goods Receipt	Invoice Verification	Accounts Payable	Warehouse	Marketing	Sales	Goods Issue	Invoicing	Accounts Receivable	Corp. Planning	Business Intelligence	Controlling	General Accounting	Cost Accounting	Human Resources
Technologies																	
Augmented Reality							X	X				X					
Commercial UAVs						X	X	X	X								
Blockchain				X	X					X	X		X	X	X	x	
Autonomous Vehicles		X				X			X								
Machine Intelligence	X	X	X			X			X				X	X			
IoT and IoT Platforms	X	X	X			X		X	X			X	X	X			X
Augmented Data Discovery				X	X					X	X	X	X	X	X	X	
4D Printing							X	X	X								
Smart Dust		X	X			X	X		X				X	X			
5G		X	X				X	X					X	X			

Our findings (see Table 1) show that there are 10 technologies that are applicable for one or more core processes:

Fifth-Generation Wireless and Mobile Communication Systems (5G)

Definition and delimitation

The fifth-generation (5G) wireless and mobile communication systems, were built in an attempted by the major industry players (from Alcatel-Lucent to Huawei) in order to align with an anticipated future (Monserrat et al., 2014). The prediction that the development is based on, comes to the conclusion that “it will be necessary to support 1000 times higher mobile data volume per area” (Cisco, 2014), and these “[...] requirements will go beyond the natural evolution of [current] technologies, which shows the need for a new mobile generation [...]” (Monserrat et al., 2014).

With 5G, the used spectrum of the mobile and wireless systems is broadened to higher-frequency bands (> 6 GHz) which allow the support of a much higher data rate-up, to several gigabits per second (Wang et al., 2014), compared to the predecessors.

However, the underlying architectural paradigm is also changing. Here, the 3rd Generation Partnership Project (3GPP), the regulating body working on the upcoming standards, defines three types of networking capabilities: enhanced mobile broadband (eMBB), massive machine-type communications (mMTC) and ultra-reliable, low latency communications (uRLLC). EMBB will allow the higher bandwidth needed, alongside a lesser latency. With uRLLC, this latency is even smaller, as uRLLC relies on millimeter wave (mmWave) spectrum bands (> 24 GHz), where very fast signals are possible. As the name obviously suggests, mMTC is about massive wireless access, by a large number of devices, and therefore, an enabler for the Internet-of-Things (IoT).

Areas of Application in Retail

The 5G systems will primary serve as a basis technology, enabling new operational purposes or enhancing existing ones. Here, the higher bandwidth alongside the possibility to connect a large number of IoT devices, will fuel the further application of 5G within retailing. Particularly, all scenarios that failed in the past (due to the lack of networking infrastructure), will get another chance.

Especially the tracking of the flow of goods will benefit by the revival. Here, the whole warehouse and logistic processes - from the receipt of goods, to warehousing goods issue – are areas of application. Fully transparent logistic processes in real-time are conceivable, which is of great interest, especially for multi- and omnichannel retailers.

Some argue that the diffusion of autonomous driving (Bönsch 2018), is only possible with the capabilities of 5G networks. Here, the full automation of all logistic processes is imaginable. Any application of virtual and augmented reality, was obstructed by the lack of a fast bandwidth. The extended data rate of 5G will improve the existing application of the VR technologies, for example: from IKEA, the kitchen sales process is noticeable. This is valid for local scenarios within the stores. In the past, an issue was the bandwidth of Wi-Fi was not sufficient for the parallel application of such applications, or on the customers' mobile devices.

Coming to mobile devices, 5G will enable a much broader utilization of wearable devices. These devices are allowed to have an independent network access, as less energy is needed, and will extend today's limited capabilities of many devices (like Google Glass). This influences the retail processes of marketing and sales in particular.

Examples of Prototypes or Existing Implementations

As the first prototypes of 5G networks are currently set up, only limited prototypes exist. The Fraunhofer Institute for Telecommunications built an initial prototype to use the extended bandwidth of 5G to enhanced virtual reality (Rommel, 2018). Here, the VR application, is able to stream the HD-videos that adapt in real-time to the user's movements.

Conclusion and Outlook for Retail Decision-makers

As 5G acts as the basis for many applications, it is clearly a technology to follow. However, for most retailers 5G will just become an IT commodity. Nevertheless, a commodity enabling and improving many use cases, which failed in the past, due to the lack of fast and reliable wireless and mobile internet access. Areas of use include: Materials Planning, Goods Receipt, Marketing, Sales, Business Intelligence and Controlling.

4D Printing

Definition and Delimitation

Recent developments have managed to add a new dimension to 3D printed objects. Printing in 4D, is a new process that enables a radical shift in additive manufacturing: "it entails multi-material prints, with the capability to transform over time, or, a customized material system that can change from one shape to another, directly off the print bed." (Tibbits, 2014). In this process, active materials (like shape memory polymers), can be printed to create an active microstructure within a solid structure (Zheng et al., 2014).

Areas of Application in Retail

A common example for this new technology, is childcare products that can react to outside temperature changes or humidity, for example. There are also use-cases for programmed, individual, self-deforming materials in healthcare, such as bio-compatible components that can be implanted in the human body.

For retailing, the area of application are similar to 3D printing (Vanderploeg, Lee, & Mamp, 2017): to produce customized products for consumers, produce in real-time and allow the customer to design and create their own goods.

Examples of Prototypes or Existing Implementations

So far, there are no existing implementations for 4D Printing, but you *can* find a lot of research and prototypes, for example, at the University of Wollongong in Australia, they have designed a 4D-printed water valve, which shuts when it comes into contact with hot water and it re-opens again, when the temperature subsides. The application of 3D printers is already tested by major companies. For example, the German fitness giant, ADIDAS is printing individual shoes for customers with 3D printers (Levi & Eichmann, 2004). Adding the fourth layer with self-deforming materials, that adapt to different under-grounds, is just a matter of time.

Conclusion and Outlook for Retail Decision-makers

4D printing can be judged as an advancement of 3D printing; to advance a lean, or just-in-time manufacturing and the individualization, for customers. Here, the type of goods is essential to the consideration of 3D and 4D printing. In fashion (see the example above), the need for individualization is high; for grocery and food retailing, it might be low. Areas of use include: Marketing, Sales and Goods Issue.

Augmented Reality

Definition and Delimitation

AR technology adds virtual objects, superimposed upon or composited with, the real world.

Therefore, “AR supplements reality, rather than completely replacing it.” (Azuma, 1997). Systems for Augmented Reality systems have the following three characteristics:

- Combines real and virtual
- Interactive in real-time
- Registered in 3-D

Virtual reality (VR), immerses a user in an imagined or replicated world, or simulates presence in the real world. In contrast to that, augmented reality (AR) adds only a digital layer to reality (Bellini et al., 2016).

Areas of application in retail:

AR-Technic can be used in retail, for example, within an app (Scholz & Smith, 2016). The Lacoste brand provides such an app to their customers, to try on shoes virtually, using AR technology. American Apparel uses an app to display information about a garment, Timberland uses Microsoft’s Kinect technology to try on different garments.

Examples of prototypes or existing implementations:

Several prototypes of Virtual/Augmented Reality technologies, are currently under development, or have already appeared on the market, such as: Microsoft HoloLens, Google Glass or the HTC Vive (Bellini et al., 2016).

Google Glass is a pair of glasses that expands reality by displaying data and information about the location. A sensor detects people, and displays information about them accordingly. It also allows activities, such as; reading books through glasses.

Various AR applications can support the tasks of employees. For example, the applications make it possible to work with free hands, while at the same time e.g., Google Glass displays the required information. In the automotive industry, this supports employees in their work-steps on the assembly line (Heun, Kasahara, & Maes, 2013).

Conclusion and outlook for retail decision-makers:

For marketing and sales activities involving the customer directly, this technology might serve as a great foundation to improve customer service and satisfaction, without the need to staff employees at the stores. It is also possible to extend the sales activity, towards the customers home directly. For service and communication intensive retail sectors, this might be a key technology. The areas of use include: Marketing, Sales and Corporate Planning.

Autonomous Vehicles

Definition and Delimitation

Autonomous Vehicles (AVs) are vehicles which “partially or fully drive themselves and which may ultimately require no driver at all” (Anderson et al., 2014).

There are five levels to classify automation (Anderson et al., 2014), from the status-quo of no automation, to the full self-driving automation. Here, the system takes full control of the vehicle. The driver is only necessary for entering the destination, they do not have to be available while driving.

Areas of application in retail:

One possibility for the use of AVs in retail, are the classical logistics and transportation processes (Heutger, Kückelhaus, Zeiler, Niezgoda, & Chung, 2014) and the warehouse operations.

It will not be long before the logistics industry deploys self-propelled vehicles on a large scale; the first applications are already in place. One of the reasons for this, is that logistics usually transports goods and not people, which often makes it easier to clarify legal issues. Many processes take place within private or on company premises. In addition, increased efficiency and safety, make autonomous vehicles interesting for the industry.

Examples of prototypes or existing implementations:

For many years, various companies have been working with unmanned vehicles in their warehouses to transport requested products. For public roads, the development is lagging far behind. Google's subsidiary, *Alphabet*, has been developing an autonomous driving system called, *Waymo* since 2009, which is expected to be launched in 2020.

Conclusion and outlook for retail decision-makers:

Autonomous vehicles will certainly have a great impact on any logistics process within retailing. Replacing the necessary human involvement, monetarizes as extensive reduction in one of the costs and labour-intensive processes in retailing. Alongside the advancement of the technology, autonomous vehicles will be available for serving the customer direct at their homes as well. Areas of use include: Materials Planning, Warehousing and Goods Issue.

Blockchain

Definition and Delimitation:

A block chain is a continuously expandable list of data sets, called "blocks", which are linked together by cryptographic methods. Each block typically contains a cryptographically secure hash of the previous block, a time stamp and the transaction data.

The term "blockchain" is used more specifically for a concept with which an accounting system can be kept on a decentralized basis, and yet a consensus is reached on the correct state of accounting, even if many participants are involved in accounting. This concept is called, *distributed ledger technology* (decentralized account book technology). It is thus, well suited for applications requiring transparency in records, with a permanent time and date stamp, such as titles, document histories, and notary services." (Lorenz et al., 2016).

Areas of application in retail:

A main area of application, is the processing of transactions and payments, since the technology enables more efficient processing of transaction processes, e.g., long transaction times can be avoided. According to a study (Accenture, 2015), the technology can be mature and an integral part of the financial system, by 2025.

Retailers can also benefit from blockchain technology. Blockchains can also be used in the public sector. This would allow public systems, based on blockchain technology, to manage and collect taxes or enable corruption-free and transparent elections (Schlatt, Schweizer, Urbach, & Fridgen, 2016).

DHL logistics uses blockchain technology to more efficiently handle transaction processes, thus, lowering costs (DHL, 2017). For retailers, there are three major areas of application: Supply Chain and Inventory Management (transparency between multiple constituencies, including; manufacturers, distributors, shipping carriers, insurers, importers, wholesalers and retailers), Payments and Accounting (customers complete transactions in cryptocurrencies, rather than traditional currencies), Loyalty and Rewards (blockchain offers real-time liquidity, making points more easily swappable between consumers and across retailers) and Advertising and Consumer Data (enabling collaboration between stakeholders and reducing fraud).

Examples of prototypes or existing implementations:

There are many examples of the utilization of this technology for retailing, such as:

Warranteer—A blockchain application that allows consumers to easily access info regarding the products they purchased and get service in the case of product malfunction.

Blockpoint—Simplifies the creation of payment systems and allows mobile wallet, loyalty programs, gift cards and other point-of-sale functionalities.

Loyyal—Uses smart contract technology in their loyalty and rewards platform, to create a more customized program that even allow for multi-branded rewards.

Conclusion and outlook for retail decision-makers:

Blockchain can serve as a commodity technology, replacing many legacy technologies. The challenge for decision makers will be, to find use cases where the advantages of this technology out-do long-trusted technologies. Mainly, processes between untrusted partners come into mind, but are rather rare in retailing.

Areas of use include: Invoice Verification, Accounts Payable, Invoicing, Accounts Receivable, Business Intelligence, Controlling, General Accounting and Cost Accounting.

Commercials UAVs (Drones)

Definition and Delimitation

Commercial “unmanned aerial vehicles” (UAVs), also known as “Drones”, are unarmed aircrafts, without a human pilot aboard. Either they fly under remote control by a human, or they fly autonomously, controlled by on-board computers. “UAVs range in size from large military drones with a wingspan of nearly 200 feet, to commercially available, inch-wide micro drones. Their ranges of flight vary, with some commercial drones being confined to a few feet away from the operator, to advanced military drones that can fly for over 17,000 miles, without having to land” (Rao, Gopi, & Maione, 2016).

Areas of application in retail:

The field of application is wide. They are already use to; “survey crops, in search and rescue operations, to count wild life and keep track of animal population, in land surveying, to survey forest fires, to inspect oil pipelines, power lines and other remote infrastructure (Rao et al., 2016). There are also various applications for commercial UAVs in retail. One of the best areas of application, was the delivery of minimal parcels and packages. This area has enormous potential, including the positive impact on CO2 emissions or the obstruction of delivery due to traffic jams. In addition, the personnel costs will be *drastically* reduced nationwide, *if* the drone replaces the people in this area. In the near or distant future, the market leaders in mail order, will offer a delivery service by drone.

Examples of prototypes or existing implementations:

Amazon is currently conducting experiments with Prime Air in the USA, to deliver minimal packages to customers in less than 30 minutes. DHL has already started a test run, in Europe, with the “Parcelcopter”.

Conclusion and outlook for retail decision-makers:

As autonomous vehicles, drones will have an impact on many logistics processes. Contrary to the first-mentioned vehicles, drones can first of all, be used for serving the customer directly. Areas of use include: Materials Planning, Warehousing and Goods Issue.

Augmented Data Discovery

Definition and delimitation:

Augmented Data Discovery (ADD) describes tools that allow the user to visualize, analyze and analyze data in the simplest way without the help of IT or data experts. ADD technology consists of at least two components: Augmented Data Preparation and Augmented Analytics (Smarten, 2018).

Augmented Data Preparation helps users access data, integrated from varied data repositories and sources in a single interface, so they can test theories and hypotheses. These tools give users access to crucial data and information and connect to data sources.

Augmented Analytics automates data insight by utilizing Machine Learning and Natural Language Processing and automates data preparation, so users can share crucial data and make educated decisions. With an advanced augmented data discovery solution, the organization can share, manipulate and present data, with clear results and access to sophisticated tools. These tools ensure that the organization makes decisions based on fact rather than opinion.

Areas of application in retail:

Practically the same as existing Business Intelligence Solutions, just adding real-time reporting. This could be used for fraud detection, customer feedback processes or gaining insight for professionals, except IT-oriented, users.

Examples of prototypes or existing implementations:

There are still very few intuitive tools that can be understood as ADD software. One of the best known and most used solutions in this area, certainly offers Tableau with its software suite.

Conclusion and outlook for retail decision-makers:

This technology can support better decision-making processes within retail. Also, the dependencies on key employees (these with the knowledge in data analytics), can be massively reduced. Areas of use include: Invoice Verification, Accounts Payable, Invoicing, Accounts Receivable, Corp. Planning, Business Intelligence, Controlling, General Accounting and Cost Accounting.

IoT and IoT Platforms

Definition and delimitation:

The internet refers to a world-wide network to connect objects that are uniquely addressable, based on standard communication protocols, so that these objects are able to interact with each other, in order to achieve: smart recognitions, positioning, tracing, monitoring or administration. The difference between IoT based systems and personal computers or smartphones, is that a human can control the IoT devices, but it's not necessary. This is because IoT systems are capable of operating autonomously and to adapt themselves to a specific situation.

IoT platforms are software products offering comprehensive sets of application-independent functionalities, that can be utilized to build individual IoT applications (Wortmann & Flüchter, 2015). Providers of IoT platforms (such as: Google, Amazon, Microsoft or SAP) focus on different aspects of the IoT technology in order to support their customers. In general, there is no standard for IoT platforms, but various individual IoT platforms with individual technology stacks.

Areas of application in retail:

According to Accenture and (Gregory, 2015), IoT can be used in three critical areas of the retail business: customer experience, the supply chain, and new channels and revenue streams. Predictive maintenance can be used for managing energy, failure or detecting other issues. Moving merchandise

more efficiently is one of the goals that can be achieved with IoT in logistics. Many retailers have been using GPS to track and route trucks in the past. IoT offers a much higher degree of accuracy and can track even a single product or package from the logistics center, to the individual checkout by a customer.

Examples of prototypes or existing implementations:

When Ocado launched its automated packaging service in February 2016, it was the largest of its kind. With the help of a RFID system, Ocado has been able to control and coordinate the movements of *millions* of grocery store items, and thus speed up the logistic processes, when an online order is placed.

In 2015, Levi's partnership with Intel, resulted in a "Proof of Concept", with the goal of delivering near real-time inventory monitoring for stores in San Francisco. The concept is now marketed as; "Intel Retail Sensor Platform".

Over 4,000 beacons are currently installed in 700 Macy's stores. This is part of a broad corporate investment strategy in Omni-Channel retail technologies. It allows to push notifications to customers, based on their current location.

Conclusion and outlook for retail decision-makers:

The IoT-devices and platforms will not bring a benefit by itself, but rather act as basis for many "build-upon" applications, enabling many use cases. Especially the interaction with machine learning and augmented data discovery; this will be of the most potential in retailing. Areas of use include: Purchasing, Materials Planning, Goods Receipt, Warehousing, Sales, Goods Issue, Corp. Planning, Business Intelligence, Human Resources and Controlling.

Machine Intelligence and Learning

Definition and delimitation:

Machine learning (ML) is a generic term for the "artificial" generation of knowledge from experience. An artificial system learns from examples and can generalize them *after* the learning phase is completed. This means that it does not simply memorize the examples, but "recognizes" patterns and laws within the learning data. Thus, the system can also evaluate unknown data (learning transfer), or fail to learn unknown data (over-adaptation). There is a wide range of possible applications, these include: automated diagnostic procedures, credit card fraud detection, stock market analysis, nucleotide sequence classification, speech and text recognition, and autonomous systems.

Areas of application in retail:

ML has great potential in areas such as forecasting or strategic optimization, and can be used across industries.

(Henke et al., 2016) has, "identified more than 300 specific use cases, across 12 industries". For example, in healthcare, the systems can diagnose diseases on the basis of various data, while logistics is supported by route optimization. ML in retailing can, for example, help businesses to order the right quantity of goods, by analyzing demand based on various factors.

Examples of prototypes or existing implementations:

Amazon uses ML by analyzing the customer's data, drawing conclusions about the customer's interests, and making suggestions for further purchases accordingly. Walmart's use of ML in brick-and-mortar stores, is very similar to the "Amazon Go" concept store, which combines computer vision, machine learning, and sensors to bypass the checkout process entirely. By using ML, Blue Yonder optimizes the ordering and replenishment of brick-and-mortar stores. ML also makes it possible to regulate prices by analyzing demand.

Conclusion and outlook for retail decision-makers:

This technology can fully automate and provide an optimized decision making within retail. As many processes in the area of application lack any IT-support, and are fully handled manual today, the potential is huge. Areas of use include: Purchasing, Materials Planning, Warehousing, Goods Receipt, Goods Issue, Controlling and Business Intelligence.

Smart Dust

Definition and delimitation:

The intention of Smart Dust is to build low-power computers, within a cubic millimeter mote to allow for an integrated, massively distributed, sensor network. Smart Dust requires massive advances in “miniaturization, integration, and energy management.”. Designers can use microelectromechanical systems to build small sensors, optical communication components, and power supplies; whereas, microelectronics provides increasing functionality in smaller areas, with lower energy consumption (Warneke, Last, Liebowitz, & Pister, 2001).

Areas of application in retail:

Original projects are mostly research-based: deploying defense networks rapidly by unmanned aerial vehicles, monitoring environmental conditions that affect crops and livestock, and managing inventory control or monitoring product quality.

Examples of prototypes or existing implementations:

Hitachi has developed the world’s smallest and thinnest Radio Frequency Identification (RFID) chip. It is the size of only 0.15 x 0.15 millimeters, and is 7.5 micrometers thick. There is no known application or use of this project within retail, yet.

Conclusion and outlook for retail decision-makers:

Smart Dust is in a too early stage of development, to say something about the implications for retail. However, as soon as the chip industry overcomes the present technical and physical limitations, the impact will be huge. Especially in the logistics processes; the Smart Dust Technology might deliver the promises that RFID did not.

Areas of use include: Materials Planning, Goods Issue, Warehousing, Goods Received, Marketing, Business Intelligence and Controlling.

FUTURE RESEARCH DIRECTIONS

From a scientific perspective, the Hype Cycle Model is not a verifiable model, as many empirical (bibliometric) studies, verify or reject its forecasts (Dedehayir & Steinert, 2016; Jarvenpaa & Makinen, 2008; O’Leary, 2008).

Following this article, there is need for further research in terms of judging the potential of new technologies for different domains and industries, as the author does not see a general applicability, of any new technology, for any possible field or industry. This focus is not the intention of the Gartner model, but for a profound judgment, a domain-oriented perspective is indispensable.

The other large field of possible further research, is about developing the right strategy to adopt a new technology. Just to adopt technologies at the end of the cycle (arriving at the ‘Slope of enlightenment’), is not the way to follow, as you are losing any first-mover advantages. Finding the right spot, might be individual for each company, domain or industry. So far, not much research, especially for retailing, on these questions has been conducted.

CONCLUSION

Gartner's Hype Cycle is a technology life-cycle model, that has already been established in practice and is relevant to many industry managers. It serves good to describe, explain and forecast technological or market-relevant developments. It provides insights into subjectively perceived market expectations, as well as the technology or market maturity of the object under consideration.

As the literature review shows, see Table 1, is the major adoption of digital technologies present within the already IT-focused parts of retailing and wholesaling. The business processes of controlling, business intelligence and marketing are always for a high penetration of advanced technologies. Therefore, it is not odd that the future adoption of digital technologies is seen in these process areas. Other cost sensitive processes like logistics are target of digitalization because of the huge potential of cost savings.

Especially in view of increasing external influences such as: globalization, dynamic market and environmental conditions or shorter product and market life cycles; the Gartner Hype Cycle is an important tool for companies with regard to strategic decisions. It can help with technology strategy or investment decisions. The information, categorizations and descriptions are not transparent or imprecise enough for empirical and scientific verification.

Managers should use internal and external technology, as well as market knowledge, to extend and adapt the model against the background of the model's weaknesses. The information from the model, can then be used as guidelines for strategic decisions, but should *not* be used as the sole criterion for decisions.

For retailers in general, not all new technologies that are hyped, sustainable. As the domain is very unique, it is always needed to check the fit of an upcoming technology, for their use cases within retailing.

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KEY TERMS AND DEFINITIONS

4D Printing: Multi-material prints, with the capability to transform over time, or a customized material system that can change from one shape, to another.

5G: The fifth-generation (5G) wireless and mobile communication systems, which uses a much broader spectrum and higher-frequency bands, which allow the support of a much higher data rate up, to several gigabits per second.

Augmented Data Discovery: Tools that allow the user to visualize, analyze and data in the simplest way, without the help of IT or data experts.

Augmented Reality: A technology adding virtual objects, superimposed upon or composited in the real world.

Commercials UAVs (Drones): Unarmed aircrafts, without a human pilot aboard.

Gartner's Hype Cycle: A technology life-cycle model.

Internet of Things (IoT): A type of network to connect anything with the Internet, based on stipulated protocols, through information sensing equipment, to conduct information exchange and communications, in order to achieve smart recognitions, positioning, tracing, monitoring, and administration.

Machine Intelligence and Learning: A generic term for the “artificial” generation of knowledge from experience.

Smart Dust: Low-power computers within a cubic millimeter mote, to allow for an integrated massively distributed sensor network.

eLancing the Future Work Model: Opportunities and Challenges

8

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INTRODUCTION

Technology has penetrated our lives, this permits it to be a key changer and shaper of our daily activities. Evidence of the growing influence that technology has in our lives can be seen by the number of internet users worldwide estimated to be 4 billion users (Internet World Stats, 2017). In general, digital platforms can be an information analysis platform (i.e., online reviews), capital platform (i.e., facilitate the sale or rent of assets) and labor platform (i.e., links client-online freelancers). Firms are now repositioning their production strategies towards a distributive system, this explains why some high-tech firms remotely outsource talent from global labor markets (Cascio & Aguinis, 2008). Work is not just central to how we contribute to and participate in the society, but also a powerful mechanism for economic inclusion and social identification. Advances and progress made in technological gave rise to a new labor market mechanism known as electronic lancing (eLancing) as noted by Abubakar and Shneikat (2017). In eLancing is a type of work arrangement that takes place in the cyber platform in which individuals and/or client organizations hire other individuals (i.e., freelancers/sellers/workers) for lucrative assignments and/or work (Abubakar & Shneikat, 2017).

The eLancing platform resembles the eCommerce platform, the demarcating line between the two is that eLancing is a computer-mediated platform (market place) to advertise vacancy/demand, recruit, select, hire and compensate/pay virtual workers as oppose to the buying and selling of goods and services. eLancing platform is an online platform where online freelancers are connected through the internet to provide various services (Shneikat, 2016). Virtual workers are the eLancers, (i) who work without meeting or knowing the employer, (ii) work on microtasks lasting for specific hours and paid on hourly basis or fixed amount within a given period, (iii) do not have the traditional work schedule 9 to 5, and (iv) do not report to anyone (i.e., unit chief or supervisor). Example of such platform includes: upwork.com, guru.com, fiverr.com, freelancers.com and many more. The world largest eLancing platforms are upwork.com and freelancer.com. Upwork has 12 million registered eLancers with 3 billion jobs posted annually and more than US\$1 billion worth of work done annually (Upwork, 2017). The Freelancer has 27 million registered eLancers with 13 million jobs posted and more than US\$588 million worth of work done annually (Freelancers, 2017).

Technology and talent management are the main forces pushing for change in the human resource management in the 21st century. Modern scholars (Abubakar & Shneikat, 2017; Cascio & Aguinis 2008) claimed that present staffing and work models does not match with the present fast-paced work systems and organizations. The traditional way in which labor and capital are organized for production and service delivery in one physical location seems to be losing appeal. Artificial intelligence, robotics, augmented and virtual reality, and the internet of things have been linked to digitalization and the 4th

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industrial revolution. However, it is about us “humans” - the way we live, learn, earn and play. Thus, the future of work is all about pliability and the ability to reinvent oneself. The orthodox archetype of having a stable life time job is eroding and is being replaced by more flexible short-term precarious work arrangement, the eLancing.

Technically, eLancing represents the resurrection of dead capital, the comatose human capital in the context of the World Wide Web’s genealogy. Our values, norms, cultural institutions, and educational systems were designed to create traditional workers. eLancing work model has the propensity to alter the traditional work perceptions, norms, institutions and regulations. This new baby of digitalization and the 4th industrial revolution, eLancing, calls for further examinations, new policies, work practices and theory development and revalidation of existing theories. Thus, this chapter’s aim is to provide a comprehensive overview of existing work models and potential future work model. Subsequently, in this chapter analogy of various work arrangements ranging from independent professionals, contracted professionals, outsourcing and offshoring, teleworking, crowdsourcing and eLancing was conducted. This chapter also classifies eLancers based on several socio-demographic factors, describes the challenges, opportunities and implications of eLancing.

BACKGROUND

Hybrid Work Models

Hybrid and flexible work models are designed to allow individuals work from home, work outside regular office hours, to reduce or extend contract hours (Groen et al., 2018). These practices make employees to perform all work-related duties at a remote location and any time of day. The common theme linking independent professionals, contracted professionals, outsourcing and offshoring, teleworking, crowdsourcing and eLancing is work (Aguinis & Lawal, 2012; Shneikat, 2016). Prior researchers often interchangeably use these terminologies; however, they have several distinguishing features. This section will provide a more nuance understanding of each work arrangement:

Independent Professionals

An independent professional or contractor are self-employed persons who do not have any employees but can provide goods and services to other entities under terms specified in a contract or within a verbal agreement (Sayah, 2013). Conventional workers or temporary workers are under the directives and control of the hiring firm. However, independent professionals are not controlled by the client, because client’s control is limited to accepting or rejecting the outcome (Connelly & Gallagher, 2006; Fragoso & Kleiner, 2005). Independent contracting shares several similarities with eLancing. *One*, working alone on a project-related basis for various clients, either in parallel or in succession, project pay, and other details is governed and regulated by a contract. *Two*, as with eLancing, the client does not supervise the professionals directly the professionals have leeway in terms of hours of work and location. The demarcating line with eLancing includes; one, independent professionals face constraints based on clients’ needs e.g., new workplaces, conditions and locations (Sayah, 2013; Süß & Kleiner, 2010). However, eLancers can have specific working conditions e.g., hourly rate, fixed amount, milestone, and do not face new conditions or location since they work online. A freelancer (e.g., plumber, carpenter, auditor, former employee) can be an independent contractor, but an independent contractor is not an eLancer

(Connelly & Gallagher, 2006). *Three*, eLancers work online, while independent professionals can work both online and offline. *Four*, independent professionals work arrangement is governed by two parties (i.e., the professionals and the client organizations), while eLancing is governed by three parties (i.e., eLancer, the platform, and the client).

Contracted Professionals

Contracted professionals are individuals or micro-group who execute special duties and tasks inside the physical location of the client firm, state or region, usually on demand, for a specific amount and time. The contract can be either vendor-on-premises or co-employment arrangement. In vendor-on-premises arrangements, the responsibility for managing and protecting workers, and work regulations is transfer to the contracted professionals. In co-employment arrangements, the responsibility for managing workers is shared, while, workers protections and work regulations is transfer to the contracted professionals (Kuhn & Maleki, 2017). Contracted professionals differ from eLancing as professionals can work both offline and online. *Two*, contracted professionals entail two parties (i.e., the professionals and the client organization), whereas, in eLancing there are three parties (i.e., eLancer, the platform and the client). *Three*, work process is controlled by the contracted professionals as the client organization mostly have limited know-how on the specialization. *Four*, contracted professionals somehow engage in temporary jobs which typically lack the job security, fringe benefits, and possibilities for advancement that are available to incumbents of permanent job, however, eLancing is time or task based which gives no room for further implicit expectations neither from eLancers or from the client organization.

Outsourcing/offshoring

Outsourcing is an agreement in which a firm delegate some of its business process and operational, and/or non-core functions to another party. Aguinis and Lawal (2013) argued that offshoring and outsourcing are similar, the only designated difference is that offshoring requires that outsourcing be sent to another country. Outsourcing/offshoring and crowdsourcing are similar, as both utilize external human capital and resources to accomplish internal activities (Afuah & Tucci, 2012). Outsourcing/offshoring differs from crowdsourcing and eLancing on several fronts. *One*, in crowdsourcing, undefined number of individuals are recruited to solve business problems (Howe, 2006), as oppose to eLancing and outsourcing/offshoring where only selected vendor (Ye & Kankanhalli, 2015) and eLancer are recruited (Abubakar & Shneikat, 2017). *Two*, in outsourcing/offshoring and/or eLancing, client can monitor the development of the solution to ensure desired quality. Howbeit, the quality of business solutions acquired through crowdsourcing is questionable as solvers might not be professional (Poetz & Schreier, 2012). *Third*, crowdsourcing has solution diversity, while eLancing and outsourcing/offshoring does not (Ye & Kankanhalli, 2015). *Four*, in outsourcing/offshoring individuals follow the directives of the client. Whereas, in eLancing, eLancers are paid based on the given task, choose what tasks to work on and have little or no interaction with their client. *Five*, outsourcing/offshoring is governed by two parties (i.e., the outsourcer and the service provider), while eLancing is governed by three parties (i.e., eLancer, the platform, and the client).

Teleworking

Individuals who engage teleworking work arrangement are referred to as ‘teleworkers’, ‘commuting-based workers’ and ‘home-based workers’. The generic term ‘teleworker’ delineates an individual or group of individuals who work at a place other than the physical workplace facilitated by the Internet technology at a scheduled hour. Bailey and Kurland (2002, p. 384) defined teleworking as, “working outside the conventional workplace and communicating with it by way of telecommunications or computer-based technology.”. Gajendran and Harrison’s (2007) meta-analyzed 46 empirical and theoretical papers associated with teleworking and then coined a true definition for the activities. An alternative work arrangement in which employees perform tasks elsewhere that are normally done in a primary or central workplace, for at least some portion of their work schedule, using electronic media to interact with others inside and outside the organization (Gajendran & Harrison’s 2007, p. 1525). In essence, telework constitutes an early form of virtual work, long before hypermedia and rich media emerges (Aguilera et al., 2016; Hunton & Harmon, 2004). Thus, teleworking precedes crowdsourcing, and eLancing. Human, social and organizational arguments have been prescribed as the drivers of teleworking e.g., time saved in commuting, rational, cost-effectiveness, schedule flexibility, freedom from interruptions, reduced pollution, work-family enrichment strategy (Harker-Martin & MacDonnell, 2012). Whereas, professional, social isolation and reduced psychological health are cited as challenges (e.g., Aguilera et al., 2016; Coenen & Kok, 2014; Giovanis, 2018; Hunton & Harmon, 2004).

Teleworking spans into several work domains ranging from hospitality and tourism, telemedicine for doctors and nurses etc. Teleworking differs from eLancing on several fronts. *One*, teleworkers have a conventional relationship with one employer or firm; while eLancers do not work exclusively for one employer or firm (Shneikat, 2016). *Two*, eLancers do not report the specific hours that they work for a specific employer and they do not negotiate the teleworking arrangement. Consequently, eLancers telework 100% of their time, whereas, teleworkers can work in firms’ physical location and telework as well. *Three*, in teleworking there are two parties (i.e., employee and hiring organization), whereas, in eLancing there are three parties (i.e., eLancer, the platform and the client). *Four*, Aguinis and Lawal (2013) contend that in teleworking: (i) teleworking frequency (ii) teleworking time arrangement e.g., fixed or flexible schedule, (iii) teleworking location e.g., home or satellite station, and (iv) teleworking decision e.g., firm decision or teleworkers decision and initiative. These four facets distinguish teleworking from eLancing, as they are not applicable to eLancing.

Crowdsourcing

According to Howe (2006, p. 1), crowdsourcing is the act of “outsourcing organizational task to an undefined (and generally large) network of people in the form of an open call”. This definition has been criticized and redefined as “the use of IT to outsource any organizational function to a strategically defined population of human and non-human actors in the form of an open call” by (Kietzmann, 2017, p.152). Crowdsourcing as a concept, amalgamates ‘crowd and outsourcing’. The central idea is to distribute work, generate ideation and critical thinking, vote in favor of the best alternatives culled from crowds (Ikediego et al., 2018; Prpić et al., 2015) to produce optimal and superior results (Majchrzak & Malhotra, 2013). Crowdsourcing is an online and distributed problem-solving model (Brabham, 2008), in which organizations (i.e., Amazon Mechanical Turk, InnoCentive, Dell IdeaStorm, and TaskCN) target crowds and request for contributions to develop business solutions. Perhaps, just as businesses and their problems vary, so do the types of crowds and contributions they can offer the firm. In this view, busi-

ness enterprises can build crowd capital through crowdsourcing by adopting a top-down process to seek bottom-up resources (e.g., expertise, know-how and opinions) from the crowd (Aitamurto, Leiponen & Tee, 2011; Prpic & Shukla, 2013). This occurs in as a three-stage model: (i) constructing a crowd, (ii) developing crowd capabilities, and (iii) harnessing crowd capital for the benefit of the organization. Liu, Yang, Adamic and Chen (2014) highlighted that in crowdsourcing marketplace, businesses/enterprises post business problems and then problem solvers (i.e., the crowds) enroll and partake in solving the business problem to gain rewards (by competing with other solvers). While the firm gets business solutions that is approved by crowds (i.e., potential consumers) and at a lower price. Crowdsourcing differ from eLancing in several dimensions.

One, crowdsourcing is outsourcing whereby the workers doing the tasks are recruited through the Internet, whether or not the actual work is done online—although in the vast majority of cases it will be. Whereas, eLancing is basically executed in a computer-mediated platform (Schmidt & Jettinghoff, 2016). *Two*, crowdsourcing is operationalized with individuals willing to do micro-task for little returns (Ikediego et al., 2018), as oppose to eLancing where task can be micro or macro and is executed by the eLancer (i.e., individual, group or small firm). eLancer has the luxury to bargain for price and milestone, whereas, the crowd only follows client directives (i.e., individual or organization). *Three*, although, outsourced business problems and activities are performed both in eLancing and crowdsourcing platforms. However, eLancing “constitute of an individual or group of individuals who work independently for a client; while in crowdsourcing, the work is done collectively” (Abubakar & Shneikat, 2017; Aguinis & Lawal, 2012; Prpic’ et al., 2015). From relational taxonomy view, eLancing constitute of three parties (eLancer, the platform and the client) and one business solution. While, crowdsourcing constitutes of multiple parties (crowd of people, the platform and the client) and multiple business solutions. *Four*, in crowdsourcing, the client (i.e., client, business owner or employees) operate in crowdsourcing platforms to specify business problems and requirements, monitor, provide feedback and rebuttals, and nominates final business solutions (Sieg, Wallin & Von Krogh, 2010). Contrariwise to crowdsourcing fundamental objectives (i.e., lowering business solution cost), these activities may incur costs (i.e., resources, time and effort) for businesses (Ye & Kankanhalli, 2015). Even though the fundamental objectives of eLancing and crowdsourcing are the similar, clients have minimum level of involvement in eLancing, thereby saving scarce resources, time and efforts.

FOCUS OF THE ARTICLE

Electronic Lancing (eLancing)

eLancing is a process in which client organization delegates task to individuals, group, or small-sized firms interested in being hired online. More subtly, “organizations/individuals (i.e., clients/buyers/requesters) access other individuals (i.e., freelancers/sellers/workers) for remunerative tasks of varying temporality and complexity with commensurate qualifications and returns” (Abubakar & Shneikat, 2017; Green et al., 2014). Thus, “eLancers and their clients are spatially dispersed strangers from across the globe, interactions, which are short-term, occur virtually and largely asynchronously, relying on written communication” (Abubakar & Shneikat, 2017; Kneese et al., 2014). According to Abubakar and Shneikat (2017) and D’Cruz, and Noronha (2018), “registered eLancers and clients are linked only via projects conducted on the platform or discussion fora provided by the platform. Interactions occur via synchronous and/or asynchronous text messages and rich media (i.e., audio, video clips and conference)”.

eLancers compete for jobs via bidding, clients select the best bidder via several metrics (i.e., rating, number of successful projects, earnings if visible and reviews). The eLancing platforms stipulates commissions on every project, ensures supportive work atmosphere, performs authentication check, resolve conflicts, borderless nature, and bears no legal, financial or any sort of liabilities towards clients and eLancers (Caraway, 2010; D’Cruz & Noronha, 2016). Abubakar and Shneikat (2017) advocated that eLancers engage in eLancing activities primarily for autonomy, flexibility and work-family balance. Others are driven by economic circumstances and labor market conditions (i.e., high returns; unemployment, geographical location, equality and disability) and personal factors (i.e., skills development, reputation, passion, enjoyment in problem-solving, trust, and transparency). Bughin, Manyika and Woetzel (2016) further argued that eLancers can be taxonomized into four, based on several demographics, socio-economic and socio-psychological needs namely:

- **Free agents** – unemployed, eLancing is the primary source of income and actively prefer eLancing work style.
- **Reluctants** – unemployed, eLancing is the primary source of income, but would prefer a traditional job.
- **Casual earners** – employed individuals, eLancing is a supplementary source of income and eLance by choice or as a hobby. The primary motivation to work is often social, pleasure, fun, derived satisfaction and not money.
- **Financially strapped** - employed individuals, eLancing is a supplementary source of income, but would prefer not to eLance. The primary motivation is money and to save up for a rainy day (Bughin et al., 2016). See Table 1 for more details.

Table 1. eLancing/eLancers Matrix

eLancing is my....	Primary Income	Supplemental Income
Preferred Choice	Free Agents Primary source of income Willingly choose eLancing work style Not employed in traditional jobs Example: Students, freelancer, and others	Casual Earners – The Hobbyist Supplement source of income Willingly choose eLancing Some have traditional primary jobs Example: Students, retirees & others
Necessary Choice	Reluctants Primary source of income Prefer traditional jobs Example: A fresh graduate looking for job	Financially Strapped Supplement eLancing out of necessity Prefer not to eLance Example: Low wage translator

SOLUTIONS AND RECOMMENDATIONS

eLancing Opportunities

Critics argued that digitalization, artificial intelligence (AI) and robotics will take over our jobs. It is important to recall that our forefathers also feared massive technological change. AI and robotics might wipe off today jobs, but it is more difficult to know what jobs will be in demand in 30 years. AI and robotics have created more jobs—not fewer e.g., engineers, AI specialist and data scientist. Digitalization and AI will create more jobs, not mass unemployment if we responsibly guide innovation ~claims tech leader Elon Musk.

Consequently, the intersection of AI and eLancing work arrangements led us to scrutinize smart services. Smart services are strictly based on field and artificial intelligence (Dreyer et al., 2019), which denotes the ability of machine to assist human activities through the seamless use of pervasive computing (Clay, 2018; Korzun et al., 2018). Online smart rooms are known as enhancers and facilitators for distributed and online collaboration (Rogers & Lindley, 2004). In the context of eLancing, smart services are prevalent in smart rooms which improve and facilitate collaboration between several client organizations and eLancers. For instance, chat panels, conference calls, video conferencing, file sharing etc. Thus, eLancing offers a suitable environment that supports to support a collaborative and remote activities. In addition, smart services co-create value by the eLancers and client organization via eLancing platforms and machine intelligence. eLancing is one of these innovations, it has bunch of opportunities and benefits to offer to both eLancers and client organizations. Amongst them are:

For eLancers

Greater returns and earnings - eLancing offers exciting job opportunities e.g., writing, translations, social media management, developing algorithms for machines and robots. eLancers can access international and competitive market across globe. The future will not be a matter of human versus machine, but rather machine and human working in tandem to solve the business problems. eLancing is expected to play an important role. Individuals can earn more than the national average.

Institutional trust and transparency - is one factor that distinguishes eLancing from traditional contracting, outsourcing/offshoring and crowdsourcing work arrangements who cite difficulties collecting the money and wage theft (Kuhn, 2016). For instance, in MTurk clients are free to withhold payment without explanation for any work they find unsatisfactory. Similarly, Amazon does not provide a channel for workers to rate clients or comment on their transaction experiences. Whereas, eLancing marketplaces offer escrow and dispute resolution services (eLancing court), to facilitate and reduce unfair transactions and allow workers to collect their money and rights in case of dispute. Moreover, eLancers and clients can rate and comment on each their experience (managed by the platform), this would facilitate the decision of a potential client or eLancer.

Opportunity to grow – emergence of robotics and AI, and hybrid work models like eLancing implies that work and workforce must be redefined. Work should be reengineered because technology has and will reshape every job through alternative work arrangements. In this regard, individuals will engage in lifelong learning, oversee their destiny and career path, and pursue their passion.

Autonomy and flexibility - eLancers have the luxury to work from their beds, in their pajamas, and coffee shops, and spend more time with family. If the remote work system is to become a norm in the future, eLancers can choose to live in a tech-friendly city, thus, future talent war might be between cities and not companies.

Geographical barriers breaker - throughout history, geography profoundly shapes labor markets, in that employees must to live in proximity with the productive capital and other factors of production. The beauty of eLancing is that it has remove the barriers of geography (Clemens, 2011; Chen, & Horton, 2016). eLancers can work from anywhere, anytime in the world.

Equal employment opportunity – eLancing platforms to some extent offer economic inclusion for individuals who do not hold the educational qualifications necessary to secure a decent job in the local labor markets. Similarly, disabled, less privilege individuals (i.e., minorities) have access to work opportunities (Graham, Hjorth & Lehdonvirta, 2017).

Table 2. eLancing opportunities individuals/eLancers

eLancers
Greater returns and earnings
<i>Example:</i> eLancers can earn more money compare to traditional work setting. For instance, Indian computer programmers who work as eLancers can earn up to 5 times the national average.
Institutional trust and transparency
<i>Example:</i> eLancers and client organizations work based on trust, as eLancing platforms such as Upwork have integrated “escrow” to serve as safe net and to avoid conflict of interest among the parties. Online reviews are known to influence business decisions. Upwork platform allows parties to comment on each other’s performance and share their experiences through rating and online reviews. resolution center is also available to solve disputes between client organizations and eLancers.
Opportunity to grow
<i>Example:</i> eLancing provides individuals with opportunities to grow through challenging and task diversity.
Autonomy and flexibility
<i>Example:</i> eLancing provides individuals with autonomy to choose what, when, where and how to work.
Geographical barriers breaker
<i>Example:</i> eLancing has eliminate geographical barriers, in that individuals across the globe can sign-up and work.
Equal employment opportunity
<i>Example:</i> eLancing ensures that everyone including disabled and minorities have access to work opportunities.
Protection
<i>Example:</i> eLancers are not susceptible to workplace accidents and injuries as applicable to normal work.
Short term insurance / safety net
<i>Example:</i> eLancers can choose to be insured e.g., Trupo
For firms and client organizations
Client organizations can benefit from the eLancing work arrangements in various ways. Examples are summarized in table 3.

Protection - eLancers are not susceptible to workplace accidents and injuries as with independent and professional contractors who are vulnerable to lack of paid sick days, not covered by antidiscrimination employment legislation and safety net programs (Kuhn, 2016).

Short term insurance / safety net - Trupo is the first short-term disability insurance designed specifically for eLancers, who have the freedom to decide how much of their average income to insure by paying a monthly premium. In return, if an illness or injury keeps them away from working for more than a week, Trupo kicks in and sends you up to 50% of your normal income for up to three months. Table 2 summarize the benefits of eLancing for eLancers.

Numerical flexibility – with eLancing client organization has the luxury to adjust the number of eLancers they work with, the type of work, amount to be paid and the number of hours to be delegated workforce size, or the number of hours worked, in response to changes in product demand.

Functional flexibility – eLancing platforms provide access to individuals with expertise and highly specialized skills, thus, client organization can easily complement the capabilities of their in-house employees on an on-demand basis with high pliability.

Financial flexibility – Apart from numerical and financial flexibility, eLancing platforms can provide client organizations with financial flexibility. In that, hiring is on-demand basis and financial status basis, and access to eLancers with specialized skills and expertise.

Table 3. eLancing opportunities for client organizations

Client organizations
Numerical flexibility
<i>Example:</i> Downside eLancers at any time especially during off-season.
No accrued worker compensation as applicable to traditional work setting.
Functional flexibility
<i>Example:</i> Hire eLancers on demand thereby reducing cost of maintaining workers.
Financial flexibility
<i>Example:</i> eLancing reduces overhead for organizations.
Eliminates traditional hiring barriers
<i>Example:</i> eLancing eliminates the cost of searching, hiring, and even insurance. eLancing allows firms to hire individuals anyway in the World, technically bypassing governmental and bureaucratic pressure and cost.
Reduces start-up and transaction costs
<i>Example:</i> eLancing eliminates the cost of training, orientation, medical test (new employees) as well as reduces time frame.
eLancing Challenges
Everything good comes with challenges, eLancing has several challenges that need urgent adjustment in managerial and practical policies:

Eliminates traditional hiring barriers – eLancing platforms facilitates the hiring process, eliminate or at least reduce geographical, informational, and administrative barriers in the hiring process. In this regard eLancers, can be used for short term projects, on demand basis. With eLancing platforms, firms can have access to varieties of skill sets, individuals with varying degree of work histories, educational and cultural backgrounds who likely to create knowledge that will be useful for innovation (Corporaal & Lehdonvirta, 2017).

Reduces start-up and transaction costs - eLancing platforms is a way to reduce firm's start-up and transaction costs in all fronts. In that client organization can hire eLancers quickly to address project needs and also adapt faster to environmental changes (Corporaal & Lehdonvirta, 2017).

Economic policy - the growth in eLancing work model raises issues on the economic front. In fact, the in and out of eLancers in response to projects demands makes the economy's labor supply procyclical. This causes discrepancy and understatement of unemployment rate in recessions and employment rate after economic expansions.

Production and tax – the present economic policy does not take eLancers willingness to work extra hours or employed individual's willingness to earn from eLancing. Thus, additional hours mean an increase in production, because every increase in output means a change in the hours worked, which unfortunately is off the record and not subject tax by the current economic and production policy.

Income security and insurance – income security and social insurance system was built to discourage labor unrest and to associate workers to employment. eLancing is threatening the system that provides benefits such as retirement pensions plan, disability, health, and unemployment insurance, and compensation that go with holding a traditional job. eLancers are mostly not eligible and sometimes abuse the system.

Isolation and psychological wellbeing – eLancing threatens our health and also undermines productivity growth due to absence of productive social connections and activities e.g., lack of training and skills development opportunities, lack of workplace public goods, lack of ergonomic worksites, though eLancers have union, but the framework is still fragile and membership is low, and absence of interactions with coworkers or public while commuting as with traditional 9 to 5 jobs.

Benchmark – eLancers, unlike conventional workers are probably too fragmented to agree on output restrictions (Lehdonvirta, 2016), and monitoring virtual coworkers' behaviors is difficult. Thus, the need and awareness for development rarely surface in the eLancing platform.

Unrealistic flexibility (work-family interference) – advocates of flexibilization extol about eLancing ability to liberate individuals to determine their own schedules, while critics enumerated several structural reasons that inhibit eLancers ability to iron out ideal schedules e.g., ability to triumphantly coordinate their schedules relative to other social practices, and their understanding of time matters (Malone, 2004; Wajcman, 2015). Because of eLancing, leisure becomes work, work becomes leisure, “socialization turns costly, and people price every interaction according to market value. Jobs become something that you constantly-and feverishly- seek with very little regularity or certainty” (Lobel, 2017).

Competition, entry barriers, “race to the bottom” – In every sector, barriers of entry, competition intensity and equal employment opportunity matters. An ideal industry should have sufficiently low barriers to allow poor and uneducated people to participate. Nevertheless, if the barriers are too low, competition may lead to a “race to the bottom”, which in the worst-case results in wages falling to a level that no longer contribute to economic development. eLancers who operate in eLancing platforms are subject to intense global competition, which results to low income. For instance, a task that an average American eLancer would execute for \$100 is often executed by eLancers from other regions (i.e., Asia, Africa and Eastern Europe) for only \$30.

FUTURE RESEARCH DIRECTIONS

The importance of e-skills has been cited in previous scholarly (i.e., Gareis et al., 2014). eLancing is still at its nascent stage which comes with several challenges that encompass social, cultural and economic problems. For instance, Stewart and Stanford (2017) stated that several uncertainties and complexities surrounds eLancing work scope, work regulations and legal solutions. This chapter also raises important issues ranging from eLancers insurance, intense competition that results to lower wages, income taxes, psychological distress and the absence of vibrant and clear economic policies to guide the implementation of eLancing work arrangements. eLancing challenges requires urgent attention from researchers because they are pressing issues that need practical solutions. These solutions will contribute to practical usage of eLancing platforms and management theory. Future researchers and policy makers can consider the applicability of several eLancing opportunities into their macro-economic plans.

CONCLUSION

Digitalization and AI technologies have fueled a new wave of work arrangements, in which organizations utilize digital platforms to access national and international talents that would otherwise be inaccessible on demand. On the other edge, “digital economy” of online services has given rise to new kinds

of entrepreneurship and earning opportunities, the eLancing. This borderless, no limit and multi-scope work arrangement is transforming work, work relationship, organizational structure and even business models across the globe. However, milking the benefits in full-scale requires sophisticated skills and technical know-how that is outside the reach of less affluent countries, poor and uneducated people. HR scholars to date have paid comparatively little attention to the eLancing platform. This has created a need to refine and extend management theory beyond full-time traditional employment requires acknowledging the heterogeneity of eLancing activities. The importance of e-skills as part of the economic reforms and policy to prepare future generation for the future work has been cited several times. Additionally, several reforms packages have been proposed and debated. These reforms have been implemented in the European Union. Other countries are encouraged to initiate and implement plans for e-skills developments. eLancing entails several uncertainties about the scope, employment regulations, standards, and remedies. Notwithstanding, policymakers are encouraged to revise the framework governing online labor and/or eLancing. By weighing the pros and cons of eLancing enumerated in this chapter, policy makers can harvest fruitful insights on how to address pressing macro-economic issues that can abate unaccounted transactions, underestimation of employment rate, other economic indicators and labor unrest. Policy makers are encouraged to redefine or expand the definitions of 'employment, create a new category of workers e.g., eLancers, define and distinguish the rights of eLancers from conventional employees e.g., social and health insurance, pension and retirement plan. Subsequently, there is a need to reappraise and review the concept 'employer' e.g., income taxation in the virtual agora. Doing this might define new rights and protections for (i.e., eLancers and client organization) and provides a guide for theory development.

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Value Network View on Digital Marketplace

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INTRODUCTION

The advancement of the Internet has transformed the way people conduct businesses all over the world. Customers nowadays are equipped with smart mobile devices that can access information about products and services over the Internet easily. Similarly, firms can reach their customers directly through the Internet. Hence, this may cut intermediaries and potentially offer their customers cheaper prices. At the same time, they can engage their customers interactively through the available and specially designed social media. Many new business models have emerged that created disruption to traditional business models, for examples, mobile-based ride-hailing and ride sharing such as Uber, online travel or accommodation agencies such as Travelocity and Trivago, and peer-to-peer rentals such as Airbnb to name a few.

Incorporating the Internet in business is highly influenced by the digitation of business and business transactions, which is divided into three dimensions, (i) product/service digitation, (ii) process digitation and (iii) delivery digitation. Digitations create immense impact in businesses and have created new and innovative business models. For example, both Uber and Airbnb rely on digitation of process as both product/service and delivery cannot be digitized. However, with the digitation of process, they facilitate and manage transactions between supply and demand and create much more efficient business models as compared to the traditional counterparts.

One of the greatest impacts from the digitation of process is the creation of digital marketplaces as it creates immense impact on how supply and demand meet and transact. Digital marketplaces increase effectiveness and efficiency of market functions and significantly lower transactions costs. Essentially, there are three functions of a market, (i) matching buyers and sellers, (ii) facilitating of transactions, and (iii) providing institutional infrastructure (Bakos, 1998). In general, digital marketplaces are firms that offer these market functions digitally in two-sided or multi-sided markets. For examples, Airbnb offers a marketplace accommodation for owners and travelers (two-sided markets) and Uber offers a marketplace for drivers, food outlets and others with their customers (multi-side markets). A two-sided (in general multi-sided) markets is an intermediary or a platform that facilitates or enables collaboration between two sides, producers or sellers and consumers or buyers, to interact and transact (King, 2013; Parker & Van Alstyne, 2005; Rochet & Tirole, 2006). A digital marketplace is a kind of two-sided market that provides digital interactions and transactions to run market functions between both side markets. Literature on two-sided markets has also discussed how a platform creates a price structure which attracts both sides of the market to transact (Armstrong, 2006; Roson, 2005; Rysman, 2009).

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A platform offers values to both sides to stay in business. Stabell and Fjeldstad (1998) extends Porters' value chain concept (Porter, 1985) into three generic value configurations – value chain, value shop and value network. A platform applies value network as it mediates all sides in multi-sided markets. It provides a networking service or basically providing market functions to facilitate exchange between customers.

The next chapter discusses network externalities, two-sided markets, and value network theories and how these theories can be applied to view digital marketplace firms in setting their expansion strategies. Some digital marketplace business models will also be discussed. Future direction and conclusion will be presented in the last part of this chapter.

BACKGROUND

The advancement of information and communication technology (ICT), especially the Internet, has created a new way of conducting business and business transactions. E-business and e-commerce have been globally adopted and expanding in various sectors.

Globally the size of e-commerce market is growing steadily. For example, retail e-commerce is growing 20.9% yearly. Retail e-commerce was US \$2.3 trillion in 2017 and is expected to reach US \$4.88 trillion in 2021, and one of the most popular activities on the Internet is on-line shopping (Statistica, n.d.).

The Internet has given the opportunity for firms to reach their customers directly, offering direct sales to customers with cheaper prices; interacting with customers and providing them better customer services; providing mass customization and personalization to suit customers' need.

Although customers can find products and services that they need faster through the Internet, with so many firms offering similar products or services, finding the firm that offers suitable products or services directly from the Internet could be time consuming. Similarly, for firms, they may have difficulties to reach their potential customers through the Internet as they cannot easily target the right customers. Digital marketplaces on the Internet help provide the necessary functions for firms or suppliers to meet their customers and facilitate them to transact.

Digital marketplaces are developed along with the development of the Internet. Among early digital marketplaces is eBay. It was founded by Pierre Omidyar in September 1995 and designed to be a digital marketplace to help individuals transact goods and services easily and conveniently (Hasker & Sickles, 2010). There are many digital marketplaces that serve as platforms for business to business (B2B), business to consumer (B2C) and consumer to consumer (C2C) markets. Recently, there are many innovative digital marketplaces that created new markets and grow as global players in a relatively short time. For example, Uber is basically a digital marketplace for the transportation sector and Airbnb is a digital marketplace for the hospitality sector (Oskam & Boswijk, 2016). There are also plenty of digital marketplaces for digital products such as Google Play (Play Store) for Android mobile apps, iTunes for entertainment related products (music, movies, TV shows, etc.), and Craigslist for classified to name a few.

Digital marketplaces also grow locally and regionally, there are many digital marketplaces that concentrate on local/national and regional markets. As they have strong local or regional networks, they can compete with global players. Although local digital marketplaces are accessible globally, expanding a local digital marketplace to global markets is not easy as many factors need to be considered and the local firm needs to have the right internationalization strategy to penetrate global markets.

RELATED THEORIES

There are a number of theories related to digital marketplace, which will be briefly discussed in this section. The first theory is *network externalities*, the second one is *two-side markets*, and the third one is *value network*.

Network Externalities

Utility of an independent product or service such as the utility of air condition is solely based on the product/service. However, there are many cases that the utility of a product/service is also influenced by other products/services or other users (externalities). For example, the utility of computer hardware is definitely influenced by its software and the utility of telephone is clearly influenced by the other telephones connected to the telephone network.

Network externality or network effect (Katz & Shapiro, 1985, 1986, 1992, 1994) is the effect of additional consumers or users of a particular product or service on the utility of existing consumers or users to the same product or service. In other words, the total utility of a product or service for a particular user depends upon the number users of the product or service. Positive externality means additional consumers or users of a product or service increase the utility of the product or service. For example, additional users that join a social network will increase the utility of the social network to existing users or the utility of the social network to a particular user depends upon or a function of total number of users of the network.

Katz and Shapiro (1985, 1986) discuss direct and indirect network externalities, which are discussed further by Clements (2004). Direct network externalities are the direct effect of existing users of a product/service to the utility of purchasing the product/service. For example, the utility of a person purchasing a telephone is directly influenced by number of other telephones connected to the network.

Indirect network externalities are created by complementary products/services. For example, a person who buys a particular car is concerned by number of similar cars sold since services and parts for the car are easily available.

Indirect network externalities can take place in more than one related networks linked by intermediaries. A classic example is a credit card platform such as Visa or MasterCard. The utility of a credit card platform to its customers increases along the increase of total number merchants that accept the credit card issued by the platform. Similarly, the utility of a credit card platform to merchants increases along with the increase of the total number of customers of the platform. Another example is a newspaper that links readers and suppliers or vendors. Clearly the utility suppliers or vendors in buying space for advertisements depend on the number of readers or subscribers of the newspaper.

Intermediated indirect externalities are discussed thoroughly in two-sided networks or two-sided markets literature. In two-sided or multi-sided markets, the network externalities of the one side market depends on the size of the other side (Rochet & Tirole, 2006; Roson, 2005; Rysman, 2009).

Two-Sided Markets

Two-sided or in general multi-sided markets are two or more different but related markets managed by an intermediary or platform in which the growth of one side market is highly influenced by the other side. Two-sided market exhibits indirect externalities (Clements, 2004; Katz & Shapiro, 1985; Roson, 2005). A notable example is credit card platforms mentioned above. The platform manages and facilitates both

markets to interact (and possibly transact). Rochet and Tirole (2004) define two-side markets based on total quantity transacted and the price allocation. A market is a two-side markets if total quantity transacted is not only depends on the per-unit fee collected by the platform, but also depends on the allocation of fees paid by both sides. Rysman (2009) mentioned that the majority of two-side market literatures focus on price allocation. Hence, a marketplace, including a digital marketplace that allow both sides of the market to transact by applying pricing strategy is a two-sided market.

A platform normally provides infrastructure and rules (Eisenmann, Parker, & Alstyne, 2006) that facilitates the two sides to interact and transact. The main task of a platform is to attract both sides to join the platform to interact, and “getting both sides on board”. There are various strategies to fulfill this task but the most important strategy is the pricing strategy. The pricing strategy is basically discussed on how to allocate prices or charges between two sides so that both sides will grow and keep growing because of indirect externalities or cross network effects.

Rochet and Tirole (2004) discuss two charges applied by platforms to both sides, fix membership charge (α) and usage access charge (β), where $\alpha \geq 0$ and $\beta \geq 0$. If S is the seller side and D is the buyer side, pricing strategy is basically the allocation of $S_\alpha + S_\beta$ and $D_\alpha + D_\beta$ is such a way so that both S and D are attracted to transact. In some cases the platform give away the membership charge of one side such as free member charge the buyer ($D_\alpha = 0$) or even both membership and usage charges are free for the buyer side ($D_\alpha + D_\beta = 0$) to attract them to the platform. For example, Adobe (acts as a platform) give away (gratis) Acrobat Reader for documents' readers and charge for a premium license fee for the Acrobat Writer for documents' producers. In fact, a platform apply the lost leader strategy for one side of the market (such as $D_\alpha + D_\beta < 0$), especially during a promotion time, to attract the other side. Price allocation strategy or price structure is an interesting topic discussed by many two-sided markets researches (Armstrong, 2006; King, 2013; Parker & Van Alstyne, 2005; Rochet & Tirole, 2003; Roson, 2005; Rysman, 2009). Eisman et al. (2006) argue that it is very important to get the right price structure and this may imply that a platform subsidizes one side of the market to grow in order to attract the other side and then charge the other side with premium access to subsidize the other side.

Parker and Van Alstyne (2005) thoroughly discuss the price allocation strategy for two-sided markets (they use the term two-sided networks), especially on the issue of giving a subsidy to a side in attracting other side for revenues. They develop a two-sided network model that can determine which side to receive a subsidy or discount. Price allocation strategy is crucial to grow the market, however, there are some other factors that are also important such as the enabler technologies, suitable business models and expansion strategies. For example, e-Bay and Airbnb will not be possible without the Web and Uber will not be possible without the Web, Global Positioning System (GPS), digital map and smartphone.

Value Network

There are several value network concepts discussed in the literature with different approaches (Allee, 2008; Christensen & Raynor, 2013; Peppard & Rylander, 2006; Stabell & Fjeldstad, 1998)

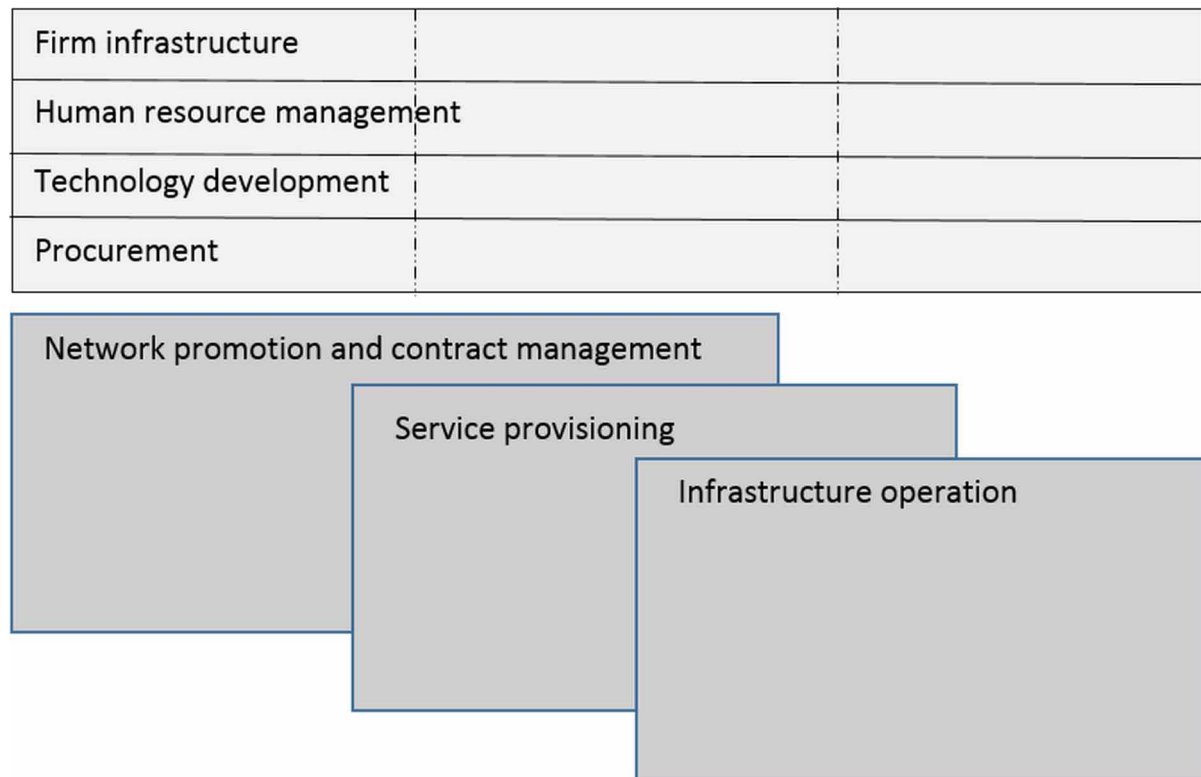
Allee (2008) considers networks are interactive agents that carry specific roles and values geared towards an achievement of a specific task or outcome by converting intangible and tangible assets into negotiable offerings. The key concept of Allee's value network is value conversion where agents engage in intangible and tangible exchanges to achieve economic or social good. A value network is divided into two categories, internal value networks and external-facing value networks. Internal value networks are interactions between or among agents (individuals or work groups) that make up an organization. External-facing value networks are interactions of an organization with its stakeholders.

Christensen (Christensen, 1997; Christensen & Raynor, 2013) defines value network as the collection of related entities in the environment of a business (industry), such as suppliers, channels to market, and ancillary providers that support the business. To compete, any business needs to adapt or conform to its value network.

According to Peppard and Rylander (2006), a value network is a network of connected entities that facilitates complex relationships of different players to deliver services to end customers. Value is created through these relationships. How value is created and its position in a network is described by Network Value Analysis (NVA), which can be used to construct a competitive strategy.

Stabell and Fjeldstad (1998) extends Porters's value chain concept (Porter, 1985) into three generic value configurations – value chain, value shop and value network. A business applies a value network if it mediates customers or clients. Note that the business itself is not a network, but it provides a networking service to facilitate exchange between customers. Thus, the network is the interaction among customers and value network is the service that facilitates the matching among customers. The Stabell and Fjeldstad's value network concept is related to the concept of network externalities. The value creation in a value network is the facilitation and management of exchange among customers and "the value is derived from service, service capacity and service opportunity." (Stabell & Fjeldstad, 1998, p.428)

Figure 1. Value Network Diagram (Courtesy Stabell & Fjeldstad, (1998))



VALUE NETWORK VIEW OF DIGITAL MARKETPLACE

The value network of Stabell & Fjeldstad (1998) integrates the concept of externalities and also absorbs the concept of two-sided market for a platform that manages two-side networks. Stabell & Fjeldstad (1998) extends the Porter's value chain (Porter, 1985) as there are many cases where value are not created by a linear chain of activities. In a value network, value is created when the platform provides services that connect its users/customers to interact and possibly transact. A value network diagram describes the platform activities to create value for its users/customers

Like the Porter's value chain diagram, the value network diagram is divided into primary activities and support activities. The primary activities are composed of overlapping activities: *network promotion and contract management*, *service provisioning*, and *network infrastructure operation*. The support activities are composed of separate activities: *firm infrastructure*, *human resource management*, *technology development*, and *procurement*. Figure 1 depicts the diagram of a general value network.

Support Activities

Firm infrastructure is a set of activities related with running business functions and operations such as general management, accounting, finance, and information systems. Human resource management is a set of activities related to managing human resources such as recruitment, training, and promotion. Technology development is a set of activities related to network development and service development. Procurement is a set of activities related to purchasing network infrastructure and service development.

Primary Activities

Network promotion and contract management is a set of activities that attract customers to join the network, setting the joining requirements, initialization, management and termination of contracts. Service provisioning is a set of activities related to initiating, operating and terminating services. Infrastructure operation is a set of activities for operating and maintaining both physical and information infrastructure.

Services offered and the networks itself create values. However, these values can be boosted further through network effects or positive network externalities. According to Katz and Shapiro (1985) value of a service is a function of positive network externalities. This means adding a node (such as a customer) to the network will affect the value of the service to other nodes.

Digital marketplaces are platforms in which value is created through value network. The value network diagram (Figure 1) is very useful to help a platform owner crafting a competitive strategy and business expansion on the chosen business model.

BUSINESS MODELS

Many digital marketplaces grow with innovative business models based of platforms of two-sided or multi-sided markets or networks. Basically a business model is a framework or architecture on how a business is organized and financed to create, deliver and capture value. Teece (2010) defines business model as a concept that describe the mechanism of a firm creates and deliver value to customers and making profits through the payment of the value. Hence, a business model has to outline the detail on

how to create value and how customers receive the value as well as making profits from the revenue generated by the value.

Teece (2010) provides elements of business model design which create value for customers. The value can be the fulfilling needs of customers or offer solutions to their problems. As such, customers do not hesitate to pay the value on the price offered. The firm captures the value that it creates and delivers through converting payments from customers into profits. According to Teece (2010) business model design has the following elements: 1) select technologies and features to be embedded in products/services, 2) determine customers' benefits from consuming products/services, 3) identify the segment of the target market, 4) confirming the availability of revenue streams, and 5) design mechanism to capture value.

Osterwalder and Pigneur (2010) identify 9 building blocks of business model, which are *customer segments*, *value propositions*, *channels*, *customer relationship*, *revenue streams*, *key resources*, *key activities*, *key partnership*, and *cost structure*. These 9 building blocks are arranged to form the Business Model Canvas (BMC) that can be used to describe, analyze and generate business model. Figure 2 is the structure of BMC.

Figure 2. Business Model Canvas (Osterwalder & Pigneur, 2010)

Key Partners	Key Activities	Value Propositions	Customer Relationships	Customer Segments
	Key Resources		Channels	
Cost Structure			Revenue Streams	

Based on Teece's definition of business model, also the building block of BMC, Täuscher & Laudien (2017) classify digital marketplaces into six clusters namely, *efficient product transactions*, *digital product community*, *Product aficionados*, *on-demand offline services*, *online services*, and *peer-to-peer offline services*.

Efficient product transactions are marketplaces that offer efficient transactions on physical products between individuals or businesses (C2C and B2B). The majority of the platforms use commissions to generate revenue, although some of them also use subscriptions to generate revenue. *Digital product community* facilitates transaction on digital products, although some products may not necessarily digital. Most transactions in the community are between individuals (C2C), although there are also B2C transactions. A platform in this category generates revenue through commissions. *Product aficionados* are marketplaces typical physical products such as art and handmade products and build communities

Table 1. Six clusters of digital marketplace models (taken from Täuscher & Laudien (2017))

Business model type	Platform type	Platform participants	Value proposition	Transaction type & good	Revenue model	Example
Efficient product transactions	Web-based platform	C2C, B2B	Large product variety	Physical products	Commission fee, subscription fee; mostly supply side	Beepi (eBay for used cars)
Digital product community	Web-based platform	C2C	Being part of a primary non-commercial community	Digital products; physical products	Commission fee; supply side, demand side	Sellfy (connecting 'neighbors' to share durable goods with each other)
Product aficionados	Web-based & mobile platform	B2C, C2C	Exchanging knowledge about niche products with community of like-minded people	Physical products	Commission fee; supply side	HobbyDB (Knowledge database and transaction platform for collectibles)
On-demand offline services	Web-based & mobile platform	B2C	Large service variety in a novel form	Offline services	Commission fee, subscription fee; mostly supply side	StyleSeat (connecting beauty salons & consumers)
Online services	Web-based platform	C2C, B2C	Novel online services with social networking character	Online services	Commission fee, subscription fee; mostly supply side	iTalki (connecting language learners with teachers for 1-on-1 online lessons)
Peer-to-peer offline services	Web-based & mobile platform	C2C	Novel services with community feeling within & outside digital platform	Offline services	Commission fee (demand & supply side), subscription fee (third parties)	Airbnb (connecting people to list, discover, and book private accommodations)

to share passion on these products. Most of transactions are within B2C, although there are also many C2C transactions. Revenues are generated through commissions and/or subscriptions of the seller side. *On-demand offline services* are marketplaces that facilitate online transactions of services between providers and their users. Services are carried out physically such as car rides or ride hailing, delivery services and shipping. Revenues are generated through commissions (most commission taken from the seller or provider side). *Online services* marketplaces are similar to the previous ones, however, all services are carried out digitally via the Internet and revenue are normally generated through commissions. *Peer-to-peer offline services* provide platforms for individuals that can offer services physically to those individuals who need them. In general, a platform in this category provides efficient way for individuals to share their physical resources, time or skills. Furthermore, most platforms in this category generate revenue through commissions. Table 1 summarize feature of the six clusters of digital marketplaces identified by Täuscher & Laudien (2017).

FUTURE RESEARCH DIRECTIONS

We are witnessing a growing number of companies adopting the digital marketplace model with various expansion strategies. Interestingly, the number of new companies that are adopting the digital marketplace,

successfully grow their business in a relatively short time and create disruption to the established players such as Airbnb in the accommodation industries or Uber in the transportation industry. Research on digital marketplace or digital platform is still in its infancy although a number of publications are growing recently. Some future research directions should include digital marketplace economy, this include impact of digital marketplaces in the national economy and the society; digital marketplace ecosystem this including studies on business ecosystem of digital marketplace and competition within an ecosystem and among similar ecosystems; studies on impact of digital marketplaces on the traditional business will be interesting as well; There are also an increasing number of studies on value co-creation. Focusing studies on value creation and value co-creation on digital marketplace is another good study to pursue.

CONCLUSION

A digital marketplace is a virtual platform that mediates two or more markets (two-sided or multi-sided markets) and creates value by governing efficient interactions between consumers from different markets. The main business strategy of most marketplaces is to expand markets they govern through a network effect to boost the value of their platforms. To do this, a marketplace is not only needed to create an effective pricing strategy to its customers, it also needs to increase the value of its mediation power and to make sure the support from its stakeholders.

Many innovative business models have been crafted within digital marketplace realm. These innovative business models have made the associated marketplaces grow so fast, much faster than traditional companies since all business processes and interactions are digitized, although services or products are not necessarily digital services or products.

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KEY TERMS AND DEFINITIONS

Business Model: A concept that describes the mechanism of a firm that creates and delivers value to customers and making profits through the payment of the value.

Digital Marketplace: A platform that governs interactions between two or more different markets and creates different values for different market and captures those values mainly through subscription and/or commissions.

Network Externalities: Network externality or network effect is the effect of additional consumers or users of a particular product or service on the utility of existing consumers or users to the same product or service.

Two-Sided Markets: Two-sided or in general multi-sided markets are two or more different but related markets managed by an intermediary or platform in which the growth of one side market is highly influenced by the other side.

Value Network: A value configuration in which value is created through providing connection or mediating interactions with consumers.

Crowdsourcing Maturity and Its Application in Public Organization Management

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INTRODUCTION

Crowdsourcing is an important variable in the research on public organizations. Crowdsourcing is important for generating information, improving communication between employees of a public organization and citizens (Brabham, 2015), engaging citizens in creating services (Noveck, 2009), solving public problems (Mergel and Desouza, 2013), shaping policy (Prpić et al., 2015), and improving public services (Nam, 2012). In addition, crowdsourcing increases the capacity of citizens' participation in public life, the sense of having a chance to make changes in their immediate environment (Seltzer and Mahmoudi, 2012). Crowdsourcing is part of contemporary public organization management trends (Lenart-Gansiniec, 2019; Nam, 2012). It is considered part of the New Governance, a new method of civic empowerment. It is also compared with e-government and Digital Era Government, open government, and instruments of social participation (Dutil, 2015). However, the implementation of crowdsourcing by public organizations alone does not contribute to achieving the assumed benefits, it is important to manage it (Blohm et al., 2018). The basis is improvement of specific skills and abilities by the organization in the context of crowdsourcing and its readiness to implement crowdsourcing, thus obtaining crowdsourcing maturity (Birch and Heffernan, 2014).

In the literature it is suggested that starting to implement and use crowdsourcing by the organizations should be preceded by significant organizational changes related to the processes, infrastructure, and organizational culture – it is only then when the organizations may include crowdsourcing in their strategies and consider its strategic application. The evaluation of crowdsourcing maturity may constitute a set of principal requirements and framework guidelines for a given process. The existing empirical achievements quite unequivocally prove the importance of crowdsourcing for the functionality, effectiveness, and efficiency of public organizations; however, it does not answer elementary questions, what crowdsourcing maturity of public organizations really is and what is the level of this maturity in public organizations, in particular in municipal offices. The search for answers to these questions seems to be justified for two reasons.

The aim of this article is to identify the level of crowdsourcing maturity of municipal offices in Poland.

BACKGROUND

Crowdsourcing

There is no agreement in the literature on the way crowdsourcing should be defined, although a significant number of researchers refer to the findings of Howe (2006). In this perspective, crowdsourcing means “the act of a company or institution taking a function once performed by employees and outsourcing it to an undefined (and general large) network of people in the form of an open call. Postulates appear in the literature that in order to conduct research on crowdsourcing, those of its areas should be taken into account (Zhao and Zhu, 2014) which are related to crowdsourcing components. In the crowdsourcing approach adopted, three areas of crowdsourcing have been specified, i.e. organizational, individual, and technological (Table 1). The adequacy of such a specification of crowdsourcing areas is also confirmed by Rouse’s (2010) findings. This fits in with the researchers’ deliberations started in 2018 on the topic of effective crowdsourcing management, taking into account precisely the intra-organizational perspective (Blohm et al., 2018).

As part of the organizational scope of crowdsourcing, the activities undertaken by the organization-initiator are important. In particular, this area allows to answer the question whether the problem addressed to the virtual communities by the organization has been properly assigned to a specific task. In addition, within this area crowdsourcing processes, intellectual property protection aspects, crowdsourcing coordination mechanisms, methods of acquiring, motivating virtual communities and evaluation of ideas sent by this community are indicated (Schenk and Guittard, 2011). The individual area focuses on the importance of employees in crowdsourcing endeavors. It is emphasized here that an appropriate motivation of employees, perceiving the benefits of crowdsourcing by them can cause that new solutions and ideas obtained from virtual communities will be adopted, disseminated, assimilated, and used to propose improvements in their workplace or for the entire division/department and building own reputation. The next area, technological, concentrates on the technical aspects of crowdsourcing. It allows for indicating software components, technical functions, important for the success of a crowdsourcing initiative, including: interface, authentication of the users, tracking the history of their posts, payment mechanisms, quality and workflow control and adaptation to the organization’s contextual, relational, and situational needs (Erickson et al., 2012).

Crowdsourcing Maturity

On the basis of management sciences, maturity is perceived as: the degree of the organization preparation for the implementation of specific tasks in a comprehensive manner and the achievement of its set goals, achieving a state of full development including the possibility of achieving excellence, the resultant of the maturity of business processes resulting from the organization’s activity and the maturity of the teams implementing these processes, as well as the normative, postulated procedure. Such approach to maturity is a set of basic and specific requirements or framework guidelines - which allows for diagnosing the current state of maturity and determine the target one. Among the few scientific studies one can find the statement that crowdsourcing maturity determines the actions that the organization should perform to achieve the desired crowdsourcing state. According to Birch and Heffernan (2014), crowdsourcing maturity is a certain ability of organizations and processes to achieve the assumed benefits of crowdsourcing (Birch and Heffernan, 2014). On the other hand, Boughzala et al. (2014) state that crowdsourcing

maturity consists of activities, processes, and their management that allow for improving crowdsourcing initiatives, and more specifically transiting from the initial state to an advanced state.

The manifestation of the organization's maturity are the specific features, which is associated with the skills that demonstrate the organization's readiness to implement certain tasks. The more the organization meets the requirements in more areas, the more it deserves to be called crowdsourcing mature. If, therefore, we assume that the maturity is the competences, skills, level, or degree of advancement of a chosen area of the organization, it can be recognized that crowdsourcing maturity is the degree of the organization's preparation for crowdsourcing implementation. This approach emphasizes the need for organizational changes in terms of the processes, infrastructure, and organizational culture (Howard et al., 2012), which increases efficiency and readiness to perform tasks, customer satisfaction, reduces costs, and contributes to building the organization's competitive advantage (Fisher, 2004). This means, therefore, that mature organizations carry out specific activities systematically, regularly, in a planned and conscious manner and are oriented towards continuous development, improvement of competences, and learning. An immature organization is one that performs specific actions chaotically, spontaneously, often only on a one-off basis or does not perform them at all. Crowdsourcing maturity models are used to identify the desired and current level, but also to evaluate the activities performed as part of the crowdsourcing framework. In the literature on crowdsourcing, only few models of maturity can be identified. They are usually original and have not been verified by other researchers. For example, the Crowdsourcing Ideation Maturity Assessment Model (CIMAM) by Boughzala et al. (2014) is intended to be so universal that it can be used to assess various types of crowdsourcing initiatives. According to the assumptions adopted by the authors, it may be helpful when choosing a crowdsourcing platform provider and selecting and evaluating ideas developed by virtual communities.

Other researchers, Birch, and Heffernan reviewed ten models of crowdsourcing maturity assessment in clinical trials. They considered that two of them, i.e. the Project Management Maturity Model (ProMMM) by Hillson (2003) and the National Infrastructure Maturity Model (NIMM) by van Dyk et al. (2012) - are so universal that they can be useful to assess crowdsourcing maturity in organizations. The ProMMM model focuses on the assessment of the skills of the management staff involved in crowdsourcing, while the NIMM on the assessment of the maturity of clinical trials using crowdsourcing. As indicated, both models discussed above can be used to assess crowdsourcing maturity in activities related to gathering of clinical data, patient reporting, treatment, and control of clinical signs and symptoms, and thus all practices involving medicine. Their verification has not been carried out in sectors other than medical. It is therefore difficult to consider these models as universal and transfer them to other organizations. The General Crowdsourcing Maturity Model (G-CrMM) by Durango Yepes and Gil Vera is based on the approach proposed in the National Infrastructure Maturity Model (NIMM). The authors stated that understanding the overall development of crowdsourcing required a strategic and systematic view of crowdsourcing. However, this model has not been verified empirically. The presented crowdsourcing maturity models are typically developed for business organizations and do not take into account the specificity of the public organization. In literature, however, it is difficult to find models of crowdsourcing maturity dedicated to public organizations. In one case, Lee and Kwak proposed an open government maturity model. The authors distinguished five levels oriented on the use of a website, the presence of the organization in the social media and the use of other technologies to communicate with residents (Lee and Kwak, 2014). However, this model is not useful for assessing crowdsourcing maturity.

RESEARCH METHODOLOGY

The research began in January 2018 and ended in June 2018. In the process of collecting the questionnaire survey data, the Computer Assisted Web Interview technique was used, which implies conducting surveys using survey questionnaires made available electronically. The choice of this technique was dictated by the possibility for the respondents to maintain their anonymity, the desire to eliminate the adverse effects associated with the presence of the researcher and the possible impact on the answers provided. Moreover, this technique can be used despite spatial limitations as it allows for completing the survey in any place and time convenient for the respondent. A simple percentage measure were used to identify the level of crowdsourcing maturity of municipal offices in Poland.

A total of 501 municipal offices participated in the survey, including 205 using crowdsourcing. In order to identify what percentage of municipal offices uses crowdsourcing and whether crowdsourcing maturity actually contributes to the municipal offices' organizational learning, compared to those that do not use it - a filtering question was used in the survey questionnaire, which enabled the separation of municipal offices that use crowdsourcing from those that do not. Generally, the municipal offices participating in the survey mainly pertain to cities of up to 20 thousand inhabitants (55.49%), employing between 50 and 99 people (45.51%%). The respondents were women (59.68%) in the age group of 41-50, (33.73%), employed in managerial positions (79.44%%), with seniority of over 10 years (68.26%%), with higher education (97.00%).

Taking into account the lack of tools for measuring public organizations' crowdsourcing maturity found objectively, an original survey questionnaire has been proposed. It has been assumed that the development of a crowdsourcing maturity assessment tool may be a diagnostic instrument to identify areas that the organization should improve. On the other hand, the measurement of crowdsourcing maturity will allow to observe the progress and the level of advancement of a given crowdsourcing initiative, and further to discipline, organize, and systematize the crowdsourcing used and set directions for action in improving management. The proposed tool in the 5-point Likert scale (where 1 –means a definite lack, and 5 - a strong relationship) contains 24 questions grouped into three areas of crowdsourcing maturity: organizational, individual, and technological. The general basis for the creation of a tool for measuring crowdsourcing maturity of municipal offices the methodology for measuring the maturity by Yepes and Vera (2014) has been adopted in the study. The choice of methodology was guided by important premises, i.a.: simplicity and the possibility of quantitative analysis, functionality, diversity of perception, and the desire to maintain continuity. It should be noted that the primary purpose of the crowdsourcing maturity tool is to provide clues that are logically related to each other and serve a specific purpose - however, it should not simplify the reality (de Bruin et al., 2005).

In order to better understand crowdsourcing maturity with division into three areas, an attempt was made to visualize it in the form of a crowdsourcing maturity evaluation key. The proposed key, in reference to the findings in sub-chapter 2.2, consists of three areas: organizational, individual, and technological. The basic simplification is the adoption that each of these areas affects the growth of crowdsourcing maturity (each has approximately a 33.33% share in it). The adoption of 33.33% of the total share in each of the areas results from the fact that in the literature, as far as it is known to the authoress, the significance of a given area is not indicated. Hence, individual areas complement each other and they create a full and comprehensive image of crowdsourcing maturity. Achieving crowdsourcing maturity is linked to the improvement of specific skills, characteristics, and abilities in a given area (defined as parameters), which is important for the level of maturity (Table 1).

Table 1. Crowdsourcing maturity evaluation ley

Areas	Parameters	Levels					Total share in an area (in %)
		1	2	3	4	5	
Organizational	Procedures on acquiring opinions from residents	0.83	1.66	2.49	3.32	4.15	33.33
	Ordinance implementing crowdsourcing	0.83	1.66	2.49	3.32	4.15	
	Crowdsourcing initiative coordinator	0.83	1.66	2.49	3.32	4.15	
	Crowdsourcing initiative target group	0.83	1.66	2.49	3.32	4.15	
	Methods of engaging the virtual community	0.83	1.66	2.49	3.32	4.15	
	Methods of motivating the virtual community	0.83	1.66	2.49	3.32	4.15	
	Methods of rewarding the virtual community	0.83	1.66	2.49	3.32	4.15	
	Defining tasks	0.83	1.66	2.49	3.32	4.15	
Individual	Informing the employees	1.11	2.22	3.33	4.44	5.55	33.33
	Employee training	1.11	2.22	3.33	4.44	5.55	
	Employee motivating	1.11	2.22	3.33	4.44	5.55	
	Employee engagement	1.11	2.22	3.33	4.44	5.55	
	Evaluation system	1.11	2.22	3.33	4.44	5.55	
	Assigning tasks	1.11	2.22	3.33	4.44	5.55	
Technological	The fact of having crowdsourcing platform rules	0.67	1.34	2.01	2.68	3.35	33.33
	Accessibility to the crowdsourcing platform regulations	0.67	1.34	2.01	2.68	3.35	
	Criteria for post evaluation	0.67	1.34	2.01	2.68	3.35	
	Possibility for communication between the office –Internet user	0.67	1.34	2.01	2.68	3.35	
	Possibility for communication between the Internet user-office	0.67	1.34	2.01	2.68	3.35	
	Commenting on the posts of others	0.67	1.34	2.01	2.68	3.35	
	Voting for other ideas	0.67	1.34	2.01	2.68	3.35	
	Notifying about problems	0.67	1.34	2.01	2.68	3.35	
	Gathering and storing resources	0.67	1.34	2.01	2.68	3.35	
	Information on implementing the best ideas	0.67	1.34	2.01	2.68	3.35	
General evaluation of the municipal office crowdsourcing maturity (in %)							
0–20 21–40 41–60 61–80 81–100	Very low level of crowdsourcing maturity (initial) Low level of crowdsourcing maturity (repeatable) Moderate level of crowdsourcing maturity (standard) High level of crowdsourcing maturity (managed) Very high level of crowdsourcing maturity (model)						
Municipal office crowdsourcing maturity in the organizational area (in %)							
0–20 21–40 41–60 61–80 81–100	Very low level of crowdsourcing maturity in the organizational area (initial) Low level of crowdsourcing maturity in the organizational area (repeatable) Moderate level of crowdsourcing maturity in the organizational area (standard) High level of crowdsourcing maturity in the organizational area (managed) Very high level of crowdsourcing maturity in the organizational area (model)						
Municipal office crowdsourcing maturity in the individual area (in %)							
0–20 21–40 41–60 61–80 81–100	Very low level of crowdsourcing maturity in the individual area (initial) Low level of crowdsourcing maturity in the individual area (repeatable) Moderate level of crowdsourcing maturity in the individual area (standard) High level of crowdsourcing maturity in the individual area (managed) Very high level of crowdsourcing maturity in the individual area (model)						
Municipal office crowdsourcing maturity in the technological area (in %)							
0–20 21–40 41–60 61–80 81–100	Very low level of crowdsourcing maturity in the technological area (initial) Low level of crowdsourcing maturity in the technological area (repeatable) Moderate level of crowdsourcing maturity in the technological area (standard) High level of crowdsourcing maturity in the technological area (managed) Very high level of crowdsourcing maturity in the technological area (model)						

Source: own elaboration.

In order to determine the level of a given area, one should diagnose a set of parameters characterizing it. Therefore, it has been assumed that the more parameters the municipal office implements, the more it deserves to be called a crowdsourcing mature office. In this approach, maturity is reduced to the degree of complexity and quality of the parameters implemented in a given crowdsourcing area. The total level of all parameters of a given area determines its percentage share in the crowdsourcing maturity generation processes. Whereas, the level of maturity of individual parameters determines the level of maturity of a given area and translates into the level of crowdsourcing maturity. In particular areas, the parameters complement each other, hence the share in the generation of crowdsourcing maturity attributed to them can be added up - which reflects the share of a given area in the perceived crowdsourcing maturity of a given office. In total, 24 such parameters were identified in the model: in the organizational area - 8 parameters in the individual area - 6 parameters in the individual area and 10 in the technological area. For each of the three areas, dedicated wording was prepared. Their content was formulated on the basis of a literature review. Taking into account these assumptions, in order to qualify a given office to a given level of crowdsourcing maturity, a specific evaluation key for particular areas has been proposed.

RESULTS

The conducted research revealed that the municipal offices studied use 63.45% of their capabilities, which means a high level of crowdsourcing maturity. With reference to the organizational area of crowdsourcing maturity, the offices studied use 65.13% of their capabilities, 57.95% in the individual area, and 65.40% of capabilities in technology. A detailed analysis of the responses obtained allows for noticing that in the organizational area of crowdsourcing, the procedures for acquiring opinions from residents, the appointment of a crowdsourcing coordinator and the determination of an initiative's target group were rated the most, while the methods of rewarding the virtual community were rated the lowest. In the individual area of crowdsourcing maturity, the employees' commitment to new projects was rated the highest, further informing employees about the crowdsourcing initiative and precise rules for appointing people responsible for coordinating crowdsourcing. The lowest notes were obtained by the component related to conducting crowdsourcing training. In the technological area of crowdsourcing maturity, the functionality of the platform associated with the possibility of reporting problems troubling the virtual community was rated the highest, while the lowest rate was obtained by the possibility of evaluating ideas reported by the Internet users.

First, five municipal offices (2.44%) were included in the first level of crowdsourcing maturity. However, 10.24% (21 municipal offices studied) are characterized by low maturity, moderate - 25.85% of the units studied (53 offices studied), high maturity - 44.40% of offices (91 offices studied), and finally very high crowdsourcing maturity was attained by 17.07% units (35 offices studied). Analyzing crowdsourcing maturity of municipal offices characterized by low crowdsourcing maturity (2.44% of the studied offices declaring the use of crowdsourcing) using control sheets, it should be noted that they use 20% of their abilities in the area of crowdsourcing maturity, including: 20% in the organizational area, 20% in the individual area, and 20% in the technological area. It follows that in these offices no procedures have been developed to obtain opinions from residents - as indicated by 100% of the surveyed municipal offices. The same number of respondents recognized that there was no ordinance implementing crowdsourcing in their office. There were also no crowdsourcing initiative coordinators (100%), and the target group of the crowdsourcing initiative (100%), methods of engagement (100%), motivating Internet users (100%), and rewarding them (100%) had not been determined. In the case of

defining tasks that were to be transferred to virtual communities, 100% of the municipal offices studied that are at the first level of crowdsourcing maturity do not do that. Employees in offices located at the first level, according to the respondents, do not know about the crowdsourcing initiative used in their unit (100%), they did not participate in crowdsourcing training (100%), they are not encouraged to use knowledge from crowdsourcing and are reluctant to engage in new projects (100%). The offices had not developed any rules for assessing the employees' use of knowledge coming from crowdsourcing (100%) and rules for appointing people to coordinate this initiative (100%). The crowdsourcing platform owned by the investigated offices at the first level tends to have regulations (80%), which are generally available (80%). The platform rather includes criteria for evaluating ideas sent by members of the virtual community (80%). The owned platform a tool enabling the office to communicate with the residents (80%) and the residents with the office (80%). In addition, it has the following functionalities: the ability to comment the posts of other members of the virtual community (80%), vote for the best ideas, in their opinion (80%), the opportunity to report problems that trouble them (80%), collect and store the knowledge resources acquired in this way (80%). The platform also contains information pertaining to the implementation of the winning ideas.

Second, 21 municipal offices studied were qualified to the second level (10.24%). Research conducted in these offices indicates that they use 28.33% of their capabilities in the field of crowdsourcing maturity, including: 26.78% in the organizational area, 32.38% in the individual area, and 27.14% in the technological area. Over 33.3% of the examined municipal offices positioned at the second level, stated that they rather had procedures for obtaining opinions from residents (14.3% of respondents declared a lack of such procedures). As regards the implementation of crowdsourcing, 71.4% of the respondents believe that they do not have one. In the overwhelming majority of offices positioned at the second level, no crowdsourcing initiative coordinator had been appointed (61.9%), no target group of the crowdsourcing initiative (61.9%), methods of engaging the virtual community (85.7%), motivating Internet users (71.4%), and methods of rewarding them (71.4%) had been determined. In turn, 57.1% of the offices studied had not defined tasks that were to be transferred to the virtual community. Offices, at the second level of crowdsourcing maturity, had not provided their employees with information about the crowdsourcing initiative (61.9%), they had not provided training in this area (100%), and they had not encouraged them to use knowledge coming from crowdsourcing (76.2%). However, in 42.9% of the municipal offices studied, the employees are willingly engaging in new projects (19% declare that "definitely yes"). On the other hand, 76.2% of the municipal offices studied, which are at the second level, declare that they do not have the rules of employees' assessment in terms of their use of knowledge coming from crowdsourcing. Whereas, 100% of the respondents point to the lack of rules for appointing people to implement crowdsourcing initiatives. The crowdsourcing platform owned by the studied second level offices definitely does not have any regulations (100%), and which are not generally available (90.5%). The platform does not rather include criteria for evaluating ideas sent by members of the virtual community (90.5%). The platform is not a tool for the office that allows for communicating with the residents (71.4%) and the residents with the office (61.9%). On top of that, the platform does not have the following functionalities: the ability to comment the posts made by other members of the virtual community (81%), vote for the best ideas in their opinion (71.4%), report problems that trouble them (57.1%), collect and store knowledge resources (61.9%). The platform does not provide information on the implementation of the winning ideas (71.4%).

Third, at the third level there are 53 municipal offices studied (25.85%). Research in these offices indicates that they use 54.53% of their capabilities in the area of crowdsourcing maturity, including 56.88% in the organizational area, 46.48% in the individual area, and 57.47% in the technological area.

The research results indicate that 45.3% of them, in relation to having procedures for obtaining opinions from the residents, answered: “neither yes, nor no”. The same indications were obtained by the parameter connected with crowdsourcing implementation - 41.5% answered “neither yes, nor no”. In turn, 39.6% of the offices studied gave the answer: “neither yes, nor no” connected with appointing a crowdsourcing initiative coordinator. However, 20.8% have already done so. The offices studied neutrally assessed the fact of determining the target group of the crowdsourcing initiative (49.1%), methods of engaging the virtual community (62.3%), motivating Internet users (47.2%), and rewarding them (49.1%). On the other hand, only 3.8% of the municipal offices studied defined tasks that were to be transferred to the virtual community. Offices at the third level neutrally assessed the fact that employees had knowledge about crowdsourcing (41.5%) used. As regards conducting training for employees in the area of crowdsourcing, 49.1% of respondents felt that this was not the case. The offices studied do not encourage the employees to use the knowledge acquired as part of crowdsourcing (37.7%) - 41.5% answered “neither yes, nor no”. It was declared that the employees are rather willing to engage in new projects (30.2%). In addition, these offices do not have well-developed rules for assessing the employees’ use of knowledge acquired from crowdsourcing (47.2%). Only 9.4% have developed rules for appointing people to implement a crowdsourcing initiative - while 35.8% gave a neutral answer, and 34% said that there were rather no such rules in their offices. The fact of having the crowdsourcing platform regulations by the third level offices studied was assessed at the neutral level (43.4%), while 18.9% confirms the definite fact of having them. On the other hand, disclosure of the regulations was assessed neutrally - 37.7% answered “neither yes, nor no” (18.9% definitely confirms this fact). The platform definitely does not include criteria for assessing the ideas sent by the virtual community members (35.8%). The possessed platform is rather not a tool for offices that allows for communicating with the residents (30.2%) and the residents with the office (30.2%). In addition, the platform does not provide the possibility of commenting on the posts of other virtual community members (24.5%), voting for the best ideas, in their opinion (41.5%). However, it allows for reporting problems that trouble them (30.2%). As to the collection and storage of the acquired knowledge resources, the following answers were obtained: 28.3% recognize that the platform does not allow it, while 24.5% state that it rather allows it (80%). Usually, the platform does not contain information about the implementation of winning ideas (45.3%).

Fourth, at the fourth level there are 91 municipal offices studied (44.40%). Research in these offices indicated that they use 69.62% of their capabilities in the area of crowdsourcing maturity, including: 71.62% in the organizational area, 63.5% in the individual area, and 71.67% in the technological area. These offices have procedures for obtaining opinions from residents (46.2% of the municipal offices studied declare this fact). The respondents indicated that they rather have an ordinance implementing crowdsourcing (31.9%). On the other hand, 42.9% assess this parameter neutrally. In 49.5% of the municipal offices studied, the crowdsourcing initiative coordinator had been appointed, while 5.5% had not done so. The target group of the crowdsourcing initiative (61.5%), the ways of engaging the virtual community (49.5%) had rather been defined, while this parameter was neutrally assessed by 42.9% of the offices studied. The parameter regarding the methods of motivating Internet users (56%) and their rewarding (50.5%) was also neutrally assessed. In turn, 46.2% of the municipal offices studied had rather defined tasks to be transferred to the virtual community. At the fourth level, 44% of the studied municipal offices found that the employees rather had knowledge about the crowdsourcing initiative. As for conducting training for employees in the area of crowdsourcing, 40.7% of the respondents considered that this had not been the case, and 20.9% stated that it had rather been conducted. Offices at this level usually do not encourage their employees to use knowledge obtained from crowdsourcing (34.1%), while 42.9% answered: “neither yes, nor no.” In the offices at this level, the employees are willing to engage in

new projects (53.8%). The respondents neutrally assessed the parameter related to possessing developed rules for assessing the employees' use of knowledge acquired from crowdsourcing (40.7%). Only 4.4% have developed rules for appointing people to implement a crowdsourcing initiative, while 54.9% gave a neutral answer (27.5% stated rather yes). The crowdsourcing platform owned by the studied offices at the fourth level rather has regulations (39.6%). However, its availability was assessed neutrally - 41.8% stated "neither yes, nor no" (16.5% definitely confirms this, while 35.2% considers rather yes). The platform rather includes criteria for evaluating ideas sent by members of the virtual community (31.9%). The platform is usually a tool for the office enabling communicating with the residents (45.1%) and the residents with the office (49.5%). The possibility of commenting on the posts made by other members of the virtual community was assessed as neutral (34.1%). The offices studied declare that their platform allows for voting for the best ideas, in their opinion (44%), reporting problems that trouble them (44%), gathering and storing the acquired knowledge resources (50.5%). The platform also includes information on the implementation of the winning ideas (53.9%).

Fifth, on the fifth level there are 35 city offices using crowdsourcing (17.07%). Research in these offices indicates that they use 88.19% of their capabilities in the field of crowdsourcing maturity, including: 90.21% in the organizational area, 81.5% in the individual area, and 90.57% in the technology area. Offices positioned at this level have procedures for obtaining opinions from residents (74.3%). When assessing the existence of the crowdsourcing implementing ordinance, 45.7% stated that the office had rather had one, while 42.9% of the respondents considered that such an ordinance had definitely existed. In 68.6% of the studied offices positioned at level five, the crowdsourcing initiative coordinator had been appointed, while 65.7% had definitely defined the target group of crowdsourcing and the ways of engaging participants (54.3% - rather, while 45.7% - definitely). In the case of determining the methods of motivating Internet users, 43% of respondents felt that they had rather been determined. On the other hand, 42.9% of the municipal offices studied claim that the methods of rewarding the virtual community have been developed. The fact of determining the tasks to be transferred to the virtual community was assessed in a similar way. At the fifth level, 51.4% of the studied offices declared that the employees had knowledge about the crowdsourcing initiative, while this standpoint was definitely accepted by 40% of the respondents. Offices positioned at this level declare that training on crowdsourcing for the employees was definitely conducted (28.6%), while 22.9% stated that it had rather not been conducted. Offices at this level rather encourage their employees to use knowledge acquired as part of crowdsourcing (51.4%), while 37.1% answered "definitely yes".

In the offices studied, the employees are usually willing to engage in new projects (60%). Additionally, these offices have rather developed rules for assessing the employees' use of knowledge acquired from crowdsourcing (42.9%). In the case of a parameter connected with the existence in the office of rules for appointing people to implement a crowdsourcing initiative - this fact is confirmed by 40% of offices positioned at the fifth level, while 54.3% considered that such rules had rather been established. The crowdsourcing platform owned by the examined offices positioned at the fifth level definitely has regulations (54.3%), which are generally available (71.4%). On the platform, there the criteria for evaluating ideas sent by members of the virtual community are rather present (48.6%). The owned platform is for the office a tool enabling communication with the residents (65.7%) and the residents with the office (65.7%). The platform's functionalities include: the ability to comment on the posts made by other members of the virtual community (40%), voting for the best ideas, in their opinion (85.7%), the opportunity to report problems that trouble them (82.9%), gathering and storing the acquired knowledge resources (77.1%). The platform also includes information on the implementation of the winning ideas (71.4%).

DISCUSSION

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Our research focused on identifying the level of crowdsourcing maturity of municipal offices in Poland. Although there have been no previous studies focusing on crowdsourcing maturity of municipal offices, there are some empirical results with actions aiming at gaining benefits from crowdsourcing and its management, as well as key success factors. Taking into account the theoretical foundations applied, our research supports the studies on crowdsourcing maturity conducted by Durango Yepes and Gil Vera. Taking into consideration the previous empirical findings, it is claimed that the results obtained should be perceived as supporting, deepening, and widening the previous ones. This applies, in particular, to the findings related to the managing and designing of crowdsourcing in public organizations (Clark and Logan, 2011; Clark et al., 2019; Noveck, 2009). First, in order to obtain optimal solutions in terms of the amount and diversity of knowledge from crowdsourcing participants, public organizations must develop procedures for obtaining opinions from residents, a document implementing crowdsourcing, plan the coordination of a crowdsourcing initiative, define its target group, the methods to engage, motivate, and reward the virtual community. It is also important to define the tasks addressed to these communities. The quality of the knowledge acquired by the organization is dependent on the level of engagement of a given virtual community member. It is also important to select the right members of the virtual community considering the specificity of the task and to determine the appropriate size and diversity of the said community. On the other hand, an appropriately selected task may contribute to the motivation of the virtual community and encourage it to act and will help achieve the goal set by the office. In particular, the task should be characterized by autonomy, diversity, degree of difficulty, whereby autonomy means the degree to which the task allows for freedom, independence, anonymity, capability to adapt the schedule and procedures to the participants' individual needs, but also the ability to divide tasks into smaller parts. However, diversity is connected with the degree to which a specific task requires from the crowd to use skills and knowledge in its implementation.

Second, the individual area of crowdsourcing maturity is based on the assumptions that before the organization can use crowdsourcing, it must remember the motivation, knowledge, commitment, attitude and behavior of its employees. Implementation of crowdsourcing may be associated with the fear and reluctance felt by the employees. It is not without significance in the individual area to communicate changes, which is connected with conducting training and allowing for ongoing answering the employees' questions - so that they do not recognize crowdsourcing as a threat and do not feel confused. In general, in this area it is important not only to constantly inform the employees about the benefits of crowdsourcing, but also to supervise the use of new knowledge in daily work, which means that all employees should benefit from it in a similar way. For example, Andriole (2010) examined 100 organizations and demonstrated that only 6% of employees used the knowledge acquired from online communities in their work, and 4% to support decision-making processes.

Third, the crowdsourcing maturity level is determined by the parameters in the form of the crowdsourcing platform's functionality, including: the platform's regulations and its general accessibility, the ability to comment and vote. Hosseini et al. (2014) indicate that the crowdsourcing platform should enable interaction with the virtual community, including: the ability to register and log in for individual members of the virtual community, their authentication, declaration of skills and abilities, assigning tasks, sending ideas, coordination, supervision and the said feedback.

Our research shows that the majority of activities within a given crowdsourcing maturity area are undertaken, however the engagement of the employees of the examined offices in new projects and the fact of placing on the crowdsourcing platform information on the implementation of the winning ideas

is of the greatest importance. On the other hand, training for employees in the field of crowdsourcing was rated the lowest.

CONCLUSIONS

The conducted research allowed to deepen the existing knowledge, clarify and verify the theoretical postulates concerning crowdsourcing maturity formulated in the literature. First of all, crowdsourcing maturity is the degree to which the organization's resources in the organizational, individual, and technological areas enable the implementation of crowdsourcing and achieving the assumed benefits arising from it. Second, the conducted research has allowed to develop an original tool for measuring crowdsourcing maturity of a public organization, taking into account the organizational, individual, and technological areas. In order to qualify a municipal office for a given level of crowdsourcing maturity, a sheet for the evaluation of individual areas of crowdsourcing maturity has been proposed. Third, the study identified the level of crowdsourcing maturity of the municipal offices in Poland. Therefore, it is claimed that this study directly responds to, expands, and deepens the earlier findings which have been limited to healthcare institutions only (Birch et al., 2014). Moreover, since in the previous literature there have been no studies on crowdsourcing maturity of municipal offices, it is claimed that the results obtained develop knowledge in this field.

It seems that this research is valuable to practitioners because it directly points to the key activities that allow municipal offices to benefit from crowdsourcing. This research shows that crowdsourcing requires appropriate and conscious management, which is associated with the improvement of specific skills, features, and capabilities of the organization in a specific area - hence the awareness of decision makers, at what level of crowdsourcing maturity they are and what actions they should take before crowdsourcing implementation is significant. The results obtained in the empirical research and proposed original crowdsourcing maturity evaluation sheet for the organizational, individual, and technological areas can be a response to postulates regarding conscious crowdsourcing management. The basis is to prepare the office for implementing crowdsourcing. In addition to the appropriate designing of the tasks transferred to the virtual community, issuing ordinances and procedures, selecting and matching of an appropriate crowdsourcing platform to the needs and expectations of the office or appointing an initiative coordinator as well as other activities specified in the proposed crowdsourcing maturity evaluation sheet – one cannot forget about the employees and management staff of the municipal offices. As the research results show, it is the motivation and engagement of the employees as well as the openness and support of the management staff that play a large role in the achievement of crowdsourcing maturity. According to this approach, the management takes the initiative, initiates a given action, initiates, is able to find the best solution, and actively and constantly searches for information to increase knowledge resources.

This research has certain limitations. First of all, the majority of respondents was management staff (79.44%), which may pose a threat of bias and subjectivism in assessing the situation. Second, it was limited to the study of municipal offices in Poland, which may weaken the universality of the results obtained and the analyses carried out. However, it should be highlighted that this is, as far as the author is aware, the only study of the importance of crowdsourcing maturity for organizational learning at municipal offices in Poland conducted so far. It is justified to repeat the research in other countries. It seems that such replication is needed not only to test our results and make comparisons between nations, but also to reveal the possible differences between municipal offices at the national level (Brabham, 2008). Third, a significant limitation of the conducted empirical studies is the use of an original research tool

for measuring crowdsourcing maturity, which was developed on the basis of literature analysis. It has not been used in previous studies. However, the reliability of the proposed scales has been verified based on Cronbach's alpha coefficient. It should be emphasized that research into crowdsourcing maturity is valuable because more and more offices are including crowdsourcing solutions into their development strategies (Clark et al., 2019).

FUTURE RESEARCH DIRECTIONS

The presented research results, despite their limitations, allow for proposing the directions for future research. There is a need to focus the research efforts on the following aspects: identification of the motives and barriers related to the use of crowdsourcing by municipal offices, key factors for crowdsourcing success. It is also worth considering multi-level empirical studies, taking into consideration the triangulation of researchers. The parallel implementation of research by several researchers is important here. Such an approach would enable mitigating the unconscious preferences of the researchers.

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KEY TERMS AND DEFINITIONS

Crowdsourcing: The organization's operation, consisting in the inclusion of virtual communities, in the form of an open call via an online platform, in problem solving, implementation of innovations or creating ideas or other tasks so far only implemented by the organization's employees.

Crowdsourcing Maturity: The degree to which the organization's resources in the organizational, individual, and technological areas enable the implementation of crowdsourcing and achieving the assumed benefits.

Crowdsourcing Maturity Model: A set of different tools, practices, and activities that enable the assessment of a given organization's competencies in the area of crowdsourcing and improvement of key factors leading to achieving the assumed goals.

E-Government: Use of information technology in general to provide citizens and organizations with more convenient access to government information and services and to provide delivery of public services to citizens, business partners, and those working in the public sector.

Maturity: The degree of the organization's preparation for the implementation of specific tasks in a comprehensive manner and the implementation of the goals set.

Public Organization: A complex entity that has the features specific to all organizations. Its essence is constituted by distinctive specific characteristics of certain features, and in particular its orientation towards pursuing the public interest.

Social Participation: Participation of citizens in managing the affairs of the community of which they are members.

Theory and Practice of Search Engine Optimization

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INTRODUCTION

The extensive range of information resources and services is certainly one of the most important features of the Internet while at the same time, web search is considered as a crucial application for managing the massive volumes of distributed web content. Beyond argument, search engines have made an enormous contribution to the web by making the process of finding information online a very quick and easy process. Today, major search engines are considered to be the most common and trusted tool or service to retrieve information from the Internet. Also, they are the primary method used for navigation for hundreds of millions of users worldwide and one of the most common online activities (Spink & Xu, 2000; Purcell, 2011; Purcell, Brenner, & Rainie, 2012). Studies have shown that a significant percentage of consumers turn to search engines first when shopping for products online or when information gathering really matters (Murga, 2017; Schwartz, 2018). The majority of Internet traffic depends largely on them and thus, web search is one of the best sources of traffic for any website (Safran, 2013; Giomelakis & Veglis, 2016; Brightedge, 2018). However, it is true that the vast majority of all search traffic comes from the first or the first pages of search results as users usually focus on the top ranks.

There are two ways an online user – customer will find a business website via a search engine: through a pay-per-click campaign (PPC) or through an organic result listing that is based essentially on what is called Search Engine Optimization or briefly, SEO. The latter can be defined as the process of affecting - improving the visibility of a website (or a web page) so that it ranks well for particular keywords in a search engine's "natural" or "organic" (un-paid) search results (Ledford, 2009; Potts, 2007). Generally, the earlier, and more frequently a site appears in the search engine results page, the more visitors it will receive from the search traffic. In other words, it is a set of techniques that take into account the evaluation criteria of search engines regarding website content and structure (Giomelakis & Veglis, 2015).

There have been plenty studies regarding online users' click behavior on search engine results pages. According to some results, about 90 percent of search engine users never read beyond the third page of search results while page two and three get only 5.59 percent of the clicks (iProspect, 2006; Petrescu, 2014). Also, the top listing in Google's organic search results receives 32.5 percent of the traffic, compared to 17.6 percent for the second and 11.4 percent for the third position (Chitika, 2013). Finally, websites listed on the first page in Google's results generate about 72 to 92 percent of all traffic from an average search (Chitika, 2013; Petrescu, 2014). From all the above, it is evident that if a website is not in the first search results page or even worse is absent from the top 30, it has almost no chance of being read by a user (Clay, 2006). As a consequence, and while more and more websites are indexed by search engines

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and compete one another to ensure their own market share, it is clear that factors as the highest ranking and top of the results page become increasingly essential for businesses of all kinds (Enge, Spencer, & Stricchiola, 2015; Giomelakis & Veglis, 2015).

This chapter provides an overview of Search Engine Optimization, with a focus on its different characteristics and practices as well its history and how it has evolved over the years. In order to give a better understanding of the importance of SEO in the current state of the Internet and in information search, basic knowledge of how search engines operate along with their recent updates are also provided.

BACKGROUND

Search engines are software that catalogs the World Wide Web and provides search using keywords into their vast databases containing full-text indexes of web pages. Users actually search this database of retrieved web pages, not the World Wide Web itself. As a consequence, they manage to take rapid results something that would be impossible if engines were trying to search billions of pages on the web in real time (Veglis, Pomportsis, & Avraam, 2004). When users click on search results they retrieve the current version of a web page. It is worth mentioning that search engines consist of three parts: the web crawler or spider, the indexer and also the query processor (Mudgil, Sharma, & Gupta, 2013). The crawler systematically browses the World Wide Web, looks at every URL (Uniform Resource Locator) collecting keywords and phrases on each page, which are then included in a massive database. The crawler is also responsible for keeping indexed pages up to date (Ledford, 2009). Search engines start with a set of very high quality sites and then visit the links on each page (of those sites) to discover other web pages. This complex process repeats over and over again until the crawling is complete. Through links, web crawlers (i.e. automated robots) can reach the many trillions of interconnected documents (Enge, Spencer, & Stricchiola, 2015).

Search engines use algorithms so as to find and collect information about web pages. Generally, a search algorithm can be characterized as a problem-solving procedure that takes the problem (i.e. the users' word or phrase), sifts through a vast database of cataloged keywords with their URLs, and then returns a listing of best-matching web pages according to the search criteria. Search results (i.e. page ranking) usually depend on the perceived quality-importance of the page (quality score - links from other sites) conforming to the algorithm that's being used as well as on relevance (relevant terms/links) and several other factors such as frequency of keywords, location, age or click-through rates (Ledford 2009; Enge, Spencer, & Stricchiola, 2015). It is worth mentioning that in the case of Google, the famous PageRank (one of its oldest algorithms) is a quality metric used in ranking (one out of many) that measures the importance of web pages by counting the number and quality of links to a page (Page, Sergey, Rajeev, & Winograd, 1998; Grappone & Couzin 2008). PageRank (PR) is a numerical measurement (0–10, the higher the better) and in the past it was one of the most important factors. Google has continuously improved the way it uses links to impact rankings (one reason is to deal with link spam), and its current algorithm is not based on PR as it was originally defined (Enge, Spencer, & Stricchiola, 2015). However, it still has some value in SEO (Grappone and Couzin 2008; Slegg 2013; Giomelakis & Veglis, 2016). Also, it is true that PR had become an obsession for many SEO workers worrying about their numbers and examining closely the quality of every new link. The last Pagerank update was in December 2013 and on April 15, 2016 the search engine has officially shut down the PageRank data to public (Southern, 2016; Schwartz 2016b). In brief, search algorithms can be classified into three broad categories: on-page algorithms that measure on-page factors looking at the elements of every page (e.g. keywords in

content or meta tags), whole-site algorithms that focus on the relationship of site elements (e.g. anchor text, linking between pages or architecture of pages) and finally, off-site algorithms that explore the links between the websites. All these three types are generally part of a larger algorithm (Ledford, 2009).

Search Engines have evolved dramatically over time and they constantly “crawl” the web to update their databases with new information. According to statistics, Google is the world’s most popular search engine having the vast majority (over 2/3) of the global search engine market followed by Yahoo, Bing and Baidu, China’s most popular search engine (Statcounter, 2019; Netmarketshare, 2019). In a com-Score survey (2015) data showed that Google sites led the U.S. explicit core search market with 64.5 percent market share, followed by Microsoft sites with 19.8 percent and Yahoo! sites with 12.8 percent. Among them, it should be noted that YouTube, a video search engine (acquired by Google in 2006 and it is integrated in its search results), is today the world’s 2nd largest search engine after Google. From a user and SEO perspective, videos can increase user dwell time on a page, they are considered highly shareable and many people turn to them when they search. According to Cisco company, videos will make up 80% of all online traffic by 2021 as people seek for more video content (Lunden, 2017; Dean, 2018a; Fishkin, 2018; An 2018; Ansley, 2019).

HISTORY OF SEO

SEO constitutes a part of Search Engine Marketing (SEM) and it is considered one of the leading and most influential activities in the field of online marketing, hence there is a wealth of information and tools designed to train and support the community (Potts, 2007; Nigro, Balduzzi, Cuesta, & Cisaro, 2012; Daniel, 2018). Historically, the actual phrase “Search Engine Optimization” was possibly first coined in 1997 by an unknown person. Search guru Danny Sullivan found for the first time the term used in May 1997 in a meta tag on his website, Search Engine Watch. However, it is quite possible that it was used before that. Sullivan acknowledges Bruce Clay as one of the first people in the industry to popularize the term (Sullivan, 2004; Dover, 2011).

SEO has always been associated with the influence of search engine results and its creation is rationally connected with the creation of the first search engines in the early-mid 90’s. Danny Dover describes (2011) that early SEO experts used to take advantage of alphabetical (“AAA”, “1ForU”) and chronological (submit websites at certain times) order to get to the top of rankings. Since then, things have changed considerably. Search engines improved using more complicated algorithms and at the same time, SEO became a more profitable business. Over time, site owners started to identify the worth of having their websites highly ranked and visible in online search results. They also noticed that the higher their website ranked, the more people would click on their content. From a simple URL submission initially and use of unsophisticated tactics, companies started to implement strategies such as keywords insertion, link building (process of obtaining hyperlinks from other websites), and recently social media utilization and multimedia content.

From the early days of search engines until today many SEO users have attempted to deceive search engines in order to artificially improve their visibility. That is usually called as “black-hat SEO” and pertains to the use of strategies or tactics (e.g. excessive use of keywords, hidden text or pages) that are used to get higher rankings in an unethical manner, doesn’t obey search engines guidelines for webmasters or involve deception. In general, it is a practice that violates the search engines’ terms of service and possibly results in a website being banned from a search engine and affiliate sites (Grappone & Couzin 2008; Ledford 2009). A remarkable example of penalizing was Google removal of BMW Germany

and Ricoh Germany for using misleading tactics in 2006 (Cutts, 2006). As stated, search engines have evolved tremendously in recent years and one of the most basic reasons that their algorithms are in a constant change is due to the need to address “Black Hat SEO” and provide the best possible results. Thus, they developed more complex ranking algorithms, considering additional factors that were more difficult for webmasters to manipulate.

SEO CHARACTERISTICS

There are definitely myths about search engines. For example, that attaining a top spot in the organic, natural results requires actually paying Google and other search sites. On the contrary, a high position in search results requires actually worthy content coupled with time, effort, and skill (Potts, 2007). SEO can be applied to many different websites to some degree and can target different types of search, including image - video search, local, voice, news or academic search (Beel, Gipp, & Wilde, 2010; Giomelakis & Veglis, 2016; Wikipedia, 2016; Sentance, 2016a, 2016b; Dean, 2018a; Ansley, 2019). Arguably, it is very closely connected to e-Commerce websites (Malaga, 2007). According to relevant studies, 89 percent of consumers turn to search engines to find information on products, services or businesses before making purchases and 36 percent turn to search engines first when shopping online (Fleishman-Hillard & Harris Interactive, 2012; Schwartz, 2018). Given that it takes into account how search engines work and the actual terms that people search for, there are several factors that affect SEO (Dean, 2018b) but unfortunately, there is no magic recipe for the first page and certainly no guaranteed results. By contrast, there is a variety of things to consider that in conjunction can bring good results. Some of them can directly affect SEO while others can have an indirect impact on search rank. Everything has its value and Google, Bing or other search engines use them to evaluate and rank web pages in their results. Although there are differences in the ways various search engines work, the basic rules remain similar and a well-planned SEO strategy can usually bring good results in all major search engines (Giomelakis & Veglis, 2015).

SEO strategies can be divided into four main categories: keyword research/selection, search engine indexing, on-page optimization and off-page optimization (Malaga, 2008). *On-page optimization* refers to the management of all factors related directly to someone’s website (content – appropriate keywords, architecture and internal link structure as well as html elements). More specifically, this category contains among others, page titles (or HTML titles tag that usually appear in search results), on-page headlines, description of web pages (or meta description tag) and URL’s. Using main, appropriate words/phrases that people often use in their searches in all the above elements is crucial to SEO. However, it should be noted that the use of keywords to a great extent in the actual content of a web page is by all means not a key requirement. In contrast, it is effective when this happens naturally without boring the readers. Besides, keyword stuffing (i.e. the practice of overloading a web page’s content with keywords) can bring unpleasant results to a website (Giomelakis & Veglis, 2015). Furthermore, as mobile devices become more prevalent in daily life, a good user experience across all devices (desktop, tablet or smartphone) has become a significant consideration in SEO strategy (mobile SEO). Google has updated its algorithm in this direction (it took the name “Mobilegeddon”) given that in many countries around the world including the US and Japan, more searches take place on mobile devices than on computers (Makino, Jung, & Phan, 2015; Dischler, 2015; Sullivan, 2015; Sterling, 2016a; Gevelber, 2016; Barysevich, 2018; Statista, 2019). It is worth mentioning that in March 2018, the company announced the mobile-first indexing prioritizing and using the mobile version of a page for indexing and ranking (Zhang, 2018).

Examples of SEO practices:

- 1) Page titles/headlines
 - World Cup 2014: Brazil humiliated by Germany 7-1 in semi-final / Novak Djokovic beats Roger Federer in epic Wimbledon 2014 men's final (SEO-Friendly)
 - Germany's triumph in the semi-final / Djoko did it again! (Non-SEO Friendly)
- 2) Url's
 - www.newsandseo.com/2014/seo-best-practices-for-structuring-urls.html (SEO-Friendly)
 - www.newsandseo.com/2014/how-to-create-seo-friendly-urls.html (SEO-Friendly)
 - www.newsandseo.com/2014/new/item.aspx?itemid=3051.html (Non-SEO Friendly)
 - www.newsandseo.com/2014/forum/viewtopic/m-159327.html (Non-SEO Friendly)
- 3) Different titles/headlines

This practice is used by several news organizations (e.g. BBC News, Guardian, Huffington Post or New York Times) and the most common is the different headlines between home page or other Web site indexes and the story page itself (see figure 1). The latter that appears in search results, is usually more specific including more keywords for the topic.

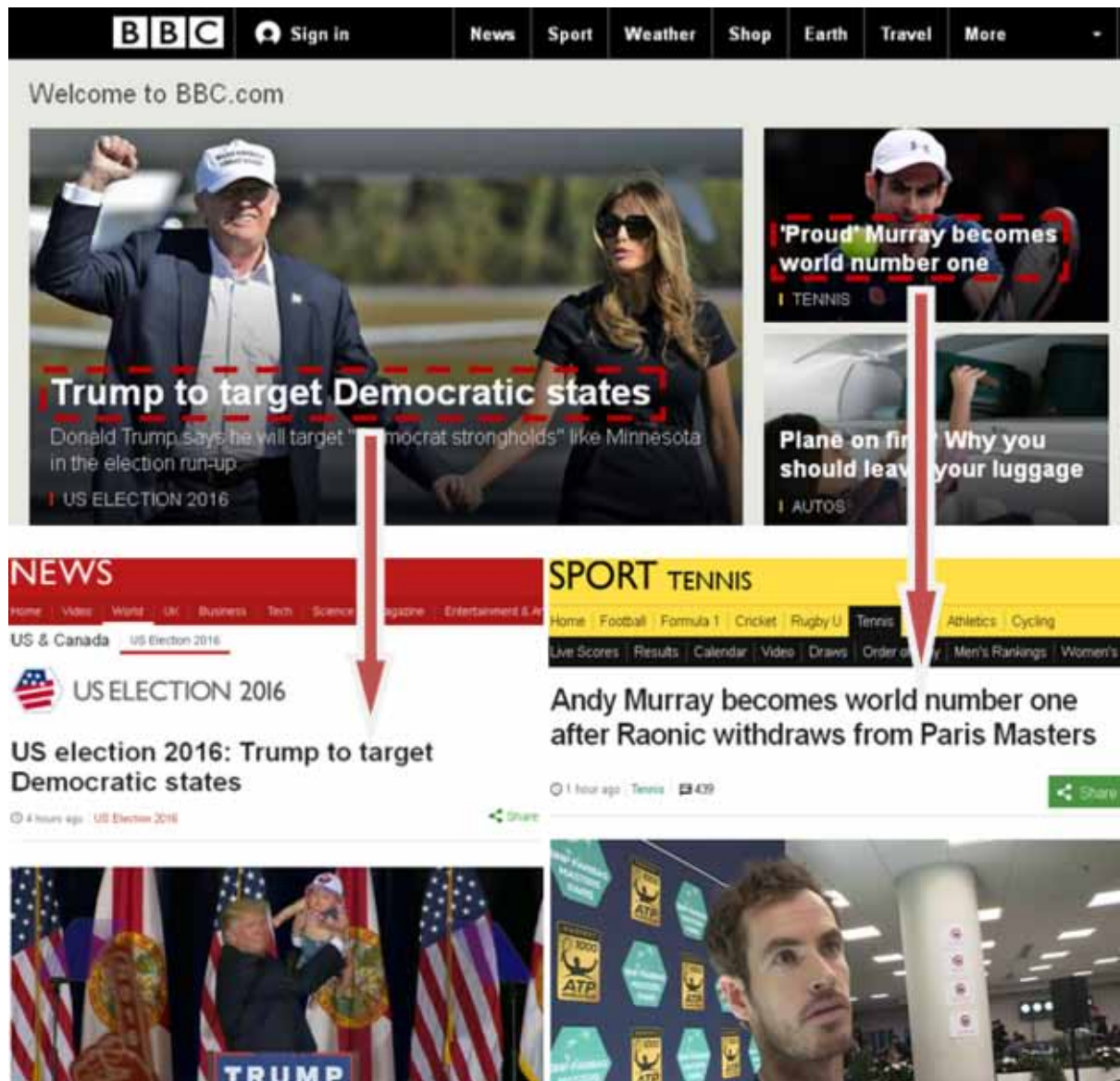
Regarding *off-page optimization*, it includes all the efforts made away from someone's website like link building or social signal strategy. Links from other websites (called backlinks or inbound links) have great importance, serve as votes for the value and are a basic requirement for a web page to be found both from search engines and online searchers (Dean, 2016). In addition, it is highly important for inbound links to be qualitative, coming from well-known, trusted websites in order to give much more value and better evaluation. There are many different ways to gain inbound links such as articles/domain submission to directories (e.g. Dmoz), forum, blogs, and news aggregators as well as building relationships and links exchange with other websites. It is true that for a website with quality content, it is usually a matter of time until it gains many natural and qualitative backlinks. However, not only inbound links but also external links that lead to other relevant web pages (preferably credible and high-ranking sites) can contribute positively especially if a website is new (Giomelakis & Veglis, 2015).

SEO, DEVELOPMENT AND GOOGLE UPDATES

The development of the World Wide Web (Web 2.0) over the last decade has affected and brought significant changes in web content such as user-generated content and social web. Furthermore, search technology itself evolved over the last years with the growth of contemporary search engines something that has arguably affected SEO. For example, Google now provides different types of search results (e.g. the knowledge Graph next to the search results) or featured snippets. Featured snippets are the quick, direct answers at the top of the search results page (position zero) and a special way that Google shows off results in response to some search queries. They can come in different forms (e.g. a paragraph, a list or a table) and have a major impact on the search world (Sullivan, 2018; Schwartz, 2018). According to a recent study on clickstream, 49% of all Google searches end without a click (Fishkin, 2019). In this context, voice search looks like a fast-rising trend in search and SEO industry given that a significant percentage of all searches on mobile come from voice searches. The numbers are only expected to grow and thus, experts have already started to optimize their content for voice searching (Huffman, 2014; Sterling, 2016b; Sentance, 2016a, 2016b; Dean, 2018a; Ansley, 2019).

Nowadays, the optimization for search engines is not anymore only about link-building and keywords. Social media and social signals (such as Facebook Shares/likes) have increasingly become one of the

Figure 1. The dual headline system in BBC news



many factors search engines take seriously into account (Searchmetrics, 2013; Peters, 2013). In order to enhance their perfect reach, many search engines incorporate information from Web 2.0 services into their searchable indexes (Zimmer, 2008). For instance, active Facebook profile pages have many ranking possibilities for branded, subject-based and personal name-based queries at Google results. Also, due to Twitter's domain authority, its profile pages also rank highly for relevant searches. Results from Twitter can be used for queries where real-time data are helpful (Dover, 2011). Social signals, in general, have a positive impact on websites and are considered as the new link building metric as search engines increasingly search for social signals to help the ranking of pages (Rayson, 2013; Frasco, 2013). The more referrals someone has across the web, the more search engine spiders notice and categorize their content (Ehrlich, 2013). Social media and SEO do overlap, and the former can contribute to the total organic success of websites in several ways (Pascale, 2014).

Search engine algorithms have gone through many changes over the last decade having a great impact on SEO industry. Recent changes especially in Google have added more value to quality as well as content marketing that many experts have called it as the new SEO (DeMers, 2013). For example, the change of Panda algorithm (February 2011) was made in order to eliminate low-quality websites in favor of those with frequently updated, in-depth content. In the same vein, Google Penguin (first launched in April 2012 and since 2016 it is part of Google's core algorithm) was the response to "Black-hat" SEO and web spam and also Hummingbird (late 2013) added the contextual search, a way to interpret content by looking at the relationship between terms (Rampton & DeMers, 2014; Barysevich, 2018; Donnelly, 2019). The new age of search will be run by mobile. In this context, Google's mobile-friendly update in April 2015 was released in order to give priority to websites that display well on smartphones and mobile devices in general (Makino, Jung, & Phan, 2015; Barysevich, 2018). A few months later, on 26 October 2015 Google confirmed the use of RankBrain, a machine-learning artificial intelligence (AI) system and actually part of the overall Google's Hummingbird search algorithm. The system was created in order to learn from real user searches - behaviors and also to help the process and the interpretation of search queries by providing more accurate results for users. Along with links and content, RankBrain is considered today one of the top three ranking signals (Clark, 2015; Sullivan, 2016; Schwartz, 2016a; Ansley, 2019). Likewise, Bing launched in 2017 new intelligent search features powered by AI (Bing, 2017). Finally, Google's Pigeon (July 2014) and Possum updates (September 2016) were both made to improve the quality of local search results (considering the physical location of the searcher) and Google Fred was another recent update (March 2017) with purpose to down-rank websites that prioritize aggressive monetization over user experience (Barysevich, 2018; Donnelly, 2019). As regards local results, a strong local SEO strategy is crucial for reaching more customers given that 80% of consumers use local searches to find a product or service and 50% of them perform a local search and visit a store the same day (Kolowich, 2016; Drolet, 2017).

The world of SEO is constantly evolving and thus, SEO workers have to be always up to date on new developments and also utilize useful tools and services for their work. Tools such as Google Analytics (the most widely known web analytics package), Google PageSpeed Insights (analyzes the performance of a web page on both mobile and desktop devices providing optimization suggestions and information on how to improve the load time), Google Search Console (previously Google Webmaster Tools that enable webmasters to monitor and maintain their presence in search results), Google Trends (a tool to identify "hot" topics), SEMrush, Ahrefs tools, Ubersuggest or finally Moz tools are among others, very popular in SEO industry. It is crucial to understand that SEO is not only about engines but also making someone's website (and its content) user-friendly and better for people. The content is still the most important thing for any website and this has to be reliable and interesting. Even search engines look now for unique, qualitative and useful content that will satisfy and motivate readers to share it through social networks, blog posts or forums. In spite of how good is SEO, it is not likely for any website with useless content to get ranked well in the long term because no one is ever going to visit or look for it. Besides, Google and other search engines got much smarter and can distinguish between content with real value and content that exists only for SEO purposes.

FUTURE RESEARCH DIRECTIONS

Beyond argument, there are several important aspects in this field that require further study. For instance, the increasing involvement of social media in SEO strategy is an area of research that has to be studied

more in order to better clarify the relation between them. And that's because there is a strong indication that social networks and social media, in general, will continue to increase their significance and presence in the internet population. It is true that web search is increasingly becoming more personalized and user influenced. For many years, SEO and search results were all about keywords and link building. Nowadays, things are changed, the search results are arguably better and the search experience is much more advanced. SEO experts need to take the audience, their interests, user experience or what device they are using more into account when developing their strategies. All the above are issues that deserve more careful attention in future research because these are elements intimately related with search engines. In this context and as the web ecosystem evolves, the so-called mobile, local or vertical search-SEO has grown considerably gaining significant attention from field experts. Today, the mobile landscape has evolved to such an extent that it has become a completely unique (mobile-first) search environment. All these new types of SEO along with the opportunities they offer in online industry are areas that need to be addressed in future studies.

CONCLUSIONS

Undeniably, search engines have come a long way since their appearance in the early 90's. In this context, SEO grew out of the development of search engines and the World Wide Web. As the years pass, there is no question that search engines will continue to evolve their algorithms and make improvements in their ability to crawl and index new types of content such as multimedia, voice search or data coming from social media. In this vein, SEO practitioners will constantly deal with new ways of searching, new types of searches as well as new devices to search on and their role in a user's experience. Over time, there have been fundamental shifts in the SEO landscape and field experts see a shift away from traditional ranking factors to deeper analysis and factors such as quality, multi-form content, social signals and user experience in general (DeMers, 2013; Dean, 2018a; Ansley, 2019).

SEO has come a long way from the days of metadata, but even though the search arena has seen a lot of innovations from AI to voice, the core concept is still the same and factors such as links, quality content and website speed remain as strong and significant as ever forming the foundation of any SEO strategy. Undeniably, high-quality, useful content as well as optimal website speed (page load time is already a ranking factor) encourages people to spend more time on a site and this, in turn help improving SERP rankings as well as conversion rate (Dean, 2016; Wang & Phan, 2018; Ansley, 2019). It might be thought that SEO will always have a place in a web strategy as long as Google and other search engines continue to drive a great amount of traffic on the Internet. The tactics involved in optimization may change, but the need will always remain. It is evident that every business that has a web presence (or wants to get clients from the web) would be wise to think about a SEO strategy as well as the potential it creates in order to increase or maintain its position within the search results. Implementing SEO into a website is becoming more and more necessary in today's digitalized world. Given that people will always be on a quest for information, and given the marketing imperative to get your information seen and keep ahead of the competition, companies will continue to figure out ways to use SEO-related techniques for higher rankings. The good use of SEO certainly does not guarantee high traffic and top rank. Nevertheless, an effective strategy can play its role by helping companies to obtain the best results and take advantage of the benefits provided through the utilization of search engines and web search in general.

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KEY TERMS AND DEFINITIONS

Click-Through Rate (CTR): The ratio of users who click on a specific link compared to the number of total users who view an email, a web page or an advertisement. It is used to measure the success of an advertisement campaign. For example, if an advertisement had 10 clicks and 1000 impressions (number of times it was served), the CTR would be 10% (clicks / impressions x 100).

Local SEO: The optimization process that focuses on results that are relevant to a user based on its current location.

Organic Results: Also called «natural» or un-paid. The results that appear because of their relevance to the search terms.

Social Signals: A kind of recommendations through social media. Social signals are the Facebook shares or likes, the tweets, Google +1s, pins or some other way of social media bookmarking or sharing.

User-Generated Content (UGC): Any form of digital content such as images, video, status updates or blogs that is produced and shared by users of an online service or website, often made available via social media websites.

Vertical Search: The search accessibility of specific segments and formats of online content. Vertical search services focus on specific topics such as news, restaurants, or products. Google provides also vertical search such as Google news or Google images.

Techniques for Developing Mobile-Friendly Web Sites

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INTRODUCTION

This article describes the three most popular techniques for developing mobile-friendly websites. Such sites are designed to accommodate the physical limitations of mobile devices. These limitations include small displays, touch screens, low bandwidth, and high latency. To accommodate these limitations mobile-friendly websites format pages for vertical scrolling, provide larger touch targets such as buttons and links, minimize the amount of data that must be downloaded, may display less information than sites designed for desktops, and utilize space saving navigation techniques. The objectives of this article are to describe the attributes of mobile friendly websites and overview the most popular methods for developing them.

BACKGROUND

The growing use of mobile devices for e-commerce, product research, news, social media, and web search has created a need for mobile-friendly websites. In the early 2000's the majority of web traffic was from desktop devices and most websites were designed to be used with full-size monitors, keyboards, and mice. The introduction of the iPhone 2007 was the beginning of a rapid shift to mobile devices (Ebner, Stickel & Kolbitsch, 2010). By early 2013 users were spending more time online with mobile devices than with desktop devices (Marshall, 2015). Google reported in May 2015 that searches from mobile devices exceeded those from desktop devices in 10 countries, including the US and Japan (Dischler, 2015). By January 2018 mobile internet accounted for 52% of total worldwide web page views (Statista, 2019). With mobile devices accounting for over half of the world's web traffic it is important that websites be mobile friendly.

Researchers have found that the usability of mobile sites has a significant influence on user perceptions, user satisfaction, and trust (Casalo, Flavián & Guinalú, 2008; Lee, Moon, Kim & Mun, 2015). Mobile usability has also been found to have a strong influence on the buying behavior of consumers (Hsu, Perng, Chiou & Ou, 2014).

PHYSICAL LIMITATIONS OF MOBILE DEVICES

In this article the term mobile device is used to refer to smart phones and tablets. Desktop device refers to desktop computer and laptops. The two types of devices differ primarily by screen size and input methods. Mobile devices typically have smaller screens than desktop computers and cannot display as much information. Web designers can accommodate smaller screens by arranging content in screen-width columns that can be conveniently viewed with vertical scrolling. Mobile-friendly sites frequently display

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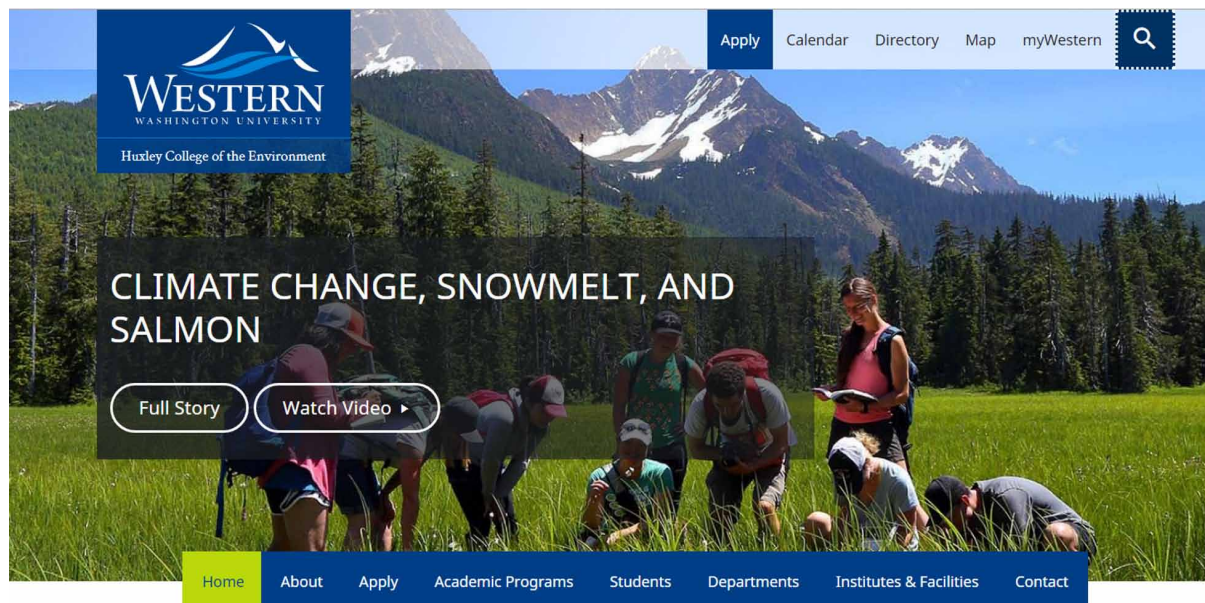
less information, smaller images, and use more space efficient navigation. For instance, navigation options that are fully visible on a desktop computer may be put into a “hamburger menu” which the user may then expand to display navigation options (Moyers, 2018).

Mobile devices also use touch screens for user input rather than keyboards and mice. Touch screens require that tap targets, such as hyperlinks, buttons and forms, be large enough that a user can tap it with a finger. They must also have enough space around them so that users can tap individual items without accidentally selecting other tap targets (Brooks, 2017).

Figures 1 and 2 compare the same web page (<https://huxley.wvu.edu/>) in desktop and mobile formats. The desktop format (Figure 1) displays a large image with navigation menus both above and below the image. The five navigation options in the top menu and eight options in the bottom menu are all visible. The page content (not visible) uses both two and three column layouts.

Figure 2 displays the same page formatted in a mobile-friendly layout for an iPhone 8. The screen of this device is only 375px wide versus approximately 1500px for the desktop site. The two navigation menus have been replaced with a hamburger menu in the top right-hand corner. When the hamburger menu is tapped it opens to fill the screen and displays all of the navigation options. The large image is reduced slightly in size and only about 30% if it is displayed on the mobile device. The page content (not visible) is displayed in a single column that is approximately 11 screens tall. On this particular page the mobile layout displays the same content as the desktop layout but it is common to display less content in mobile layouts.

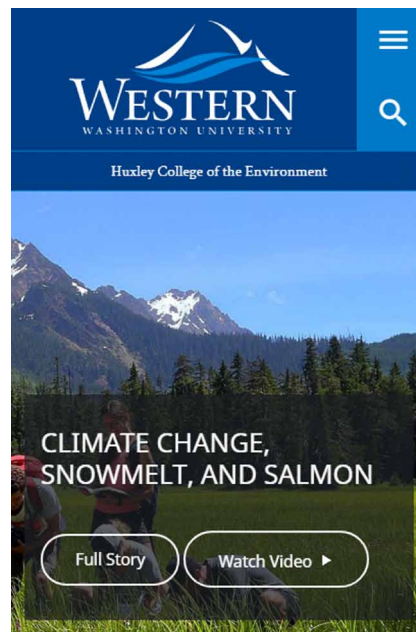
Figure 1. Example of desktop layout



OUR DIFFERENCE

Since 1969, WWU's Huxley College of the Environment has enjoyed a reputation as a premier institution for the education

Figure 2. Example of a mobile layout



OUR DIFFERENCE

Mobile devices have additional limitations besides small touch screens. Mobile data speeds are typically much slower than those of desktop computers connected to a broadband network. For mobile devices average download speed in the US during the first six months of 2018 was 27 Mbps (Megabits per second) (Murnane, 2018). In contrast, the average download speed in the US for broadband networks was 96 Mbps. Everything else being equal, the lower bandwidth of mobile networks causes download times to be more than three times greater than those of broadband networks (Speedtest, 2018).

Mobile networks also have greater network latency. This is the time it takes for a server to send a packet of data to a client. The greater the latency the longer it takes a web page to load. Web designers can minimize the negative impact of latency by minimizing the number of resources that must be downloaded to render a web page.

TECHNIQUES FOR DEVELOPING MOBILE-FRIENDLY WEB INTERFACES

The physical limitations of mobile devices can be mitigated by using design techniques that accommodate the small screens, slow download speeds, and touch screens that characterize these devices. Currently there are three popular mobile-friendly design techniques: responsive, dynamic serving, and separate URL. These techniques go by a variety of names so this paper will use the naming conventions used in the Google Developer's Guide (2019). All three techniques are utilized by major websites and have distinctive advantages and disadvantages that are discussed later in this article.

Responsive Technique

The responsive design technique sends the same content to both desktop and mobile devices. It then employs CSS (cascading style sheet) media queries to adapt the content and layout to the physical attributes of the device. CSS media queries are executed by the client's web browser when the page is being rendered.

Media queries can check for device attributes such as screen height and width and allow the conditional application of formatting styles. Figure 3 illustrates the use of media queries to switch between a two-column layout and a one-column layout depending upon the width of the screen. Lines 2-5 of the example defines a class named “column” that is 50% the width of the screen and floats to the left. This style creates a two column layout. Lines 8-12 use a media query to modify the “column” class for small screens. When the screen size is 600px or less it redefines the column class to be 100% the width of the screen. The right column is then displayed below the left column creating a tall single-column layout.

Figure 3. Media query conditional layouts

```

1  /* two columns that float next to each other */
2  .column {
3      float: left;
4      width: 50%;
5  }
6
7  /* One column for screens 600px wide or less */
8  @media screen and (max-width: 600px) {
9      .column {
10         width: 100%;
11     }
12 }
13

```

The responsive design technique has several advantages versus the other two popular techniques discussed in this article. Responsive designs are relatively easy to implement and maintain (Nebeling& Norrie, 2013). Greatly simplifying the implementation of the responsive technique are a number of open-source CSS frameworks that provide pre-defined formatting styles. Web developers then apply the styles to control layout and provide mobile-friendly layouts. These frameworks are referred to as “grid frameworks” because they provide styles for a fixed-number of pre-defined columns, typically between 9 and 16. Web designers then select the number of columns needed to achieve the desired layout.

There are dozens of free open-source grid frameworks available. They differ primarily on the number of features provided. Smaller frameworks such as Milligram, GRD, and Skeleton provide grid layout features but little else. The advantage of these “light” frameworks is that they require smaller CSS files, download more quickly, and load more quickly in the web browser. Larger full-featured frameworks such as Twitter Bootstrap provide not only a grid framework but styles for forms, fonts, color themes, responsive navigation features, and jQuery plugins. The downside of using a full-featured framework is

that the CSS and JavaScript files can be relatively large. Twitter Bootstrap is currently the most popular CSS framework (Saring, 2018)

Media queries are a relatively new addition to the tools available for developing mobile friendly websites. They were added to the CSS3 specifications in 2012 but it then took several years for web browsers to fully implement them. Early adopters of media queries had to accept that a substantial percentage of their users would not have a good mobile experience. However by 2019 browser support for media queries is almost universal. As of March 2019 CSS media queries were supported by the web browsers being utilized by 98.2% of global users (CanIUse, 2019).

Dynamic Serving Technique

The dynamic serving technique sends different content to different devices. The advantage of this technique is that content can be customized to the strengths and limitations of the requesting device. For instance, the content sent to a mobile device may include smaller images, layout appropriate for a small screen, larger tap targets, less content, and mobile-friendly navigation. In contrast the content sent to a desktop computer may include richer content, more navigation options, multi-column layout, and larger images.

The disadvantage of the dynamic serving technique is that the server must accurately determine the type of device so that it can serve appropriate content. The server identifies the device by examining information which is included with each request. The World Wide Web Consortium (W3C) standards for HTTP (hypertext transfer protocol) requests include information on the user's browser, or the user-agent. From information included in the user-agent string the server can determine what type of device sent the request. For example, the following user-agent string is for a Chrome browser running on a Samsung Galaxy S5 mobile phone:

User-Agent: Mozilla/5.0 (Linux; Android 5.0; SM-G900P Build/LRX21T) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/73.0.3683.103 Mobile Safari/537.36

Determining device attributes from the information contained in the user-agent sting can be challenging and error prone. For instance, the user-agent above starts with the word "Mozilla/5.0" which is a term that dates back to the early days of the Internet and the Netscape browser. It also includes the terms AppleWebKit, Chrome, and Mobile Safari. Of the four identifiers only Chrome/73..." identifies the browser being used. An article by Nicholas Zakas titled "History of user-agent sniffing" (Zakas, 2010) concludes:

The history of the user-agent string is marked by browsers trying to convince user-agent sniffers that they are what they are not. Internet Explorer wants to be identified as Netscape 4; Konqueror and WebKit want to be identified as Firefox; Chrome wants to be identified as Safari. This can make user-agent sniffing a bit more difficult...

Once the server has identified the type of browser the next step is to determine the device and its capabilities. The user-agent string usually provides limited information about the device. In the example above the identifier "SM-G900P" can be used to determine that the request was sent from a Samsung Galaxy S5 phone. The server can use this information to lookup the screen size and other physical attributes of the phone and use this information to dynamically generate appropriate content. However there are thousands of phone models in use worldwide and new models are frequently being released. It can be challenging and time consuming for website owners to maintain lookup tables for all of the

devices being used worldwide. So while the dynamic serving technique can provide content optimized to the device it can be a challenge to accurately identify the device and its capabilities.

Separate URL Technique

The separate URL technique utilizes two or more separate websites, with each site optimized for devices with different attributes. This technique is also referred to as m-dot, since the URL of the mobile optimized sites often use “m.” rather than “www.” for the third-level domain name. The advantage of this approach is that content can be optimized for the capabilities of each device, similar to the dynamic serving technique.

This approach has a few disadvantages. One is that like the dynamic serving approach the server must examine the user-agent to determine what type of device sent the request. Once the requesting device is identified the server redirects the user’s request to the appropriate website. As discussed in the previous section, correctly identifying the device and determining its capabilities is challenging and error prone.

Another disadvantage of the approach is that the redirecting the user’s request to a different site requires a round-trip back to the requesting device which slows page load time. Another disadvantage is the cost of maintaining two or more websites.

Other Mobilization Techniques

In addition to the three primary mobilization technique described above there are a few other techniques which can be quite effective. For instance, the responsive technique may be combined with the server adaptive technique in a technique called RESS, responsive web design with server-side components. As its name suggests it uses the responsive technique combined with the dynamic serving technique to send device-appropriate content, such as smaller images (Hogan, 2014; Firtman, 2016). This technique enjoys much of the simplicity of the responsive technique while also allowing for server optimization of assets such as images (Yousaf, Butt, Azam, & Anwar, 2018).

Another hybrid technique, JavaScript adaptive, uses JavaScript on the client device to identify device capabilities. It then makes requests to the server for device appropriate resources. It is similar to the server adaptive technique except it adapts the content on the client instead of on the server. This approach also eliminates the need to correctly identify the device based upon the user agent. The JavaScript adaptive technique may be implemented through open source frameworks such as Mobify.js (GitHub 2019a) and Response.js (GitHub 2019b).

A more recent technique that is being promoted by Google is accelerated mobile page (AMP). AMP is set of design rules that can significantly reduce page download times. It is an implementation of the separate URL technique where the mobile site implements AMP design standards. AMP standards prohibits the use of page-slowng assets such as external styles sheets and JavaScript. It requires the use of AMP JavaScript to optimize page load times. Sites that employ all of the AMP design standards are rewarded by Google search with higher search rankings and free caching by Google’s global network of AMP cache servers. AMP pages are also identified in Google’s mobile search results with the outline of a lightning-bolt inside a gray circle. The AMP standard was introduced in 2016 and by early 2019 it was being used by over 31 million domains (Jones, 2019).

Given the advantages and disadvantage of various mobilization techniques it is challenging for website owners and managers to decide which approach is most appropriate for their needs. The next section

addresses the trade-offs for the different approaches and provides guidelines for selecting a mobilization technique.

SOLUTIONS AND RECOMMENDATIONS

Selecting the most appropriate mobilization technique for a particular website depends on a number of factors. These factors include budget, available technical expertise, existing site design, and the needs of site users. The responsive technique is relatively inexpensive to implement and maintain but, unlike the adaptive and separate URL approaches, it does not optimize images and other assets to the device.

The server adaptive and separate URL approaches require more technical expertise to implement and maintain than the response technique but can provide a better user experience (Yousaf, Arshad, Nouman & Arshad, 2018). Both techniques depend upon interpreting the cryptic information provided in the user-agent string to determine device capabilities. Sites which are able and willing to invest in technical expertise are able to translate this information with a high degree of accuracy. These techniques also require tools on the server to modify the content sent to the client. With the adaptive approach this is achieved with server-side programming tools such as PHP, Python, or ASP.NET.

The responsive technique is a popular choice for many sites due to its low development and maintenance cost. Google recommends this technique for most sites while also acknowledging its limitations (Google Developer's Guide, 2018). However for sites where it is imperative to provide an optimized mobile experience the server adaptive may be a good choice. For instance, the pages that display Google's search results generate a significant fraction of the company's revenue and almost 60% of search requests originate from a mobile devices (Sterling, 2016). So while Google recommends responsive for most websites its own site uses server adaptive for displaying search results.

The choice of mobilization technique is complicated by the rapid evolution of both web and mobile technologies. Google's AMP standard illustrates this rapid evolution. The AMP standard was introduced in 2016 and by early 2019 it was being used by over 31 million domains. In addition mobile devices and mobile networks are also becoming faster and more capable. Mobile devices are trending toward larger screens and each generation of mobile device has more processing power. The current generation of 4G mobile networks are approximately six times faster than 3G networks and 5G networks are expected to be significantly faster (Ilumda, 2019). The changing mobile landscape has implications for mobile web development. As phones and networks become faster the importance of optimizing sites for fast download speeds may become less important. Conversely as mobile users become accustomed to faster page load times they may become less tolerant of sites that do not load almost instantly. Website designers need to be attentive to such trends.

One approach to deciding upon a mobilization technique is to examine which techniques other sites are using. A study by Sandvig (2016) of 527 leading global e-commerce sites found that the separate URL technique was the most popular used by 44.1% of sites, followed by server adaptive utilized by 23.8% of sites, and responsive utilized by 23.0% of sites.

A 2015 survey by Pure Oxygen Lab of 500 e-commerce sites found results similar to the Sandvig study. It found that the separate URL technique was the most popular, utilized by 59% of sites in 2014. Server adaptive was the second most popular at 15%, and responsive the third most popular at 9%. This study also examined trends in technique utilization. It found that between 2013 and 2014 use of separate URL utilization declined by 20% while server adaptive increased from 12% to 15%. Use of the responsive

technique almost tripled from 3% to 9% (Klais, 2015). So while in 2014 the separate URL approach was by far the most popular technique for e-commerce sites its usage was declining rapidly.

A longitudinal study of 37 academic library sites found that in 2015 73% were using the responsive technique, up from 32% in 2013 (Comeaux, 2017). Given that most university library websites have smaller budgets than sites like Google and Amazon it is not surprising that they favor the relatively low cost of the responsive technique.

Overall there is little rigorous academic research on the use of mobile development techniques. A recent article on mobile usability by Hoehle and Venkatesh (2015) observes many gaps in mobile usability research. These gaps include a lack of rigorously developed survey instruments, a lack of context-specific instruments for holistically measuring mobile usability, and few performance attributes measured in isolation. These shortcomings in the literature provide a poor understanding of the antecedents for mobile application usability.

The decision on which mobilization technique to utilize is complex and there are no definitive guidelines that can be applied to specific situations. For websites with limited development and maintenance budgets Google's recommendation of using the responsive technique is likely a good choice. For high traffic sites such as the large e-commerce sites surveyed by Sandvig and Pure Oxygen Labs it may be worth investing in a technique that provides a more optimized mobile experience.

FUTURE RESEARCH DIRECTIONS

The trend toward greater utilization of mobile devices is likely to continue and provides a myriad of possibilities for mobile usability research. This article has discussed a number of techniques for developing mobile-friendly websites and explored the limited research available on website mobilization techniques. Given the importance of the topic there has been very little empirical research on the utilization or performance of different mobilization techniques. Site managers and web users would both benefit from a more robust research agenda on the topic of website mobilization. A few future directions for research on the topic include:

Usage: Managers must make expensive long-term decisions on which mobile design technique(s) to employ but have only limited information on which techniques are currently employed. Additional research on technique usage, trends, and costs would help them make more informed decisions.

Performance: There is little research that provides rigorous analysis of the performance of mobilization techniques with respect to usability, reliability, and page rendering times. Techniques that adapt content on the server are usually going to be faster but there are few if any rigorous head-to-head comparisons.

Cost: Managers must weigh site performance to the cost of development and maintenance. For many non-profits and organizations with limited budgets the responsive technique is the obvious choice because of its relatively low development and maintenance costs. However for organizations where mobile web is an integral part of their business, such as many on-line retail sites, the decisions are more complicated. Managers of such sites would benefit from research exploring the cost-performance tradeoffs.

Trends: The rapid evolution of mobile devices, mobile networks, user expectations, and development technologies create a moving target for managers. Predicting technology trends is challenging

but managers who are making major investments in mobile web technologies would benefit from skillful projections made by well-informed experts.

CONCLUSION

This article has covered the three most popular web mobilization techniques: responsive, dynamic serving, and separate URL. It has also discussed hybrid techniques, such as combinations of responsive and dynamic serving, and Google's APM standards. In selecting a technique managers must examine the trade-offs between performance and the cost of development and maintenance. Despite the importance of the topic to managers of many types of organizations there is a surprising lack of rigorous research to guide their decision making.

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KEY TERMS AND DEFINITIONS

Cascading Style Sheets (CSS): A standardized scripting language used for styling web content. CSS is interpreted by the client's web browser. Web designers use it to specify web page layout, colors, fonts, backgrounds, spacing, and other stylistic features. The most recent standard, CSS 3, includes a feature called media queries which allow web designers to specify styles for specific device characteristics such as screen height and width, orientation (vertical or horizontal), and resolution. Web designers can use media queries to apply different layouts and styles based upon device characteristics.

Client-Server Network: The internet is network of connected client and server computers. Clients are the devices used by web users to make web requests. Client devices include desktop and laptop computers, tablets, and mobile devices such as phones. Web clients also include smart devices such as security cameras, appliances, lighting systems, and HVAC (heating, ventilation, and air conditioning) systems. Servers are computers that respond to web requests. They are typically identified by unique domain names, such as Google.com or Amazon.com.

HTML: Hypertext markup language is a scripting language that describes page content to web browsers. It is used to create navigation elements, paragraphs, display images, create hyperlinks, and form elements such as textboxes and buttons. It is styled using CSS (cascading style sheets).

JavaScript: A programming language that is executed by web browsers. Web developers can use it to identify device attributes, change page layout and styling, make web requests for images and cascading style sheets, and create responsive navigation. It is the only programming language used by all web browsers.

World Wide Web Consortium (W3C): The primary standards organization for the world wide web. It consists of over 475 members, including businesses, universities, governmental entities, and nonprofit organizations. Its members propose and adopt standards for browsers, HTML, CSS, web requests, web responses, security, and many other essential features that provide interoperability across devices on the internet.

Internet Banking Encounter Quality of Arab Middle East Banks: Organizational Determinants

8

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INTRODUCTION

Online banking services was first provided in the early 1980 by Bank of Scotland and the Nottingham Building Society. Nonetheless, these services were discontinued because it was not widely accepted by the bank's customers. In the early on 1990, the banks start again adopting internet-banking services with the rapid growth of electronic services and information technology (Tait & Davis, 1989). Internet banking is a virtual banking service as online depositing, withdrawal and transfer of cash (Santos, 2003). Nowadays, online banking services have become an attractive and desirable alternative to the growing number of customers because they offer many benefits, such as low cost, save time, and easy to use. The essential success for service providers is expanding and retaining their e-customers and can do this by better understanding how customers can handle and evaluate the quality of the online banking service encounter (Mauro, Hernandez & Afonso, 2007).

The Middle East region will have extraordinary advantages from the e-banking services, particularly with high demand and development in the banking industry. So banks have begun to grow their branch systems and provide a wide range of service delivery channels, for example, call centres, internet banking, mobile banking, and ATMs. The rapid expansion of online banking services is most remarkable in the developed countries where the availability of smart phones and computers with simple access to internet enables adaptation of online banking easier for banks. Despite the fact that, this adoption still faces some limitations, efficient banks that located in urban areas are more likely to adopt online banking services (Jenkins, 2007).

The recent research by McKinsey on urban consumers in UAE and KSA (primarily focusing on internet users - UAE currently has 92 percent internet penetration while KSA has 65 percent) shows that at least 80 percent of these consumers now prefer to do at least some of their banking on computers, smartphones and tablets, and visit branches and call service hotlines only to meet specific and more complex needs. Despite the growing of e-channels in the Arab Middle East region, the physical channels – branches and ATMs – will continue to play major roles in banking across the region. Banks will have to balance regulatory demands and consumers' needs for a physical presence against the cost, reach and convenience advantages of digital services (Shirish, Jayantilal & Haimari, 2016). Therefore, there is a need to understand the quality of service encounter dimensions and examining determinants that affect the internet banking adoption to better satisfy the customers wants. This study investigated the

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organizational determinants that could influence the bank's quality, for example, the impact of ownership structure (local or foreign), age of bank, size of bank determined by number of employees, the global presence and on the quality of bank website.

This study was conducted to accomplish the following objectives:

- 1- Reporting the quality of internet banking services encounter in the Arab Middle East region.
- 2- Identifying impact of bank ownership, size, age and global presence on the internet banking service encounter quality across countries in the Arab Middle East region.

This chapter was issued in the following sections; the first section discussed the research problem and contribution, followed by the research framework, the research methodology adopted, then, the findings and results were presented, next, these findings were discussed in the discussion section, followed by the implications and future researches, and finally a conclusion section summarize the main findings and contributions of this chapter.

RESEARCH PROBLEM AND CONTRIBUTION

During the last decade, electronic service quality has become a popular area of investigation by both researchers and practitioners. E-service quality can potentially increase online competitive advantages; therefore, it has a great effect in determining the success or failure of electronic services. Service quality, which is usually measured by how the service was received and matched customer expectations. Accordingly, researchers developed multidimensional service quality evaluation tool known as SERVQUAL (Santos, 2003). Banking websites have been evaluated from various perspectives using many criteria. Some researchers have proposed a model to assess the quality from the users viewpoint, while other researchers have proposed a specific framework model for website evaluation such as Diniz's model or Herey's model (Hasan & Abuelrub, 2008).

The service encounter is the interaction point between the service provider and customer, it is a virtual encounter in the context of e-banking in general and internet banking in particular, the proper design of this encounter is crucial element for the success of e-banking, since e-banking is a self service depends on the personal customer interaction with the system, accordingly, the banks should concern about developing the design of this encounter in order to give the customer more positive service experience. However, the service encounter design could be affected by many factors, internally and externally, for example, the customers (users) characteristics, type of service, the number of service routes, the organizational factors as the size of organization, the global presence...etc.

The most of previous studies of e-banking and internet banking in particular have investigated the degree of customer acceptance to adopt of the internet banking (e.g. Afshan, Sharif, Waseem & Frooghi, 2018; Safeena, Kammani, & Date, 2018; Khedmatgozar & Shahnazi, 2018; Yuan, Lai & Chu, 2018), also the perceived quality of internet banking service from the customers view point has been widely investigated (e.g. Ray, Ghosh, & Sen, 2017; Ray, 2017), and the impact of quality of e-banking on customers satisfaction (e.g. Ali & Raza, 2017; Firdous & Farooqi, 2017). Examining the determinants will help the decision makers in controlling or improving these determinants. The determinants examined by previous studies were mainly personal customer's determinants or user determinants for adopting or using e-banking (e.g. Alalwan, Dwivedi, & Rana, 2017; Oruç & Tatar, 2017). Very limited studies have investigated the determinants of internet banking service encounter quality (e.g. Migdadi & Al.Omari, 2017), and most of studies have investigated the cases in one country context.

RESEARCH CONCEPTUAL FRAMEWORK

In order to have a highly competitive internet banking service, it is important to understand the dimensions of service quality. The internet banking services are provided via the bank's website. The website is the interaction point between the customers and the bank, so investigating the quality dimensions of bank's website is the concern of this research. Online banking website quality has studied from various perspectives using many criteria. Some researchers have proposed a model to assess the quality from users point prescriptive. While other researchers have proposed a specific framework model for website evaluation such as Diniz model or Herey's model (Hasan & Abuelrub, 2011).

SERVQUAL model was developed by Berry, Zeithalm, and Parasuraman and used to assess service quality (Parasuraman, Berry & Zeithaml, 1993). Many measurements followed the principle of SERVQUAL such as BANKSERV. It contains of seventeen items on four dimensions, which are; conduct, communications, customer accessibility, and credibility (Al-jazzazi & Sultan, 2014). Some recent studies associate that SERVQUAL is a traditional instrument for assessing the service quality, which requires a little modification in order to suit the customers' wants (Jun & Cai, 2001).

Another model, which is called WebQual model is used for rating website on twelve dimensions, the focuses, is only on the rating quality of website from technical side rather than from customers' experience (Loiacono, Watson & Goodhue, 2002). More comprehensive measurement of the electronic service quality has developed by the E-S-QUAL model; this model has two different scales, the first with twenty-two items on four dimensions, which are efficiency, privacy, system availability, and fulfillment. The second scale includes nine items covered three dimensions relevant to the customer encounters with the website and they are compensation, responsiveness, and contact (Sadiq & Shaikh 2008).

Different website's quality dimensions have been investigated by the previous studies; some studies have investigated trust, empathy, and responsiveness from the customers' viewpoint (e.g. Agarwal & Venkatesh, 2002; & Chiu et.al, 2005). Other studies have investigated accessibility, navigation, security and response time (e.g. Webb & Webb, 2004). While other researchers have focused on the information quality as accuracy, understandability and richness (e.g. DeLone and McLean 2003; Cebi, 2013).

Website designers are encountering complex questions regarding how to design popular and attractive pages. Abels et al. (1999) suggested six operational definitions for using criteria such as content, structure, linkage, search and appearance. While Dholakia and Rego (1998) proposed a list of features that are considered important such as the number of links, the frequency of changes, number of pictures etc. The literature describes a number of quality dimensions of service encounter that can help to evaluate websites. The explosion of the internet has created the need for a method to measure and assess the features of websites such as usability and accessibility of a web application, where the goal is to make a website useful, gainful, user linking, and accessible to all.

The literature presents six main service quality dimensions which are; **functionality** (i.e. Cebi, 2013; Liébana-Cabanillas, Muñoz-Leiva, &Rejón-Guardia,2013). **Accessibility** (i.e. Godwin-Jones, 2001; Webb & Webb, 2004; Migdadi, 2008; Ahmad & Al-Zu'bi, 2011; Cebi, 2013; Liébana-Cabanillas, Muñoz-Leiva, &Rejón-Guardia, 2013; Hasan & Abuelrub 2008). **Navigation** (i.e. Webb & Webb, 2004; Migdadi, 2008; Hasan & Abuelrub, 2008; Sadiq & Shaikh,2008; Cebi, 2013). **Content** (i.e. Migdadi, 2008; Hasan & Abuelrub 2008; Sadiq & Shaikh, 2008; Ahmad & Al-Zu'bi, 2011; Carlos Pinho, de Lurdes Martins, &Macedo, 2011). **Customization** (i.e. Hasan & Abuelrub, 2008). Finally the main important dimension is the **security** (i.e. Webb & Webb, 2004; Sadiq & Shaikh, 2008; Hasan & Abuelrub, 2008; Sadiq & Shaikh, 2008; Polasik & Piotr Wisniewski, 2009; Keffala, 2010; Carlos Pinho, de Lurdes Martins, &Macedo, 2011; Ahmad and Al-Zu'bi, 2011; Cebi, 2013). In conclusion, after in-depth

revision of the available literature and models, the comprehensive quality dimensions are those listed above. These dimensions were investigated by this study. For more details about the definitions of the quality dimensions please see Table (1).

Table 1. Quality dimensions' definitions

Dimension	Definition	Reference
Functionality	The purpose of website whether as informational, relational or transactional	Liébana-Cabanillas, Muñoz-Leiva, &Rejón-Guardia (2013)
Navigation	The efficiency of websites in transforming information depends on the designer's easiness of design and the target audience	Cebi (2013)
Accessibility	The technique, which maximizes the ability of users to access services and information It is generally related to the implementation of website content in a way that allows users to access their information and service	Liébana-Cabanillas, Muñoz-Leiva, &Rejón-Guardia (2013)
Content	Web content is the visual, textual or aural useful information that is encountered as part of the user interaction on websites	Carlos Pinho, de Lurdes Martins, &Macedo, (2011)
Customization	The process of tailoring the content of a website based on the needs of users	Hasan & Abuelrub (2011)
Security	Security a dimension concerning about protection of users from fraud and risk of financial loss	Polasik & Piotr Wisniewski (2009)

Firm characteristics such as organization ownership structure, size, age, global presence are often considered important contextual dominants that may affect the quality of management practices in organizations (e.g. Hassan, Mohamad, Khaled & Bader, 2009) Table (2) shows the definition of bank's organizational characteristics. There is enough scientific literature that investigates the impact of ownership on the quality of traditional banking, while there are few researches that explore this issue for internet banking. Malhotra and Singh (2007) argued that there is a statistically significant relationship between the type of bank and e-banking services, while many studies have argued that the relationship between ownership and bank quality is complex, for example, Zu, Zhou, Zhu, & Yao (2011) mentioned that a company's ownership is widely suggested as critical determinant for sophisticated management techniques and it would be very difficult to found continuous enhancement in an organization without building strong quality culture.

Table 2. The measurement of bank characteristics

Bank characteristic	Measurement
Ownership	Local bank Foreign bank
Age	The years old since its established
Size	Number of employees working in the bank
Global presence	The bank has branches across boards

Most of the researches have indicated that national banks have a negative impact on the efficiency and productivity and it is linked with poor competence and higher corruption (i.e. Shleifer and Vishny,

1997). Limited studies mentioned that, government ownership is positively related to bank effectiveness. Ownership structure (Local or Foreign) is an important element for a healthy banking system (Boubakri, Cosset & Fisher, 2005). Foreign banks in developing countries performing better than their locally owned counterparts do. Moreover, foreign banks may have a tendency to achieve effective monitoring, propose a superior contact to technical, financial resources, managerial talent and thus supply the increasing bank's performance (Leech & Leahy, 1991).

H1: There is a significant differences between local and foreign banks in the quality of internet banking service encounter at the significant level ($\alpha \leq 0.05$)

The age of bank is an important determinant for the quality of internet banking from two aspects; first, it reflects the accumulation of experience, second the older banks are more capable to manage the perceived risks. On the other hand, new banks are likely to be more flexible in adopting the new technologies since it does not have to face the managerial obstacles of adopting new technologies within legacy system or need a large amount of money to install these services (Malhotra & Singh, 2007). In addition, banks that have between three to five years of services are more expected to fail rather than older banks (Hendrickson, Nichols & Fairchild, 2014). In order to survive in a competitive industry, new banks should work hard to improve their revenue, cost and profit efficiency. Therefore, old banks require a kind of reorientation to improve their abilities for surviving in the competitive industry (Hassan, Mohamad, Khaled & Bader, 2009). Younger bank have lower branch intensity so they more likely to adopt new technologies (Malhotra & Singh, 2007).

H2: There is statistically significant relationship between the age of bank and the quality of internet banking service encounter at the significance level ($\alpha \leq 0.05$).

Larger banks have more market share, capital and revenue in comparison with smaller banks, so they have competitive advantages to adopt more e-banking channels at lower cost and in appropriate way in comparison with smaller banks (Malhotra & Singh, 2007). Larger banks have more assets, higher branches intensity and more operating expenses, so they are more adopter for e-banking channels to reduce these burdens (Abiodun, 2013; Malhotra & Singh, 2007; Hassan, Mohamad, Khaled & Bader, 2009), while other studies as the study of Hassan, Mohamad, Khaled & Bader (2009) have not found a significant relationship between size of banks and the adoption of e-banking channels.

H3: There is a statistically significant relationship between the size of bank and the quality of internet banking service encounter at the significance level ($\alpha \leq 0.05$).

Banks branches intensity is one of the main characteristics that influence the adoption of internet banking. The more intensively the banks branched could potentially increasing the efficiency and saving the costs (Hendrickson, Nichols & Fairchild, 2014). Hence banks that having larger branches may have higher possibility for adopting online banking and will probably decreases the branches networks (Hirtle & Stiroh, 2007). In addition, using internet banking will eliminate the geographical boundaries (Acharya, Kagan & Rao Lingam, 2008).

H4: There is statistically significant relationship between the bank's global presence and the quality of internet banking service encounter at the significance level ($\alpha \leq 0.05$).

RESEARCH METHODOLOGY

The methodology adopted by this study was quantitative content analysis of banks websites. The methodology passed through different stages; the sample design, data collection process, and data analysis, the following sections discuss these phases in details.

First phase: Sample design

The bank is the unit of analysis; accordingly, the population of this study includes 375 banks, 226 local and 149 foreign banks. Since the population size is too big a representative sample was chosen. Table 3 shows the population and sample of the study. A sample size of 50 bank's websites in the Arab Middle East region was surveyed. This study endeavors to gather information through the multi-stage sampling method. Analysts normally utilize this technique of sample design when a complete list of the population does not exist or it is hard to gather.

Table 3. Population and sample of the study

Total Numbers of Banks		Country Name
Sample	Population	
3	30	Jordan
2	21	Kuwait
9	57	Iraq
14	73	Emirates
6	46	Bahrain
2	25	Yemen
6	46	Lebanon
2	24	Saudi Arabia
2	21	Qatar
2	16	Oman
2	16	Syria
50	375	Total

Second phase: Data collection

The data collection includes a descriptive and objective approach. Two data collection instruments were developed for this purpose. The first one is a questionnaire, which was directed to the experts in order to weigh the quality dimensions. This questionnaire was developed by reviewing the literature; the number of questionnaire items was nine. The rating scale of this questionnaire was five points Likert scales as follows: (1) not important at all, (2) not very important, (3) somewhat important, (4) important, (5) very important.

The second questionnaire was developed also by using the literature review; the main sources were Migdadi & Omari (2017), Migdadi (2008) and Miranda, Cortés & Barriuso (2006). The scale of the majority of the second questionnaire items is nominal according to the availability of function or the

attributes. Some item's scales were ratios as the number of times the websites have been updated, the age of online banks, the number of internal and external links etc. After developing the data collection instrument the data collection process was running as following:

First: specialists who have distinctive specializations were chosen to estimate the weight of various dimensions. The data collection was a structured interview whether face to face, or by telephone. Those experts were academics, IT experts, IT security administrators, software engineers, website developers, system administrators and bankers.

Second: The facts related to quality of banks' websites were collected by the direct observation of the websites and recording these facts on the second questionnaire. Then these facts were rated. Not all attributes were collected by using direct observations, other tools which are presented in Table (4) were used to collect these facts.

Third: The organizational determinants as age, size ownership and global presence were identities by revising the banks website and annual reports, Table (2) shows the measurement of bank characteristics.

Table 4. The Items Measured by Using Other Tools Rather than Direct Revision

Dimension	Item	Tools used to measure the attributes
Navigation	Number of errors	http://validator.w3.org/ The Markup Validator is a free service from world wide web consortium (w3c) that allows users to check the validity of XHTML and HTML and other web document such as SGML or XML DTD. The Markup Validator system is a very important step for site usability and browser compatibility, which has a great effect on saving money and time and consequently improves the quality.
Accessibility	Size, speed	http://sitespeed.me/en/ Slow responsiveness website will discomfit and defeat users, sending them to other sites. However, faster website will keep the users more engaged rather than keeping them waiting to load images or scripts. Developers always wish to optimize their websites and reduce hosting costs and bandwidth and as a result rank higher in search engine results. The Site speed website is easy to use: Simply enter the URL for the specific page and then click the button, and the size and speed load time will appear in the end section of the Site speed website.
Content	The number of times the website was updated each year	www.archive.org There is growing awareness and knowledge among libraries, which ensures that historical records are available for all researchers. Backing up and archiving data is essential for website owners, and helps designers to better understand the movement in shaping websites in the past in order to create better ones in the future . Internet archive is a free service provided for the public in order to access collections of digitized materials. It is very easy to use, you only have to access the site archive.org and will notice the search box, in which you enter the link (e.g. www.yourwebsite.com) and then press enter on your keyboard. You will then notice the appearance of a new page, which is the archive of your website, from the entire time of its construction until two days prior to today's date.
Accessibility	Determining the number of internal and external links	https://smallseotools.com/website-links-count-checker/ Small See tools is a free service tools that allows users to check multiple issues such as page authority, link tracker, link analyzer tool, broken link checker, etc. Link count check is one of the free tools that can be used to identify the number of internal and external links; simply enter the exact web page that you want to analyze, then the result will be displayed on the screen. It is recommended for website owners to check the number of external links as a starting point to eliminating pages that may damage the reputation. This tool is particularly helpful if the website owner wants to exchange links to avoid purchasing unneeded advertising and to ensure quality. It can also be used to check the Google rank in order to determine if the Google page rank is fake or authentic and to check if there is a benefit from publishing a link or not.

Third phase: check the reliability of data

In order to evaluate the reliability, some specialists (Academic and bankers) from different countries such as Pakistan, Iraq, Italy and the United States of America were asked to review the collected facts. For example, the collected data on the Excel spread sheets related to each 50 bank's website was sent to a banker working in the Bank of America, he revised around ten bank's websites from the sample and made sure that the data summarized in Excel sheet is correct.

Fourth Phase: Data analysis

The quantitative evaluation method (QEM) was used to assess the bank websites. QEM is a capable technique used to evaluate the artefact quality (i.e. Miranda, Cortés & Barriuso, 2006; and Evan & King, 1999). The process of the quantitative evaluation method consists of categorizing, distinguishing the dimensions, recognizing weights, rating the components of dimensions, finally, scoring of aggregate quality. Since the sample size is small and the data is not normally distributed, the Kruskal Wallis H test was used to determine the significant difference between local and foreign banks in term of quality dimensions. In addition, Spearman correlation test was used to examine the relationship between age, size and global presence of the bank, and the quality dimensions. Again, this test is useful since the sample size is small and the data is not normally distributed.

FINDINGS AND RESULTS

Table (5) shows the results of Mann-Whitney U test for the differences between local and foreign banks in term of quality dimensions. It can be seen that, there is a statistical significant differences between local and foreign banks in accessibility, content and security dimensions (p-value of chi -square ≤ 0.05). In addition, the result shows that the quality of service encounters dimensions for foreign banks is better than local banks. Moreover, the results illustrate that foreign banks mean rank ranging between 32.07 to 22.15 for content dimension and functionality dimension. Whereas the functionality and content dimensions of local banks mean rank ranging between 28.35 to 19.91. The results showed that the quality of service encounters dimensions for the foreign banks is more significant than local banks. This result is consistent with some studies as Malhotra & Singh (2007), Zouari & Taktak (2014). Other studies have not supported these results as Hassan, Mohamad, Khaled & Bader (2009), Zu, Zhou, Zhu, & Yao, (2011). These findings support hypothesis (1).

The general hypothesis of this section is that different ownership of banks has an impact of the design of website, the foreign banks could have better experience in designing high quality website and vice versa. The results of this section were amazing; three quality dimensions were affected by the ownership structure of banks, these dimensions were accessibility, content and security. The question is still why do these factors are better ranked by foreign banks in comparison with local banks?. Is it related to better technical capabilities, or related to other factors?. Almost always, the number of foreign banks' customers is less than the number of local banks, accordingly, better accessibility is expected to the website. On the other hand, better content could be related to the diversity of foreign banks' customers, which requires more diverse content and different media adopted. However, the better security could be

Table 5. Mann-Whitney U test Results for the Impact of Ownership Structure on the Quality Dimensions

Quality Dimension	Mean Ranks of ownership		Mann-Whitney U Asymp.Sig (2-tailed)
	Local	Foreign	
Functionality	28.35	22.15	233.5 .134
Accessibility	21.11	30.65	192* .020
Navigation	25.48	25.52	310.00 .992
Content	19.91	32.07	159.500** .003
Customization	23.41	27.96	254 .271
Security	21.85	29.78	214* .049

* p- Value ≤ 0.05 ** p-value ≤ 0.01

related to wider scope of foreign banks' operations outside local borders, which requires more concern about developing more secure restricted websites. In addition, the most of foreign banks working on the Middle East region are western banks; these banks are almost leaders in launching e-services in comparison with local banks, so they have better experience in adopting more advanced security technologies.

Table (6) shows that there is a statistical significant relationship at the significance level ($\alpha \leq 0.05$) between global presence and the quality dimensions of customization and security. The results showed that no significant correlation between age of bank and the quality dimensions of internet banking service encounter. The findings support hypothesis (2) and reject hypothesis (3) and (4). The findings of this study showed that the age of bank does not affect the quality of internet banking websites. Some studies don't agree with this finding, for example, Malhotra & Singh (2007) suggested the younger banks are more likely to adapt this technology, and Acharya, Kagan & Rao Lingam (2008) argued that early adaptors of modern technologies may have more efficiency and competitive advantages.

The results also showed that the number of employees does not have a significant relationship with the quality dimensions. Some previous studies reached the same result as the study of Hassan, Mohammad, Khaled & Bader (2009) and Zu, Zhou, Zhu, & Yao (2011), while other studies have not support this result such as the study of Malhotra & Singh (2007). The findings of this study concluded that there is a significant positive relationship between the global presence of banks and the quality in term of customization and content, this result is in line with many researchers as Malhotra & Singh (2007), Schiavone, Meles, Verdoliva, & Del Giudice (2014) and Shneor (2012).

The result of this part is in line with the previous result of the impact of banks ownership. The global presence of banks means working outside the local borders, which requires more concern about content and security, the justification of this result is more global presence of banks requires content that is more diverse in order to satisfy the more diverse customers. In addition, the banks with global presence should have more experience in solving technical problems since it deals with customers that are more diverse and could be encountering the hacking and security issues more than banks working within national borders only.

Table 6. Results of Sperman Correlations Test for the Relationships between Service Encounter Quality and determinates

Quality Dimension		Age of Bank	Size of Bank	Global presence
Functionality	Correlation Coefficient Sig.(2-tailed)	-.079 .583	.090 .534	-.198 .169
Accessibility	Correlation Coefficient Sig.(2-tailed)	.191 .185	-.130 .370	.143 .321
Navigation	Correlation Coefficient Sig.(2-tailed)	-.054 .710	-.135 .350	.022 .879
Content	Correlation Coefficient Sig.(2-tailed)	.215 .134	-.253 .076	.265 .062
Customization	Correlation Coefficient Sig.(2-tailed)	-.126 .382	.011 .938	.497** .000
Security	Correlation Coefficient Sig.(2-tailed)	.180 .210	.132 .362	.388** .005

* p- Value ≤ 0.05 **p-value $\leq .01$

IMPLICATIONS AND FUTURE RESEARCH DIRECTIONS

This research provides better insight about the impact of organizational characteristics on the internet banking service encounter quality. If the banks will work outside their national borders regardless of their size and age should concern about the content, security and customization characteristics of the internet-banking website. This is required since the global presence requires from the bank to deal with more diverse customers, so more diverse content and customized websites is required to satisfy the customers. On the other hand, working outside local borders will increase the probability of banks to encounter more hackers and invading the websites security, so more concern about improving the security technologies is recommended. The local banks in the Arab Middle East region regardless of their size and age could benefit from the foreign banks' experience in designing the internet-banking website in term of security, content and customization.

The academics could benefit from the results of this study through better insight of e-banking practices and the organizational determinants at regional level. The most of available contribution is still country based, or a comparison between two countries, or limited number of countries. The primary limitation of this study is the scope and the size of its sample as well as other variables (i.e. market, environmental, regulatory etc.) which may effect on the decision of the banks to adopt internet banking. So it is recommended to conduct future researches by using larger sample size, and it is more beneficial to conduct a cross regions analysis.

CONCLUSION

This study is one of limited studies that explore the impact of organizational determinants on the internet banking service encounter quality. The aim of this chapter was to evaluate the impact of organizational determinants in term of ownership, age, size and global presence on the quality of internet banking service encounter quality in the Arab Middle East region. A sample of fifty banks from eleven countries was surveyed. Two questionnaires were used; one of them was directed to professionals to weight the

dimensions of quality. Another one was used to report the quality dimensions and bank's characteristics. Detailed analysis methodology called quantitative evaluation was adopted to weight and rate quality dimensions, further, Mann-Whitney U test and Sperman correlation coefficient were used. This study revealed that; there is a statistical significant difference in accessibility, content and security dimensions between foreign and local banks. Global presence has a significant impact on customization and security, but age and size of the bank doesn't have a significant relationship with quality of service encounter dimensions.

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Section 9

Entrepreneurship and SMEs

Entrepreneurship: Concept and Theoretical Framework

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INTRODUCTION

As entrepreneurship is an engine of innovation and job creation (Thornton & Yang, 2012), nations with high rates of entrepreneurial activity are those that are more developed economically, so that entrepreneurship is one of the essential elements to achieve sustainable economic growth and the generation of wealth and well-being. Entrepreneurs discover and exploit new business opportunities guided by intuition (Saiz-Alvarez, Coduras, & Cuervo-Arango, 2013), field studies, entrepreneurial spirit, and risk control to achieve GDP (Gross Domestic Product) growth, higher socioeconomic wealth (Saiz-Alvarez, Coduras, & Cuervo-Arango, 2014), and social change.

Contrary to Van Praag and Van Ophem (1995) and Murphy (1986), who affirm that entrepreneurship was first studied in Cantillon's *Essai sur la nature du commerce en général*, published posthumously in 1755, the concept of entrepreneur (in the sense of merchant) was first studied in Spain in the second book of Tomás de Mercado's *Tratos y contratos de mercaderes y tratantes discididos y determinados* [Deals and Contracts Applied to Certain Merchants and Traders], published in 1569, and reedited with a few tweaks in 1571, as *Suma de tratos y contratos* [Treaty on Deals and Contracts]. Regarding entrepreneurship, Tomás de Mercado approves the creation of new business and the importance of exchange trade to economic growth, only if they are consistent with the moral rules based on not taking advantage of others by using abusive prices and interest rates, or by conducting unfair agreements, both socially and economically (Saiz-Alvarez & García-Vaquero, 2017).

Given the impact of entrepreneurship in a firm, «contemporary economic theory recognizes entrepreneurship as an independent factor of production on a more-or-less equal footing with land, labor, and capital» (Hébert & Link, 1989, p. 40). The objective of this chapter is to describe the different theories entrepreneurship briefly, by including classical and new theories of entrepreneurship, both from economic, sociological, ecological, and psychological perspectives.

BACKGROUND

Entrepreneurship: Concept

Entrepreneurship is the process of identifying and developing economic, business and social opportunities (Shane & Venkatraman, 2000) through the efforts of individuals and organizations (Thornton & Yang, 2012), and it can be analyzed generating a multidimensional perspective (Bula, 2012). Entrepreneurship is the act of innovation involving endowing existing resources with new wealth-producing capacity

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(Drucker, 1985), as the nature of the decision-making context with entrepreneurs' decisions (Alvarez & Barney, 2005). As a result, and applying a fundamentally personal perspective (Baum et al, 2007), «the entrepreneur is someone who is specialized in taking responsibility for and making judgmental decisions that affect the location, form, and the use of goods, resources or institutions» (Hébert & Link, 1989, p. 213).

Successful entrepreneurs must identify business opportunities (Stevenson & Jarillo, 1990; Barringer & Ireland, 2006; Timmons, 1999; Mariotti & Glackin, 2010) to create wealth, be able of choosing and managing entrepreneurial careers (Haynie & Shepherd, 2011), and be capable of acting entrepreneurially (McMullen & Shepherd, 2006; Shepherd & Patzelt, 2011) by being adapted to the market given their expertise (Velilla, Molina, & Ortega, 2018) and their capacity of resilience to failure. As a result, entrepreneurs are the business core of a company, especially in newly-born firms, where they act as inventors, investors, accountants, facilitators, organizational change specialists, leaders, technologists, and marketing specialists (Frese & Gielnik, 2014). Given the above definitions, entrepreneurship is defined as the type of business strategy focused on the creation of jobs, social wealth, and profit by optimizing the use of productive and commercial resources for economic growth (Saiz-Alvarez & García-Vaquero, 2017).

Entrepreneurship is associated with the «pursuit of the generation of value, through the creation or expansion of economic activity, by identifying and exploiting new products, processes or markets» (Ahmad & Seymour, 2008, p. 9). In this sense, Lumpkin and Dess (1996) assure that the essential act of entrepreneurship is launching startups and corporate venturing accomplished by entering into new or mature markets with new or existing goods and services. Entrepreneurial activities guided by some theories of entrepreneurship that will be analyzed in the next section.

ECONOMIC-BASED THEORIES OF ENTREPRENEURSHIP

The Neoclassical School

The combination of psychological and managerial traits in entrepreneurs is fundamental to understand entrepreneurial behavior. In this sense, entrepreneurial individualism in competitive markets and the consideration for market participants' knowledge determine entrepreneurship (Egger, 2008). In this sense, Hébert and Link (1989), cited by Audretsch (2003), have identified three distinct intellectual traditions in the development of the entrepreneurship contemporary literature: [1] the German Tradition, based on von Thünen (2015[1875]) and Schumpeter (1997[1911]), that has the most significant impact on the contemporary entrepreneurship literature; [2] the Chicago Tradition, rooted on Knight (1921) and Schultz (1980), and [3] the Austrian Tradition, based on von Mises (1949), Kirzner (1979), and Shackle (1968). We can add emerging intellectual traditions formed by Latin American, Spanish and Portuguese researchers (the Iberoamerican Tradition), given the socioeconomic peculiarities of these countries that have been barely studied so far in the economic literature on this issue.

In his classic treatise, *Theorie der wirtschaftlichen Entwicklung. Eine Untersuchung über Unternehmergewinn, Kapital, Kredit, Zins und den Konjunkturzyklus* [Theory of Economic Development. A Study of Entrepreneurial Profit, Capital, Credit, Interest Rate, and the Business Cycle], Schumpeter (1997[1911]) proposes a theory of creative destruction, where new firms equipped with the entrepreneurial spirit displace less innovative incumbents, leading to economic growth, as a «function of entrepreneurs is to reform or revolutionize the pattern of production by exploiting an invention, or more generally, an untried technological possibility for producing a new commodity or producing an old one in a new way»

(Schumpeter, 1977[1942], p. 13). As a result, Schumpeter (1934) defines entrepreneurs by focusing on adopting innovation and new business strategies that can take several forms: [1] the introduction of new methods of production to increase productivity, efficiency, and EBITDA (Earnings Before Interests, Taxes, Depreciation, and Amortization); [2] the introduction of new goods or quality thereof; [3] the opening of new markets; [4] the conquest of new sources of supply of new materials or semi-elaborated products; and [5] the entry to new market niches or sectors. In short, entrepreneurs identify opportunities, assemble essential resources, implement a practical action plan, and harvest the reward in a timely, flexible way (Sahlman & Stevenson, 1991).

Regarding the Chicago and Austrian traditions, entrepreneurs attempt to predict and act upon change within dynamic and uncertain markets (Knight, 1921). According to both cultures, free market conditions determine the competition in global markets, so public intervention is harmful, as it detracts economic resources to private firms (crowding-out effects). As a result, entrepreneurs are immune from control of rational bureaucratic knowledge (Weber, 1947), so they can be defined as the professionals who discover new business opportunities, after having taken into account commercial and financial risks, and the subsequent creation of new economic activity, often through the establishment of new business organizations (Reynolds, 2005).

For this School, entrepreneurs must compete in a globalized business world, by thinking globally and acting locally (“glocalization”). Therefore, entrepreneurs must keep labor costs in line with productivity and must achieve a steady increase in production to satisfy existing market niches and enter into new markets. If that sustained growth is not performed, there is a risk of business stagnation, which is detrimental to the company’s stakeholders.

Entrepreneurs, as coordinators and arbitrageurs, as well as the chief judgment-based agent of production in the economy (Hébert & Link, 1988, cited by Bula, 2012), are always speculators, as they deal with the uncertain conditions of the future, so it is vital for them to have success in the correctness of their anticipation of unpredictable events (Von Mises, 1949).

In a globalized socioeconomic world, entrepreneurs create social and economic wealth by bringing together unique packages of resources to exploit marketplace opportunities (Ireland, Hitt, & Sirmon, 2003) guided by opportunity recognition (Gaglio & Katz, 2001; Shanke & Venkataraman, 2000; Kirzner, 1979), and by creating a previously-unperceived opportunity for profit (Von Mises, 1949). In short, and as Grebel, Pyka, and Hanusch (2001) gather from Schumpeter and the Neo-Schumpeterian School, «no entrepreneur—no innovation — no dynamics — no evolution» (p. 7).

The New Keynesian School

Entrepreneurship is marginal in the new Keynesian school, as labor markets only deal with the development of efficiency wage models. Despite this issue, the implementation of public policies to support private entrepreneurship generates crowding-in effects, although public spending is increased, so new entrepreneurs are created.

By combining macroeconomic government spending data with individual-level entrepreneurship data, Islam (2015) finds a positive relationship between increasing the share of social and public goods at the cost of private subsidies and entrepreneurship, while confirming a negative correlation between total government consumption and entrepreneurial activity.

In our globalized world, informal ventures are increasingly important and are influenced by economic and political factors affecting entrepreneurship. In this sense, Autio and Fu (2015) study the influence of economic and political institutions on the prevalence rate of formal and informal entrepreneurship

across 18 countries in the Asia-Pacific region during the period 2001-2010 and find that the quality of institutions influences on both formal and informal entrepreneurship. Higher quality of economic and political institutions doubles the rates of formal entrepreneurship and halves the rates of informal entrepreneurship. Moreover, both economic and political institutions have a complementary effect on driving entry into formal entrepreneurship, whereas only direct effects are observed for informal entry.

Entrepreneurs for New Keynesian economies are benefited from public expense and investment. In effect, government's Keynesian functions stimulate demand for goods and services through purchases and income redistribution; while government's Schumpeterian economic policy lowers the cost of innovation through regulatory requirements, R&D subsidies and innovation, and the acquisitions of expensive and new technology. These two economic-based Schools of thought are complemented with psychological-based Schools, as a mixture of both economic and psychological thought forms entrepreneurship.

The Ordoliberalism School

Born in the University of Freiburg (Germany) as a substitute to *laissez-faire* liberalism and collective forms of political economy. The Ordoliberalism, mainly developed in Germany and Spain (Ban, 2012) during the 1940s onwards, is based on a mixture formed by a sort of Bismarckian-based paternalism, liberalism, and the social-democratic ideas of social justice to achieve both economic and social stability. This School of thought argues for active private-public collaboration, given that public intervention generates crowding-in effects that compensate for the widely discussed crowding-out effects (Saiz-Alvarez, 2018, p. 16)

For the Ordoliberalist School of Thought, the entrepreneur is fundamentally a political practice; that is, the healthy state is the political form of market liberty (Bonefeld, 2011). The free economy presupposes the exercise of persuasive state authority, and that economic freedom is a practice of liberal governance (Bonefeld, 2012). Social individuals as self-responsible entrepreneurs who more than just complying with the rules of the game do so willingly based on their initiative. As a result, Ordoliberalism "should not... be identified with *laissez-faire*, but rather with permanent vigilance, activity, and intervention." (Foucault, 2010, p. 132) For entrepreneurs to be fostered and protected, at the level of both the individual and the firm (Storey, 2017). Consequently, cartels and monopolies must be legally prohibited, while entrepreneurs must be obliged to take responsibility for their economic welfare through the market (Dulien & Guerot, 2012, p. 2).

NON-ECONOMIC-FOCUSED APPROACHES TO ENTREPRENEURSHIP

Sociology and Entrepreneurship

The dominant School of Thought in Sociology related to entrepreneurship is the supply-side perspective, which focuses on the individual traits of entrepreneurs, while the demand-side perspective has focused on the context in which entrepreneurship occurs (Thornton, 1999) to determine the economic, political and social environment that influence people's willingness and ability to undertake entrepreneurial activities (Gnyawali & Fogel, 1994). Regarding the supply-side perspective, the presence of congenial cultural attributes easing entrepreneurship are formed by social class and ethnic groups more prone to entrepreneurship (Aldrich & Waldinger, 1990; Shane, 1993; and Shapero & Sokol, 1982) daunting environmental constraints (Agboli & Ukaegbu, 2006) mainly defined by influences of firms and markets

(Thornton, 1999); public policies (Dobbin & Dowd, (1997); regulations and policies (Baumol, 1990), physical infrastructure (Agboli & Ukaegbu, 2006). Special topics related to the socioeconomic aspects of entrepreneurship are immigrant entrepreneurship (Coduras, Saiz-Alvarez, & Cuervo-Arango, 2013), and the mechanisms of intergenerational transmission of self-employment (Sørensen, 2007).

Psychological-based Schools

While the study of entrepreneurship began for Economics and Managerial Sciences in the second half of the XVI century, the first psychological studies about this topic started with the seminal works of Schumpeter (1934), and three decades later, McClelland (1965, 1967), Rotter (1966), and Atkinson (1966). These authors focused on explaining how individual and social motivation is one of the most important psychological factors to teach entrepreneurship and discover that imagination, power distance, and willingness for taking risks are critical factors for success. When the possibility of achievement gets higher, the entrepreneurial propensity rate increases (Kalkan & Kaygusuz, 2012).

Self-efficacy and the need for achievement are highly associated with entrepreneurship (Frese and Gielnik, 2014). From a psychological perspective, entrepreneurship has three phases (prelaunch or opportunity-necessity identification, launch, and postlaunch)(Baron, 2007) where the influence of the individual entrepreneur tends to diminish as well as his or her company grows (Hambrick, 2007).

The mentality of entrepreneurs differs, as they are driven by *entrepreneurial alertness* (Kirzner, 1979) defined as a unique set of perceptual and cognitive processing skills directed to opportunity recognition processes. As a result, and given this entrepreneurial alertness, only the most risk-lovers tend to be successful while managing their businesses, as «the entrepreneur always searches for change, responds to it, and exploits it as an opportunity» (Drucker, 1985, p. 25).

Regarding entrepreneurship, five Schools of thought can be distinguished, as follows: [1] *Functionalism*, where theorists try to explain ideas, the learning process, instincts, and decisions merely describing what entrepreneurs do, without asking how they do it.

In this sense, is of interest to link resilience and functionalism, as rule-governed behavior turns people insensitive to contingencies, so a higher capacity of resistance is achieved; [2] *Behaviorism*, rooted on Functionalism, is focused on both human and animal behaviors, so it analyzes the reasons why entrepreneurs act; [3] *Gestalt*, where human mind interprets data through several norms, laws, and organizational principles, so partial information can be completed. This completeness is necessary to make decisions with imperfect or asymmetric information, as is standard in the daily operations done by companies; [4] *Humanistic Psychology*, based on human motivation and satisfaction of needs, has a direct influence on entrepreneurs, as they want to be happy by achieving corporate goals, and [5] *Cognitivism*, as well as Behaviorism, studies the mind through scientific experimentation, but differs from Behaviorism by accepting that psychologists can research and understand the inner workings of mind and mental processes, so psychoanalysis is rejected given its subjectivity.

These psychological theories applied to entrepreneurship complement economic and managerial theories on entrepreneurship, to have an overview of the entrepreneurial behavior. Entrepreneurs with better growth prospects have a high need for power and independence (Duchéneau and Orhan, 1998), as the need for achievement and competition is positively correlated with the result of the company. Moreover, entrepreneurs have a greater need for success (Box, White, & Barr, 1993).

The influence of psychological aspects on entrepreneurs is also seen in the modern theories of entrepreneurship that will be analyzed in the next paragraph.

Table 1. Psychological Aspects of Entrepreneurs

	Risk-lover	High Necessity for Achievement	Innovation	Desire for independence	High Necessity for Competence
Anna, Chandler, Jansen, & Mero (2000)		X	X	X	
Box, White, & Barr (1993)		X			X
Collins, Moore, & Unwala (1988)		X		X	
Crainich, Eeckhoudt, & Trannoy (2013)	X				
Davidsson (1988)					X
De Pablo, & Bueno (2004)	X	X	X		X
Duchéneau, & Orhan (1998)				X	X
Dubini (1988)	X	X	X		
Douglas, & Shepherd (1997)	X				
Feesen, & Dugan (1989)				X	X
Genesca, & Venecia (1984)				X	
Jenssen, & Kolvered (1992)		X	X	X	
Jindapon (2013)	X				
Johnson (1990)		X			
Koh (1996)		X		X	
McClelland (1965)		X			
Rusque (2002)		X		X	
Sheinberg, & MacMillan (1988)				X	
Sijbom, Janssen, & Van Yperen (2015)		X			
Smith, Bracker, & Miner (1987)	X		X		
Woo, Cooper, & Dunkelberg(1988)		X		X	

Source: Elaborated from Barba-Sánchez, Jiménez-Zarco, & Martínez-Ruiz (2007), and Marulanda, Correa, & Mejía (2009)

NEW APPROACHES OF ENTREPRENEURSHIP

The Theory of Effectuation

According to this approach, entrepreneurs make decisions and perform actions only when they identify the best way to assess the resources available focused on achieving their business goals, while continuously balancing their goals with the resources they have. As a result, the four principles of effectuation are (1) Entrepreneurs create solutions with the resources really available (*Bird-in-Hand*); (2) Mistakes, and surprises are inevitable and can be used to look for new opportunities (*the Lemonade Principle*); (3) Entrepreneurs should only invest as much as they are willing to lose (*Affordable Loss*); and (4) New partnerships can bring the project new funds and new directions (*Crazy Quilt*)(Sarasvathy, 2001)

The Feedback Loop Theory

Developed by Ries (2011), decision-making used by entrepreneurs is guided by turning entrepreneurial ideas into developing a minimum viable product, which is then tested on potential customers, partners,

and other stakeholders in a constant feedback loop formed by three iterative stages: (1) to build a product; (2) to measure data created by messages developed by stakeholders, primarily customers and partners, and (3) to learn ideas to be applied into the firm.

The Jack-of-all-trades Theory

Theoretically developed by Lazear (2005), and mathematically by Kaiser (2012), entrepreneurs' primary task is to organize professional teams ("generalists"/"specialists") by combining capital. In this respect, Saiz-Alvarez (2012) affirms that capital is composed of intellectual capital (sum of human capital, relational capital, and structural capital), physical capital and ideas to innovate with the final goal of creating products and services to actual and prospective clients. According to this entrepreneurial theory, only generalists ("jacks-of-all-trades") become entrepreneurs, as they assemble production factors, and have knowledge, skills and working abilities in a large number of areas, especially when entrepreneurs are individuals. The reason for this behavior is that entrepreneurs need to manage different people and tasks, so they must be sufficiently well versed in diverse fields by the positive affecting accumulation of various skills (Silva, 2007). Generalists "typically have a more varied labor market experience, and that varied work experience is associated with the lower household income" (Astebro and Thompson, 2009, p. 1). As a result, and according to Kaiser (2012): [1] individuals with more balanced skill sets are more likely to become entrepreneurs; [2] the supply of generalists entrepreneurs is smaller for production processes, as they require a large number of independent skills; and [3] generalists entrepreneurs have, on average, a more balanced human capital strategy than specialists. Behind this theory is that entrepreneurs must have enough knowledge to put together the many ingredients needed for survival and business success, while paid employees must be specialists (Wagner, 2003).

The Mezzanine Theory

Formed by a financial and commercial mezzanine, it consists of a technique that combines two or more investment instruments, called tranches, within a facility sold as a single entity to investors. A simple mezzanine facility contains: (a) subordinated debt; (b) a tranche where the investor receives a share of the firm's earnings or profits and; (c) an equity-related tranche ("equity kicker") in which an investor receives a payment related to the company's share price. As a result, a commercial mezzanine investment usually takes the legal form of a private investment limited partnership organized by professionals in the management of mezzanine investments which identify good companies (20-30 companies on average) to invest and monitor their performance, to participate in their boards, and to liquidate the fund at the end of its mandate (usually 7-10 years). These professionals receive fees (around 2%) for all assets under management, as well as a share of the profits of the investment. The exact mix of devices in a specific firm is generally tailored to suit the needs of the firm and the investors.

The O-Ring Theory

Seminally developed by Kremer (1993), and theoretically by Fabel (2004), the O-Ring Theory deals with abilities, and product, task, and service quality in firms, as various individuals with different capacities supply different talents and skills. Teamwork is essential in this theory, as if a group member ("specialists") fails to fulfill the task, the entire project will tend to fail. The abler of the team, the more per capita capital is used, so it is preferable to limit the size of the group, as more per capita capital must be used.

The extension of this theory applied to economic development and entrepreneurship is the concept of O-ring jobs (Jones, 2013) defined by being strategically complementary in terms of skills.

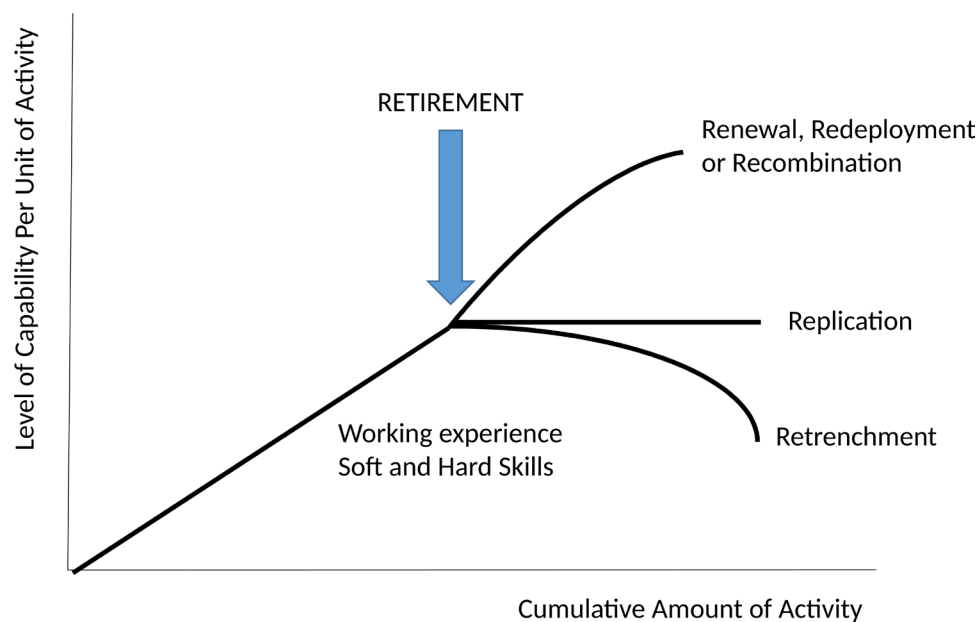
The Theory of Resources and Capabilities

This theory can be seen as an “inside-out” process of strategy formulation, as the entrepreneur looks at what resources the firm possesses to assess their potential for value generation defined in a business strategy to capture the maximum value sustainably. These financial, physical, human, technological, reputational, and organizational *resources* input to be taken into account for the production process, while *capabilities*, defined as the capacity for a team of resources to perform some task or activity, constitute the primary source of the firm’s competitive advantage.

One of the keys to having success when applying this theory into practice is to efficiently utilize *routines*, defined as those regular and predictable patterns of activity which are made up of a sequence of coordinated and repeated (*learning-by-doing*) actions done by individuals. As a result, economies of experience are created and sustainable and activities guided by appropriability.

Figure 1. Branches of the Capability Lifecycle

Source: Elaborated from Helfat and Peteraf (2003).



Achieving sustainability is fundamental to the firm’s reputation and good economic results in the long term. The four main elements for the sustainability derived from resources are [1] *durability*, defined as the rate at which resources depreciate or become obsolete; [2] *replicability* when entrepreneurs acquire resources inside the organization. The more complex the organizational routines are, the more difficult it will be to replicate them (Grant, 1991); [3] *transparency*, as incomplete information creates inefficiency-based problems; and [4] *transferability* when rivals can easily acquire resources and capabilities, so leading positions can be in danger.

Successful firms must hire the best human resources, as well as renew the level of capacity per unit of activity and to continually invest if they want to be leaders in their sectors. Complex organizational skills pose a significant barrier for other firms to enter the market, and especially when economies of experience are well developed.

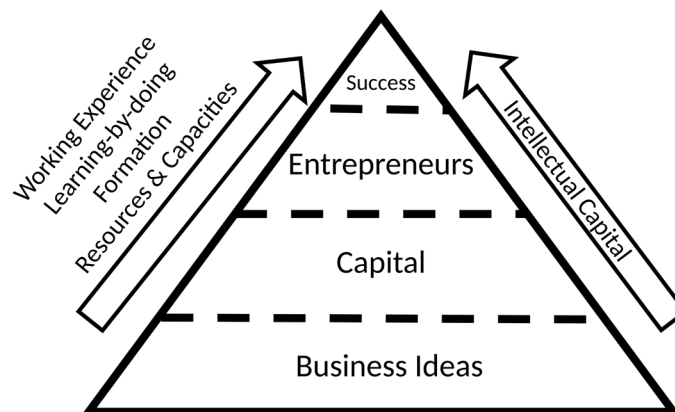
The Theory of the Optimal Triangle

Companies are having a high level of business growth and motivation, influence positively on the formation of new business ideas. It is, therefore, essential that emotional characteristics close to the ability to work and enthusiasm must be developed to take forward the company. Without passion, mainly in start-ups, it is impossible for firms to survive in the global market.

Business success is positively related to the level of training, participation in previous projects, business experience, and the number of founders. These factors, however, can change by other endogenous variables, such as debt, product prices, stakeholders' attitudes, and investments, purchases, rotation sales, and wages, and exogenous factors, such as energy prices, external shocks, and country risk, among others.

Figure 2. Optimal Situation and Business Success

Source: own elaboration



We propose to summarize these variables in three key terms: entrepreneur, business ideas, and capital, as shown in Figure 2. Successful entrepreneurs are at the top of the triangle, because they support entrepreneurs, as they are fueled by intellectual (as the sum of human, relational and structural capital), physical, and financial capital. The combination of entrepreneurial resources and capacities, working experience by learning-by-doing, formation, and capital determine the optimal situation for the company. As seen in figure 2, this point is between the vertices “entrepreneur” and “capital,” as they are fundamental to have business success.

DISCUSSION

Entrepreneurship is one of the key variables that differentiate countries, since, with a high entrepreneurial spirit, the creation of wealth is more significant, as well as the formation of quality employment. As a

result, thanks to entrepreneurship, the growth of companies is strengthened by intra-entrepreneurs, as well as by countries with entrepreneurs located in different sectors and industries.

When a nation does not have entrepreneurs, it is the State that has to assume the creation of employment and wealth, which leads to a situation of monopsony that is not desirable for the economic stability of the countries. Monopsony leads to productive inefficiencies, as well as to inevitable technical obsolescence that can be made structural over time. For this reason, the generation of private entrepreneurs that complements, and even substitutes in the most neoliberal countries, the dynamizing process generated by the Public Administrations is better for the economy. Public interventionism generator of crowding-in effects that benefits the private sector. Therefore, the ideal situation is the combination of a public and private initiative directed jointly to the creation and development of entrepreneurs.

Given the importance of entrepreneurship in countries as a generator of employment and wealth, there is a triple economic, social, and psychological vision in entrepreneurship. Regarding the economic view, the neoclassical contributions, led by Schumpeter and the tradition of the Austrian and Chicago schools, which focus on the entrepreneur as an individual with success and social recognition, as well as creator of wealth stand out. However, this neoclassical model is valid only from an entrepreneurial vision when entrepreneurs have the financial resources necessary to undertake, a situation that does not always occur in developing countries. For this reason, the impulse in the developing countries must also come from the State, in collaboration with the private sector. Hence, both a Keynesian and Ordoliberalist vision is more realistic for these countries.

In contrast to the economic vision of entrepreneurship, characterized by its diversity, there is more excellent uniformity in the application in countries of the psychological and sociological perceptions of entrepreneurship. In other words, the human being has the same psychological-based entrepreneurial characteristics in different countries which leads us to conclude that the main differences in the quality and quantity of entrepreneurs are mainly due to financial aspects related to entrepreneurship rather than the psychological characteristics of entrepreneurs who seem to be guided by a typical pattern throughout the world.

Given the severe problems of lack of economic development in developing countries, psychological theories include the so-called 'Humanistic Psychology' which advocates directing all the entrepreneurial efforts towards the satisfaction of corporate objectives. From a psychological perspective, entrepreneurs are being defined by having a spirit of improvement, a social conscience, and a desire for self-improvement to leave a legacy for the new generations. Many times in this life, entrepreneurs are happier giving than merely earning money due to the growing social impact that entrepreneurs have on society.

Entrepreneurs are the primary judgment-based agent of production, distribution, and selling of goods and services in the market, so they are speculators to earn money. The only exception of this fact is when the State does it to create social wealth and employment. As a result, this type of public-private collaboration strengthens and accelerates the creation of new jobs and wealth in the economy, which directly affects the generation of higher levels of economic and social well-being.

The new approaches of entrepreneurship enrich the vision that exists about entrepreneurship, mainly following economic reasoning. The ideas that emanate from these theories invite the creation of incubators and accelerators of companies under quadruple helix schemes (HEIs, companies, state, and NGOs) to increase and democratize the social impact of organizations. One of the characteristics of the developing countries is the weak social conscience of the business organizations, which leads them to hardly carry out (if they do) corporate social responsibility. Mainly in Europe, this social awareness of companies is much stronger than in other continents, which leads to an increase in the level of socioeconomic welfare

of the population. Levels of well-being strengthened by a robust public-private collaboration that creates positive externalities for both the company and society.

The creation of quadruple helix models, mainly in developing countries, can contribute to the structural transformation of these societies towards higher levels of wealth and socioeconomic well-being. The creation of wealth must be done among all economic agents so that the middle class guarantees the results obtained in terms of welfare. In this sense, everything achieved in the current generations will have a particularly positive impact on the new generations and those that have to come. For that reason, it is the responsibility of the current generations to leave a better world for the future ones, and in this sense, the entrepreneurial spirit has a fundamental role in fulfilling to achieve it.

CONCLUSION

Based on Information and Communication Technologies (ICTs), entrepreneurship can be classified as: [1] *Intraentrepreneurship* or *Corporate venturing* (Sharma & Chrisman, 1999), defined by the type of entrepreneurship focused on fast tracking product development to take advantage of new business opportunities or to assess feasibility of new processes or designs; [2] *Traditional entrepreneurship*, that according to Brunet and Alarcón (2004), can be classified as: [a] *Novice entrepreneurs*, when they manage their first firm; [b] *Habitual entrepreneurs*, that are classified as *serial entrepreneurs*, when they sell their original ventures to buy and develop new ones, and [c] *Portfolio entrepreneurs*, when they do not sell their innovative investments and buy others, so a cluster is created; [3] *Solidarity Entrepreneurship* (Saiz-Alvarez, 2015), where firms are guided by human values based on solidarity and not for profit, and [4] *Social Entrepreneurship*, mainly formed by cooperatives, whose aim is to maximize the impact of the company on the population searching for social wealth. In this sense, and after having analyzed data from 106,484 individuals in 26 nations, Stephan, Uhlaner, and Stride (2015) confirm joint effects on social entrepreneurship of formal regulatory (government activism), informal cognitive (post-materialist cultural values), and informal normative institutions, through socially supportive cultural norms, or weak-tie social capital. When entrepreneurs are focused on social entrepreneurship is possible to achieve social change, especially in developing countries defined by social inequalities and the generation of stable social groups characterized by poverty.

FUTURE RESEARCH DIRECTIONS

As future lines of research, the following ones may be indicated: a) Women Entrepreneurship, since women are having a growing role in entrepreneurship, especially in developing countries. The fact that has not yet been studied in depth; b) Social and Solidarity-based Entrepreneurship, because solidarity and the social economy are gaining strength in those countries where the state has fallen and does not efficiently perform its obligations to improve the lives of its citizens. This type of solidarity economy is growing very actively in Latin America and the Caribbean; c) ICTs, Business Incubators, and Accelerators, especially to form quadruple helix models where incubators and accelerators are linked to HEIs, public administrations, companies and NGOs; d) Entrepreneurship in HEIs (Higher Education Institutions), to analyze the entrepreneurial initiative of the students that are the future of the nations. The greater the number of entrepreneurs, the higher the level of present and future wealth, and the higher economic growth and economic and social well-being; e) Entrepreneurship, Poverty, and Sustainable Economic

Growth, because entrepreneurship is one of the mechanisms to fight poverty, especially in third world countries where the State is absent in support of society; and f) Entrepreneurship and Leadership, due to the importance of the spirit of leadership in the creation of companies. A leadership that goes from individual to countries, as happens with the First World.

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KEY TERMS AND DEFINITIONS

Capability: Capacity for a team of resources to perform some task or activity, which constitutes the primary source of the firm’s competitive advantage.

Entrepreneur: Individual who starts a new business or adopt new business strategies in existing organizations.

Entrepreneurship: Business strategy focused on the creation of jobs, social wealth, and profit by optimizing the use of productive and commercial resources.

Glocalization: Term created by the combination of «global» (think global) and «local» (act local) widely used in academia and global businesses.

Intellectual Capital: It is formed by the combination of human, structural, and relational capital.

Resilience: It is defined as an individual resistance to failure, usually in business.

Resource: Inputs to be taken into account for the production and commercial processes.

Social Entrepreneurship

9

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INTRODUCTION

Social entrepreneurship is commonly used to describe entrepreneurial activities that serve a social and/or environmental cause and that reinvest a large part of their surpluses in support of that mission. According to Dees & Anderson (2006), social entrepreneurs are considered as entrepreneurs with a social mission. Although this definition, and its boundaries remain unclear, social entrepreneurs focus on achieving both economic efficiency and creating social value (Martin & Osberg, 2015).

Although interest in social entrepreneurship seems to be recent, the first works on this topic were done as early as the 1960s and became widespread around the 1980s, mainly around the nonprofit sector (Guo & Bielefeld, 2014). The concept itself seems to have been developed in the 1990s in Europe, with the development of social cooperatives, and interest has grown exponentially, particularly after the 2008 financial crisis that hit the USA. Hence, the main objective of this chapter is to conceptualize social entrepreneurship, together with its importance in terms of its contribution to social value creation and its relation to innovation and sustainability.

The chapter begins by conceptualizing social entrepreneurship and the characteristics of a social entrepreneur from different points of view. Secondly, the definitions that have arisen from Harvard Business School, specifically the *Social Enterprise School*, which focuses on the organizations and considers the development of market based solutions to social problems, including profit and non-profit activities; and the *Social Innovation School*, which focuses on the role of the social entrepreneur and the way that they produce social value by shifting resources into areas where they are needed (Dees & Anderson, 2006, p. 41), are analyzed.

Finally, a social entrepreneurial ecosystem is proposed, highlighting the links between social entrepreneurship, sustainability and social innovation together with the trends, issues and challenges that have arisen in recent years. Future research directions include analyzing the influence of the socio-political, environmental and economic ecosystem on the development of social entrepreneurship in each country, at a local, regional and national level, analyzing the financial and legal difficulties faced by entrepreneurs and the reasons why social entrepreneurship is still highly gendered.

BACKGROUND

Social entrepreneurship is defined by the creation of social value, rather than personal wealth (Dees, 1998). According to the literature, its emergence began in Europe with the development of social cooperatives in Italy (1995), social purpose companies in Belgium (1995), social solidarity cooperatives
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in Portugal (1998), and cooperatives with a collective interest in France (2001). In the US, since the economic and financial crisis of 2008, there has been an increased interest in social entrepreneurship and social innovation given the dissatisfaction generated by other forms of programs, including the lack of community participation and their environmental, social and economic impacts (Moulaert, MacCallum, Mehmood & Hamdouch, 2013). Therefore, the concept itself is a reasonably new one and the area can certainly be described as an “emerging field.”

According to Brock and Ashoka (2008, cited in Guo & Bielefeld, 2014) the first social entrepreneurship class was taught at Harvard University in the mid 1990s, followed by other universities in the USA (Les repères de l'AVISE, 2007); the first European course was at the University of Geneva in Switzerland in 2003.

This developments led to a rapid rise in social orientated enterprises, together with improvements in the legal frameworks (at a national and international level); likewise, companies and devices that help social entrepreneurship emerged (such as Ashoka foundation, Skoll Foundation, Schwab Foundation and Yunus Center, Socialab, amongst others) and there was an increase in audience related to social projects (including the media, academic institutions and different economic actors) (Fournier, 2011).

FOCUS OF THE ARTICLE

Definition of Social Entrepreneurship

The concept of social entrepreneurship has its foundations in the social problems faced by communities, given the unmet social needs (i.e. due to government, market and contract failure), the importance of earned income, together with the opportunities and challenges that emerge from the external environment including demographic, technological and environmental (Thompson, Alvy & Lees, 2000; Guo & Bielefeld, 2014). Therefore, social entrepreneurship often develops at the intersection between civil-society, the state, and the market. Fowler (2000, p. 638) points out that throughout history, governments have focused on reducing “poverty, inequity, insecurity and injustice,” but their solutions have not been accurate, as this are still predominant features of the current socio-economic system; thus, a big difference has been made by social entrepreneurs none reliance on the “traditional” framework employed by the official aid system and their willingness to develop solutions to those “old problems.” This phenomenon transcends the separate domains of entrepreneurial studies, social movements, and nonprofit management (Dacin, Dacin, & Matear, 2010). Social entrepreneurs are people looking towards change, but a modern kind of change that takes its inspiration from a determined focus on solutions: “Mission related impact becomes the central criterion, not wealth creation” (Dees, 1998, p. 3).

According to Dacin *et al.*, (2010, p. 37) “social entrepreneurship depends on the context in which established types of entrepreneurs operate.” Currently, social entrepreneurship literature is a field of interest that crosses academic disciplines and challenges traditional assumptions of economic and business development. As far as conceptualizing it, Dart (2004) refers to it as an ability to leverage resources that address social problems, although there is little consensus beyond this generalization. Zahra, Gedajlovic, Neubaum, & Shulman (2009) mention the importance of activities aimed towards social responsibility or social innovation (Bornstein, 2004) and Emerson & Twersky (1996) refer to it as sustainable ventures that generate social value. These definitions also take into account the entrepreneurial ecosystem, which includes start-ups, incubators and all the business functions relating to business development, finance

and accounting, market analysis, communications, human resources, research and development, amongst other areas.

Tschirhart & Bielefeld (2012, p. 36) mention that social entrepreneurship is defined as the pursuit of social objectives with innovative methods, through the creation of products, services, organizations and practices that yield and sustain social benefits. Hence, social entrepreneurs play an important role as change agents in the social sector, adopting a mission to create and sustain social value by recognizing new opportunities and engaging in continuous innovation processes. This is done by making an appropriate use of social capital, which is considered the single strongest predictor of a successful social entrepreneurship, together with their ability to engage in resource mobilization (financial, social, environmental) (Tent, 2015).

Authors such as Hoogendoorn, Pennings & Thurik (2009) cluster the different perspectives of social entrepreneurship along epistemological dimensions in different schools of thought, namely; the School of Social Enterprise which concentrates on organizations and how they deal with funds, business models and strategies; and the School of Social innovation which centers on the development of innovative ideas to enable social transformation (Cano, Sanjuán & Fernández, 2015). However, it is also important to mention that the boundaries between these schools are blurred and generalizations should be made in a cautious manner.

Following Dees (2017, p. 38) the definition of social entrepreneurship “combines an emphasis on discipline and accountability with the notions of value creation taken from Say, innovation and change agents from Schumpeter, pursuit of opportunity from Drucker, and resourcefulness from Stevenson. In brief, this definition can be stated as follows: Social entrepreneurs play the role of change agents in the social sector, by: Adopting a mission to create and sustain social value (not just private value), recognizing and relentlessly pursuing new opportunities to serve that mission, engaging in a process of continuous innovation, adaptation, and learning, acting boldly without being limited by resources currently in hand, and exhibiting a heightened sense of accountability to the constituencies served and for the outcomes created.”

Table 1. Differences between social and traditional entrepreneurship

Categories	Social Entrepreneurship	Traditional Entrepreneurship
Impact	Social impact	Economic impact
Type of value	Create social value	Create economic value
Purpose	Create shared value with social purpose	Create value with profit purpose
Opportunity recognition	Recognize opportunities to improve social and environmental problems	Recognizes opportunities to create business
Governance	Is governed, in part, by social and environmental factors	Is governed by market concerns
Funding	Funded through subsidies, volunteering, donation, international cooperation	Funded through private capital and commercial funding
Accountability	Socially responsible in front of vulnerable and excluded communities	Corporate social responsibility in front of stakeholders
Focus	Tackle social problems	Earn profit

Sources: Literature review done by authors

Finally, according to Porter & Kramer (2011) social entrepreneurship equates to creating shared value, by reconsidering capitalism and unleashing a wave of innovation and growth. For Light (2008) the four main components of social entrepreneurship are the *Entrepreneur*, referring to the individual, the *Idea* that is considered as the mean by which transformations might occur, the *Opportunity* and the *Organization* that backs up the individual or group. Therefore, companies must realign themselves with society, in such a way that they can improve social conditions through social responsibility, in order to help marginalized communities who suffer the debilitating problems of poverty, inequity, insecurity and injustice, among others. Table 1 highlights the differences between social and traditional entrepreneurship.

Characteristics of a Social Entrepreneur

The qualities that characterize social entrepreneurs have been thoroughly studied by a variety of researchers including Bolton & Thompson (2005), Zhao & Seibert, (2006), Carsrud & Brannback (2009), Ernst (2012), Heinrichs & Sascha (2013) and variolus organizations. The Skoll Foundation, for example, states that social entrepreneurs focus on improving systems, inventing new approaches and creating sustainable solutions to change society for the better. The Schwab Foundation defines a social entrepreneur as a leader who combines innovation, resourcefulness and opportunities. Whilst, the Ashoka foundation defines social entrepreneurs as individuals with the vision and inexhaustible determination to transform an entire system, communities, societies, and the world (Light, 2005)

Light (2009, p. 5) highlights qualities centered on “issues of motivation, the ability to recognize opportunities and enact change through inspirational leadership skills, and/or the ability to gather necessary resources.” Hence, social entrepreneurs are considered “as one species in the genus entrepreneur with a social mission” (Dees, 1998, p. 2).

Social entrepreneurs have the capacity to innovate, to come up with and mobilize ideas and to focus on attainment of resources. Such people are creative, passionate and imaginative and they possess mental strength. According to Guo & Bielefeld (2014), there are four common characteristics of social entrepreneurs, which include having a balanced judgment in terms of being able to serve both the social mission and the financial needs of the organization in order to make it sustainable; being opportunistic, so that they are able to take advantage of opportunities; being virtuous by acting in an integer, compassionate and inclusive manner; and having the ability to endure risks and making accurate decisions.

Friedman (2005) stated that a social entrepreneur is “someone who burns with desire to make a positive social impact on the world, but believes that the best way of doing it is, as the saying goes, not by giving poor people a fish and feeding them for a day, but by teaching them to fish, in hopes of feeding them for a lifetime” (Friedman, 2005, p. 449). Consequently, the social entrepreneur is a top-class professional who turns their power towards the development of social ventures, by establishing either new organizations or developing programs within existing organizations, which is also referred to as “social intrapreneurship”,

Social Entrepreneurship Schools of Taught

There are two important schools of taught in which social entrepreneurship can be categorized. The School of Social Enterprise, which focuses on strategies or projects of non-profit organizations that serve society, so that it is seen as a method for creating and administrating organizations. And the Social Innovation School, which understands social entrepreneurship as an innovative strategy to solve societies’ problems. Some of its similarities and differences are mentioned below.

School of Social Enterprise

The school of Social Enterprise centers its perspective on the business strategy to earn income for the organization with the purposes of a social mission. Hence, instead of asking for donations, lobbying the government or building a community group, the organization must produce revenue, or be self-sufficient, as part of its business model to sustain itself and be able to tackle social problems. Replicability and scalability are considered desirable and methodological issues must be taken into account (Bravo, 2016). It considers that the social entrepreneur has a vital role in organizing and operating such social enterprises, which can operate as proprietorship, partnership and incorporated organizations, together with community enterprises, worker and consumer co-operatives, and even examples of corporate social responsibility within all types of business (Emerson & Twerskey, 1996). Defourny & Nyssens (2011, p. 20) integrate *social businesses* in this approach, as they are considered as *non-dividend companies* that do not distribute all its profits (Yunus, 2007). Social enterprises might be funded with philanthropic causes in the start-up phase, but it is generally geared towards creating self-sustained business models, therefore it is not considered a charitable organization in the long-term. But, due to the changing market trends worldwide, particularly the increase in businesses that are making a commitment to social impact, social enterprises can be difficult to identify in the general business population.

School of Social Innovation

The School of Social Innovation centers its viewpoint in innovative ideas. It considers the social entrepreneur as a person that transforms the patterns to create social value or tackles social problems in an innovative manner. Hence, in this school, innovation is the key and even though revenue, replicability and scalability are desirable, they are not compulsory (Bravo, 2016). The most important factor as stated by Dees & Anderson (2006) is on creating new and better ways to overcome social problems; therefore, business venture is not a necessary element. It is well known that social problems such as poverty, inequality and exclusion need to be tackled in an innovative way. Furthermore, within this school of thought, methodological barriers are disregarded as it aims to integrate all sectors (government, community and private businesses) as open innovations to solve social problems.

Therefore, both schools are considered relevant as they focus on different viewpoints. The School of Social Enterprise could be seen as a top-down model due to the implementation of business strategies and methodologies, whereas the School of Social Innovation could be seen as a model that begins at the bottom, with a social entrepreneur that has an innovative idea to tackle social problems and who implements his/her idea with the support of a variety of actors (i.e government, NGO's, private organizations, communities).

Social Innovation and Sustainability

Social Entrepreneurship interacts directly with innovation models to achieve sustainability; this interaction has attracted growing attention, especially from entrepreneurs and communities but unfortunately not from governments. Sustainability was defined by Oxford University (1987, p. 8) as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” Since then, there has been much discussion about the relationship between three key dimensions: social, economic, and environmental. In 1997 the United Nations adopted the following definition, “Development is a multidimensional undertaking to achieve a higher quality of life for all people”

(United Nations, 1997, p. 1). In recent studies Carvalho (2018) has included the impact of regional and national development which is perceived indirectly by the positive impact of organizations on economic, ecological, social and psychological sustainability. Psychological sustainability is a new broad concept developed in connection with the concepts of psychological value (Carvalho & Jonker, 2015).

Therefore, sustainability has been defined by different contextual references that include the environment, the socio-economic fields, green efforts and sustainable consumption, amongst others. Some explanations also place sustainability within a change continuum whereby the boundaries between creating social value and investing in social problems are blurred. “Economic development, social development and environmental protection are interdependent and mutually reinforcing components of sustainable development” (United Nations, 1997, p. 1).

Consequently, the relationship between the social entrepreneur and sustainability is a clear one, so long as the social entrepreneur seeks to solve problems in a sustainable manner through innovation and by creating social value in vulnerable and excluded communities in a sustainable manner. Based on the aforementioned a serious obstacle is economic leverage and the achievement of income and financial projections in order to fund the social goals. Successful social innovation comes when social entrepreneurs understand how to structure alliances and implement innovative social projects to seek social objectives, using market instruments, putting into place effective management strategies and methodologies for constant improvement. Hence, the aim is to run profitable businesses. Currently, there is a tendency to bring forward social enterprises that focus on generating social and environmental value to achieve the Objectives of the Sustainable Development Goals in the fields of poverty, climate change, inequality, among others. This type of innovation has a crucial role within social entrepreneurship.

According to Mulgan, Tucker, Ali & Sanders (2007, p. 8) from Oxford's Said Business School, “social innovation refers to new ideas that work in meeting social goals.” However, it is often difficult to lobby for government intervention and to attract private capital, despite the obvious support towards social equilibrium and its direct positive economic impact within each country.

Consequently, to understand the links between social entrepreneurship, sustainability, and innovation it is necessary to recognize the importance of developing innovative sustainable ideas that consider the welfare of the communities, together with the environmental factors. In summary social enterprises can achieve innovation by bearing in mind the following six recommendations: 1) Value proposition 2) Creation of shared value 3) Innovation for building structures that optimize costs in order to achieve benefits 4) Focus resources on investment to solve social problems 5) Engage other actors 6) Invest in technology.

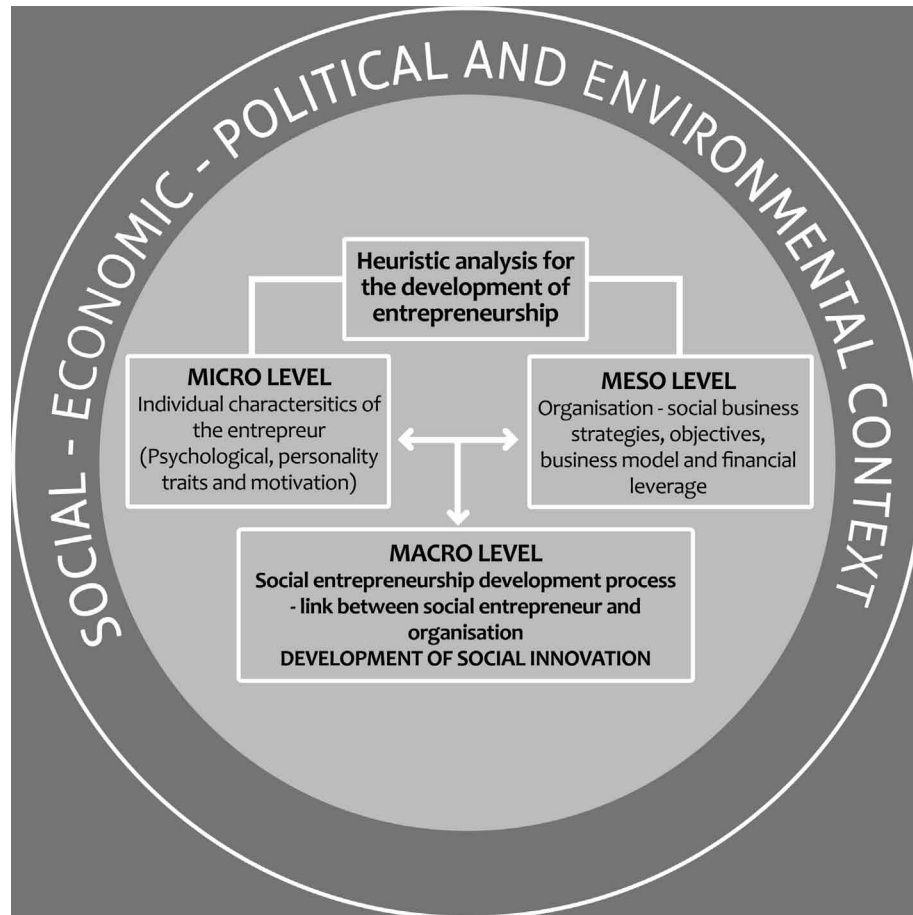
Social Entrepreneurial Ecosystem

The formation of a social entrepreneurial ecosystem is recognized as a fundamental activity that can affect start-up, growth and the long-term sustainability of any social enterprise as contribute to social welfare, community revitalization and economic development. Figure 1 shows a heuristic analysis for the development of social entrepreneurship which comprises an outer frame, namely the political, social, environmental and economic context, which includes features such as investment, legal framework, networks, public awareness and government support, allocation of resources, academic research, technological development, innovation, amongst other features. At the micro level the social entrepreneur is represented with all the accompanying psychological characteristics, personality traits, skills, motivation and points of view. At a meso level the organization is represented by aspects such as structure, strategy, objectives, business model and finance strategy. The convergence of these two levels materializes at a macro level where the social entrepreneurship initiatives develop and grow, together with the interactions

between the individual (social entrepreneur), the organization and the political, economic, environmental and social context. This heuristic analysis illustrates the way in which the micro and the meso level contribute to success on a macro level.

Figure 1. Heuristic analysis for the development of social entrepreneurship

Source: Cano et al., (2015) and literature review performed by the authors



Trends of Social Entrepreneurship

Currently, social entrepreneurship trends focus on the goals that have been highlighted by the 2030 United Nations agenda, namely the Sustainable Development Goals, particularly with regards to the social, environmental and economic dimensions and the importance of integrating business models that have an impact on the achievement of such goals. Hence, the trends can be related to the following five dimensions (United Nations, 2015):

1. **People:** this is related to both rights and welfare and includes poverty eradication, food security and nutrition, health and population dynamics, education and promotion of equality focused on gender equality and women's empowerment.

2. Prosperity: this includes employment opportunities and decent work for all, strong infrastructure, industrialization, sustainable consumption and production, sustainable cities and settlements and economic growth
3. Planet and environmental dimension, that includes climate change, marine resources, oceans and seas, energy, ecosystems and biodiversity.
4. Peace and political dimension that is related to peace building, reconciliation and reconstruction of the social fabric
5. Partnerships, which are related to building networks and connections to meet the sustainable development goals.

ISSUES AND CHALLENGES

Even though, social entrepreneurship has grown worldwide, some issues and challenges have arisen. Some of them are briefly described below:

Research data: the accuracy and validity of the data that shows the roots or causes of the social problem, together with the adequacy of the initiatives that are being developed in terms of human rights satisfaction and the fulfillment of needs of the beneficiary communities, the government and the social enterprises.

Financial strategies: financial leverage is key for any entrepreneurial initiative. Given the increase in social ones, international cooperation can be a good source. A crowd funding strategy could also be considered. Gierczak et al. (2015), mentions that crowd funding has gained a lot of attention recently due to the all the internet-based platforms that offer opportunities to raise money donated by all kinds of interested parties. The long-term viability and endurance depends on the relationships built with diverse stakeholders or crowd funders and the adequate distribution of resources. Self-sustainability throughout time is also an important issue to consider, hence social entrepreneurship need to seek innovative financial support in order to carryout their activities and social mission.

- Regulations– Tax and legal regulations regarding social entrepreneurships are not well defined. Rewards should be put in place for businesses that are driven by a social mission, as well as businesses that work with social enterprises under the principle of joint- responsibility.
- Public investment – Governments need to commit to improving social standards worldwide by investing in infrastructure, innovation and productivity; this has been clearly highlighted in the Sustainable Development Goals. It also includes generating a socio-political, economic and environmental ecosystem that values high-impact social entrepreneurship initiatives from local to global levels.
- Public awareness – All levels of education (from primary to higher and vocational education) should include basic concepts related to social entrepreneurship, as well as the development of specific social entrepreneurships skills in students. This includes leadership, effective communication, conflict resolution and teamwork. This will not only increase the value of socially oriented initiatives in society, but also encourage individuals to become socially conscious and develop their own innovative ideas as to create lasting social change.

Measuring impact – Social entrepreneurs have contributed to tackling social problems worldwide. However, in most cases, indicators are not established and impact is difficult to measure, making it difficult to get financial support from donors, private organizations, and banks, amongst others.

SOLUTIONS AND RECOMMENDATIONS

Social entrepreneurship is an activity that has been researched by different actors, including academics, the entrepreneurial ecosystem, NGO's and government agencies worldwide. However, a lot still remains to be done in order to measure its impact on society's well being, not just from the receiver point of view, but also from the entrepreneurs themselves from a psychological, sociological and philosophical point of view. Likewise, according to the Skoll Foundation it necessary to create social-financial models that can permanently shift the social and economic equilibrium of the beneficiaries and through this be able to reach all the economic agents involved including customers, banks, government agencies etc. who could develop portfolios that address financial difficulties (Martin & Osberg, 2015). This includes not only government grants and subsidies, but sources of finance through philanthropy, cooperatives, investors, civilian initiatives, crowd funding and corporate social responsibility schemes from profit enterprises and private entities.

At the same time, governments could provide subsidies to companies if they engage in supporting social entrepreneurship initiatives through their corporate social responsibility programs, as they are oriented towards society in general and in particular to the creation of social value. As stated by Porter & Kramer (2011) by associating with social entrepreneurs, companies not only fulfill expectation of corporate social responsibility, but they can also improve their reputation, creating strategic corporate social responsibility.

It is also considered important to empower local actors so that all their ideas can contribute to solving social problems. It is well known that often individuals might have innovative ideas, but these are never followed up due to economic, political or motivational constraints. Hence, it is advisable to seek support from the entire social entrepreneurial ecosystem (public, private, and nonprofit sectors) in order to develop those ideas. Simultaneously, the ecosystem needs to be more entrepreneur-friendly, provide support and advice to all actors and include the use of technologies to boost social entrepreneurship initiatives.

FUTURE RESEARCH DIRECTIONS

Social entrepreneurship is sometimes presented as an individually focused activity, which is performed by one person. However, social entrepreneurship is highly affected by the social, cultural, environmental and political context, together with the ecosystem around it, which supports it; with this in mind, further research is needed as to understand the influence of these factors on the development of social entrepreneurship in each country, at a local, regional and national level. Likewise, research is needed in order to find out why social entrepreneurship is still highly gendered and the ways in which more women, particularly those from developing countries, could receive support in order for them to contribute with innovative solutions. This is considered relevant given the UN development objectives, which address gender equality and sustainability.

Furthermore, it is clear that both entrepreneurship schools of thought are different in the sense that the School of Social Enterprise, focuses on the management of the organization and its social component, whilst the Social Innovation School focuses on the ideas to solve societies' problems in an innovative manner. However, these schools need to be further researched in the light of the socio-political events that are taking place in each country and/or continent. For example, at the moment, Latin American social entrepreneurship is rising, but the theoretical frameworks are still European and American based. Finally, research about the ways in which social entrepreneurship could be taught is needed, both at an

academic level and a practical level. This could foster innovative problem-solving skills in the population and could contribute to development and sustainability worldwide.

CONCLUSION

Social entrepreneurs seek innovative ways of creating social value and finding solutions to pressing problems such as poverty, environmental destruction, unequal access to education and unsustainable living, among others. Their reach also goes as far as to encompass peace and justice. Here lies the fundamental difference between them and the traditional entrepreneur who seeks profit and economic value. Likewise, social entrepreneurship is aimed at solving social problems through organized business models and strategies as highlighted by the Social Enterprise School, or innovative ideas that lead to social transformation, based on the viewpoint of the Social Innovation School.

From a disciplinary perspective social entrepreneurship exists at the intersection of the economic, social, political and environmental context, which are undoubtedly in turmoil and in need of improvement. Social entrepreneurs are aware of these issues and find opportunities by including innovation and sustainability in their social projects. From a multidisciplinary perspective, all types of professionals should develop social entrepreneurship initiatives in order to achieve the sustainable development goals. Finally, for these initiatives to succeed, the relationships and alliances between the different actors need to be developed and strengthened worldwide. This includes government institutions, private sector, academic and research institutes, financial institutions and investors, NGO's, the market and the media. If all these actors work together, the quality of life of the entire population can significantly improve.

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KEY TERMS AND DEFINITIONS

Corporate Social Responsibility: Programs that are done by businesses in order to benefit society while boosting their own brands or services.

Entrepreneur: The person responsible for the management of an enterprise, usually with some element of risk and creative initiative.

Innovation: A new form of achieving or creating something.

Shared Value: A management strategy in which competitive advantage and social responsibility combine.

Social Innovation: The process of developing and implementing innovative solutions to social and environmental issues.

Sustainability: The concept of continual viability, including the avoidance of the depletion of natural resources in order to maintain an ecological balance.

Sustainable: Something that continues to be viable.

Entrepreneurial Personality: To Be or Not to Be an Entrepreneur

9

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INTRODUCTION

Entrepreneurship has always been present in the course of human history, due to its inherent nature to create. In recent decades, this concept has become highly important, given the need to overcome constant and growing economic problems in different societies. Today, we can say that entrepreneurship is so essential and ingrained that it has itself become a culture: a way of thinking and acting oriented towards the creation of wealth through exploiting opportunities, the development of a global vision, balanced leadership, and taking calculated risks, whose result is the creation of value that benefits entrepreneurs, its enterprise, the economy and overall society.

Even so, many academics still ask, implicitly or explicitly, why we should study entrepreneurship. There are multiple ways to answer this question, and we synthesize them from three different perspectives: economic, social and academic. The Global Entrepreneurship Monitor (GEM) describes entrepreneurship as an increasing “world-wide phenomenon”. In the 90’s, an important business creation activity was developed, mainly in transitional economies, where the activity of the private sector was relatively new. Around the world, 9 out of 100 people of working age are involved in business activities, with approximately 300 million in the phase of creating a business venture. Due to this, the generation from the 21st century’s has also been labeled as *Generation E*, the most entrepreneurial since the Industrial Revolution (Kuratko, 2003).

Entrepreneurship is also an important source of employment for women, and there has been significant worldwide growth in women’s self-employment (Langan-Fox, 2005). A dominant trend in the 21st century is likely to be ethnic entrepreneurship, due to the free market, less restraining in the flow of people, and infrastructure development (Morris, Schindehutte, & Lesser, 2002).

Entrepreneurship can also greatly contribute in reducing poverty. Increasing the number and quality of entrepreneurs and business is probably one of the most useful ways to reduce poverty, since it creates employment, as well increases innovation and economic empowerment of people in low development countries with high unemployment rates. (Pick & Sirkin, 2010). These countries political systems are increasingly recognizing this, and have introduced several top-down programs to facilitate the creation of new businesses. These essentially refer to changes in laws and regulations in order to make easier the design and operation of business. Bottom-up programs have also been launched in an attempt to support

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entrepreneurs with either financial resources (micro-credits) or increase knowledge about business. Specifically, approaches that involve the supply of financial resources have received wide attention. Within the microcredit community, influential people, such as Nobel Prize winner Muhammad Yunus (Yunus, 1999), have argued that the provision of microcredit is enough to lift people out of poverty, but does not go beyond the training required to improve entrepreneurial skills. Although both, government programs and microloans for the low or no-income individuals are necessary, these institutional and economic strategies have often failed because they do not pay enough attention to the psychological dimensions of entrepreneurship (Chliova, Brinckmann, & Rosenbusch, 2015).

In summary, entrepreneurial activity represents one of the most important engines of economic growth, being the power behind the creation of any new company, growth of existing ones, and to a large extent, creation of employment. *Entrepreneurship has come to be perceived as an engine of economic and social development throughout the World*, or as Lazear (2002) states, “*the entrepreneur is the single most important player in a modern economy*” (p.1).

Additional to this economic and social interest, we must add those reflected by the academic field. Since the first course in entrepreneurship offered in 1947 by Myles Mace at the Harvard Business School, numerous historical events have solidified it as a growing interest. For example: the *First Conference on Small Business* at St. Gallen University in Switzerland, in 1948, and the *First Academic Conference on Entrepreneurship* that took place at Purdue in 1970. In 1974, at the Annual Meeting of the Academy, the *Interest Group on Entrepreneurship* was formed, and in 1987, the Entrepreneurship Division of the Academy of Management was formed. The first conference on “The State of the Art”, took place at Baylor University in 1980, which led to the publication of the *Encyclopedia of Entrepreneurship*, in 1982, the first of six volumes published to date. These events were followed by the publication of specific journals in the field: *Journal of Small Business Management* in 1963, *The American Journal of Small Business* in 1975, which would later be called *Entrepreneurship: Theory and Practice*, *Journal of Business Venturing* in 1985, *Entrepreneurship and Regional Development* in 1989, and so on. This explosion of events has not been matched, at least as we would like, by the dedication from the professorship into teaching and researching this field. The number of professors capable of devoting all their energy to teaching and research in this area continues to be limited, even though the prospects are good, given the increase in the course offerings on entrepreneurship at universities; from the 10 courses that were estimated in 1967, to the 1064 courses that are estimated nowadays.

To this day, we can affirm that this field of study no longer qualifies as emergent; it is no longer a promise, but a reality, a reality which is greatly established (Fayolle & Riot, 2016). Entrepreneurship is, therefore, a rapidly growing field of knowledge that is achieving better and greater social and scientific recognition.

BACKGROUND

Personality as a Determining Factor for Opportunity Development

There is a broad consensus, both in literature and practice, about the sequence on the process of creating business. This process begins by (1) recognizing an opportunity, which leads to (2) carry out a rigorous analysis of it, and ultimately results in (3) a business plan that gets implemented.

Opportunity recognition is understood as a process or processes through which individuals identify an opportunity. In this way, *recognition* constitutes a conceptually different stage from *exploiting* an op-

portunity. More specifically, opportunity recognition includes three different processes (Ardichvili *et al.*, 2003): perception, discovery, and creation of a business concept. These sub-processes are accompanied by a continuous assessment, that allows the entrepreneur to question and value the opportunities in the different stages of the process.

In its beginnings, research on entrepreneurship was developed mainly on the basis of Economic Theories, dominated by the approaches given by Schumpeter (1934) and Kirzner (1973). However, the economic approach has limitations when it comes to explaining the human and social process that accompanies entrepreneurial activity. In this regard, Zahra *et al.* (2005) points out that the psychological approach can eliminate some of established ideas about the ways in which entrepreneurs make decisions, by sustaining its analysis in both, the rational and non-rational elements that determine decision-making processes. This cognitive approach has its roots in psychology and sociology, which provide important new contributions to the understanding of entrepreneurial behavior.

The *psychological approach* has shown that internal attributes of an individual are stable, and that they differ between people. With this approach, and based on the work of recent authors, such as Ardichvili *et al.*, (2003) or Zahra *et al.* (2005), we can argue that the *recognition and exploitation of business opportunities depends on the existence of individuals who possess certain personality traits* that, combined with their own personal or social circumstances, lead to the formation new enterprises.

This approach takes into account the importance of the personality of an entrepreneur in this process, which allows us to map a set of characteristics that differentiate them from those who are not entrepreneurs. The main attributes discussed in this approach -with the exception of the demographic characteristics of individuals, such as sex, age or nationality- are (and among the most frequently accepted): creativity, optimism, self-efficacy, propensity to take risks, need for achievement, and locus of control. Although some of these, as an “entrepreneur” trait, have been questioned, much of the literature has actually converged in their conclusions on these variables and the entrepreneur profile (Thomas & Mueller, 2000).

While it is true that the relationships between personality traits and entrepreneurial behavior are frequently studied and analyzed in research, there is nonetheless certain skepticism as well about the intensity of this relationship among scholars. Although some reviews in this regard conclude on the existence of a positive relationship (Rauch & Frese, 2000), other reviews conclude that there is no such relationship (Brockhaus & Horwitz, 1986; Gartner, 1989; Low & MacMillan, 1988).

In this regard, we would like to point out that the meta-analyses done actually provide evidence of the predictive validity of personality traits in entrepreneurial behavior (Brandstätter, 2010, Collins, *et al.*, 2004, Gorgievski & Stephan, 2016, Rauch & Frese, 2007; Stewart & Roth, 2001, 2004, Zhao & Seibert, 2006; Zhao, Seibert, & Lumpkin, 2010) and suggest the analysis of contingencies that may impact on the size of this relationship.

That said, the next step is to ask: which are these personality traits? The number of traits associated to entrepreneurs that can be found just by looking at the literature is actually *huge*. For example, Hornaday (1982) listed 42 traits related to entrepreneurs. Rauch and Freese (2007) found 51 different traits in the 104 articles included in their meta-analysis. As we can see, there are so many that, at some point, it becomes reasonable to doubt if there actually exists such a being. Scientifically-wise, it does not make sense to consider those with weak empirical support, however. Out of the 51 traits identified by Rauch and Freese (2007), only 11 were actually found to be related, or highly related, to entrepreneurship.

Fortunately, literature has begun to converge a certain group of traits which, to a greater or lesser extent, many researchers seem to agree with. Considering the works of different authors (e.g. Filion, 2003, Vecchio, 2003) and the traits common to these works, we can state that the main traits of the entrepreneurial personality are: Locus of Control, Self-efficacy, Risk Taking and Proactivity. Other works have also confirmed this relation (Sánchez, 2005, Sanchez, 2010).

Locus of Control

Relates to the belief that one's actions determine the outcomes obtained by it –internal locus of control-. People with a high internal locus of control think that they are able to control results, meaning they will devote more effort and persistence towards these, which, in turn, would help in venture creation and its success. Conversely, people with external locus of control can be more passive. If one thinks of oneself incapable of controlling outcomes, there is no reason to actively change the environment and start a business. Korunka, Frank, Lueger and Mugler (2003) found, in a sample of nascent entrepreneurs, that locus of control was related to other traits, such as need for achievement and personal initiatives. Filion (2003) states that internal locus of control is a trait frequently attributed to entrepreneurs, although not exclusive, given that it is also found in successful people, whether they are entrepreneurs or not. Lastly, it should be noted that this trait can be learned, as some authors have pointed out (Hansermark, 2003).

Self-Efficacy

Self-efficacy refers to one's own conviction of capability to effectively organize and execute actions for any required result (Bandura, 1997, Chen, Greene, & Crick, 1998). In other words, self-efficacy is an attribution of personal competence and control in a given situation, and reflects the perception of one's personal capacity to perform a specific job or task. This attitude affects choice of action, as well the amount of effort given to it. It also is the main predictor for occupational choice. The relationship between self-efficacy and entrepreneurship is reasoned because: first, people avoid careers and environments that they believe exceed their abilities, hence, choose those for which they judge themselves capable (Krueger & Dickson, 1994). Second, because entrepreneurship entails significant risks and difficulties, such that entrepreneurs need, by default, high levels of self-efficacy. Third, given that self-efficacy predicts career interest and choice; perseverance when facing difficulties, as well personal effectiveness (Waung, 1995), it must also be related to entrepreneurship. Lastly, since incentive to act is greater when entrepreneurs believe that their actions will have achievable results, self-efficacy becomes a crucial determinant for their successful entrepreneurial endeavors (Sánchez *et al.*, 2005). Based on this type of reasoning, several authors have shown that self-efficacy is a distinctive attribute of entrepreneurs when compared to other business positions, or the general population (Markman & Baron, 2003). Likewise, other empirical studies have linked self-efficacy to entrepreneurial, personal and financial success, measured generally by annual earnings.

Risk Propensity

This is defined as a personality trait that determines a tendency and disposition of individuals to take risks. Individuals with high scores in this dimension will have a propensity for high-risk behaviors; that is, they're willing to consider alternatives whose end result may drift from their framework of expectations. On the other hand, subjects with low risk propensity will tend to be low risk takers, and will avoid alternatives that may lead to results that vary greatly from the ones expected. The concept of risk propensity has been related to entrepreneurship; it is obvious that entrepreneurial activity implies, by definition, taking risks of some kind. Following Covin and Slevin (1989), risk taking propensity is, along with proactivity and innovation, one of the three dimensions of the so-called entrepreneurial orientation. In this framework, risk propensity refers to the willingness of a person to commit acting on opportunities even when they are likely to fail.

Proactiveness

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This refers to the tendency to initiate and maintain actions that directly alter the surrounding environment. Proactive people identify opportunities and act on them; they show initiative, carry out direct actions and persevere on it until they achieve a significant change. In contrast, people who aren't proactive fail to identify and act on these opportunities. Proactivity implies an emphasis on anticipating and preventing problems before they occur, and an orientation for action that includes interpreting norms in a creative fashion, and having high level of persistence and patience in order to achieve the desired change. Proactivity is another of the indispensable dimensions that Covin and Slevin (1989) include in the so-called entrepreneurial orientation, referring to it a necessary factor to achieve entrepreneurial behavior, which implies perseverance, adaptability and willingness to take responsibility for failure. Proactive enterprises are those that are more likely to seek opportunities in the external environment. As for established firms, the majority of research has referred to two attributes that stem from pro-activeness: an aggressive behavior towards other firms, and the search for favorable business opportunities, finding that both are greater in the case of entrepreneurial firms. In other studies, the relationship between having a proactive attitude and entrepreneurial behavior has been found, both, in established entrepreneurs and the general population (Becherer & Mauer, 1999). Lastly, there is also evidence of a relationship between proactivity (in the context of entrepreneurial orientation) and business development (Junehed & Davidsson, 1998), as well career success (Seibert, Kraimer, & Crant, 2001). Shapero (1982) has suggested that this personal propensity to act on opportunities is one of the factors that affects the intention-behavior relationship, by either hindering or facilitating the development of these intentions. Specifically for entrepreneurship, Crant (1996) found that entrepreneurial intentions were positively related with having a proactive attitude. Likewise, this type of personality orientation has been referred in the literature (Shapero, 1982) as an important precursor of intentions and entrepreneurial potential.

Different works have also highlighted the importance of these variables in entrepreneurship (Sánchez *et al.*, 2005, Sánchez *et al.*, 2014. Sánchez & Hernández-Sánchez, 2014, among others), as well as its importance as a predictor of entrepreneurial intention (Sánchez *et al.*, 2005).

Differences in these traits has also been examined considering gender in developing entrepreneurial intentions (Sánchez *et al.*, 2007; Sánchez *et al.*, 2008; Sánchez and Licciardello, 2012; Sánchez & Hernández -Sánchez, 2014). For example, in Sánchez *et al.* (2007), differences were found between men and women within their considered variables, as well as their intentions for business, however, these weren't fully reproduced in Sánchez & Hernández-Sánchez (2014) where gender differences were found in self-efficacy. This finding is consistent with previous studies (Costa, Terracciano & McCrae, 2001) that support the idea that women show, in general, predominantly communal / expressive traits, while men score higher in egocentric / instrumental traits. On the other hand, they also suggest that gender stereotypes are widely established in culture, in the sense that the process of socialization promotes the development of certain egocentric features, such as business self-efficacy, to a greater extent in men than in women.

In summary, these results are in line with the predictions proposed by the double-impact model of gender (Abele, 2000), in reference to the effect of gender roles and stereotypes in the development of certain psychological characteristics that play a role in career choice. In our case, we have found that gender moderates the effect of self-efficacy in entrepreneurial intentions, where men feel more capable to start a business, and are more likely to do so than women.

These results can also be explained from a person-organization adjustment perspective, that is, we can explain the development of business intentions as a result of an agreement between the personal

characteristics of an individual and the requirements for its creation. People who show certain entrepreneurial traits, such as self-efficacy, will be more likely to choose a business career. Given that these results suggest that men are higher in this trait than women, we can explain some of the low participation of women in business initiatives due to a maladjustment between their personal traits to the qualities required to create a business.

Contrary to expectations, results have not been able to show the existence of gender differences in other business features, specifically, locus of control, risk propensity, and proactivity. For example, Cromie (1987) found no significant differences between men and women in dimensions strongly related to the entrepreneurial process, such as the need for achievement, locus of control, primacy of companies, trust, independence and planning. Therefore, this study joins previous literature that offers only partial support for gender differences in certain psychological dimensions.

Broad Personality Traits

There is a body of work (Brandstätter, 2011; Obschonka *et al.*, 2013; Zhao *et al.*, 2010) that defends the study of entrepreneurial characteristics using the Big Five personality traits model (extraversion, conscientiousness, openness, agreeableness, and neuroticism). These have a genetic basis, and are relatively stable throughout life, suggesting that biological factors are also important in entrepreneurship. This is supported by genetic studies that show that entrepreneurship has an important biological relationship (Nicolaou *et al.*, 2008), which can be explained, at least in part, by the mediating mechanisms of these Big Five traits (Shane *et al.*, 2010). Hence, to understand the personality of the entrepreneur, it is necessary to take into account the biological foundations of personality, as is the case of the Big Five.

Studies have analyzed each of these five traits both, jointly and isolation, and their effects on entrepreneurship. Both approaches can help to understand personality and its effect on entrepreneurship, although if one really wants to understand the individual as a coherent whole, it is more fruitful to consider these traits within the individual using a holistic approach. Research has found entrepreneurs scores high on extraversion, conscientiousness, and openness; while low scores on agreeableness and neuroticism (Zhao and Seibert 2006, Zhao *et al.*, 2010). This broader profile predicts entrepreneurial behavior in a more consistent and robust way than the simple model of the Big (Obschonka *et al.*, 2013, 2014). Other research has pointed out the importance of these traits to predict business behavior and intentions, attitudes, beliefs of control, skills and social capital (Arnaud 2011, Obschonka *et al.* 2016a, b, Stuetzer *et al.* 2013, for an overview of the studies see also Obschonka *et al.*, 2013). Other research shows how these Big Five can help explain a) gender differences in entrepreneurship (Obschonka *et al.*, 2014), b) regional differences (Audretsch *et al.* 2016, Obschonka *et al.* 2013), c) differences in regional economic growth (Stuetzer *et al.*, 2016b), etc.

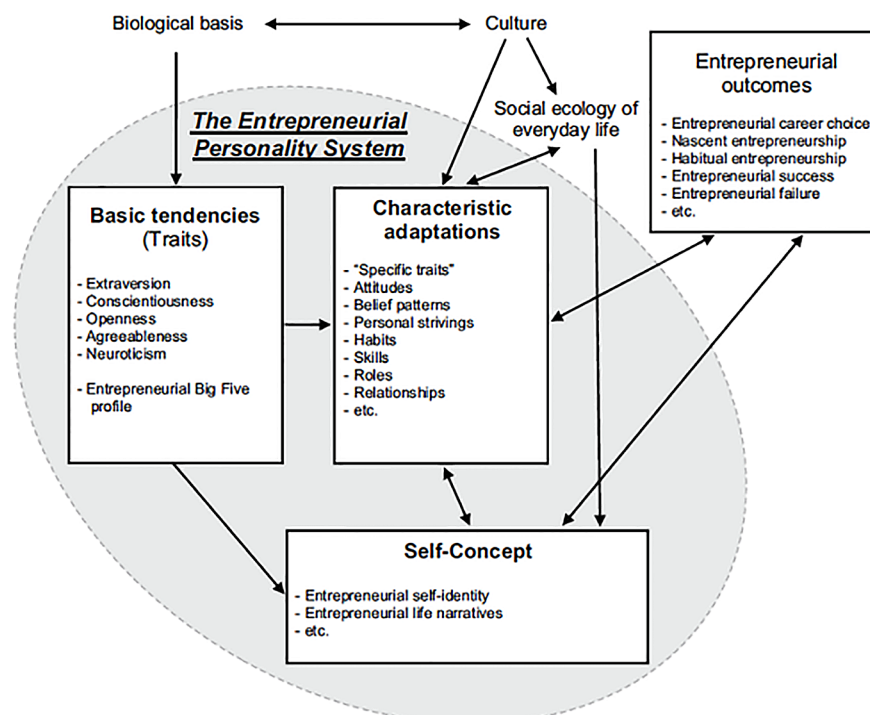
Rauch & Frese (2005) conducted a meta-analysis and found that broad, general personality traits (such as Big Five) were significantly related to entrepreneurial success ($r = .151$), although this relationship is smaller when considering specific traits, where $r = .231$. These differences between specific features and general features are more pronounced when we consider business creation, where general personality measures are not significantly related, while the specific measures are ($r = .244$).

This differentiation between general or distal traits and specific or proximal traits gives rise to two important issues. First, research that focuses on specific traits can provide lines of intervention to improve the entrepreneur mind. For example, some educational programs aim to promote these specific traits, such as self-efficacy and risk-taking propensity, in order to promote entrepreneurial behavior (Sánchez, 2011). Second, to what extent these more specific, concrete personality characteristics can be defined

as personality “traits”, when traits are conceptualized as relatively stable personality characteristics, as in the case of the Big Five. Perhaps it would be more correct to define these specific traits as attitudes and belief patterns using the term “traits” exclusively for the level of the Big Five.

Obschonka & Stuetzer (2017) applied the *FFT Personality System* model by McCrae & Costa (2008) specifically for the purpose of measuring an entrepreneurial personality, where personality is considered as a system. The result of this application was called the EPS model (Entrepreneurial Personality System). From this model, these authors try to integrate the general personality traits, or basic tendencies, with the “specific features” of personality (Figure 1). These authors found a positive relationship between the entrepreneurial Big Five profile and each of the characteristic entrepreneurial adaptations studied.

Figure 1. Relationships between specific and basic traits. Adapted from the *Entrepreneurial Personality System Model Personality System (EPS)* (Obschonka & Stuetzer, 2017)



The Cognitive Approach, Complement To Personality Traits

Personality research has been complemented with cognitive approaches as well (Mathews, 2018; Sánchez *et al.*, 2011, Sánchez, 2012, 2014). Regarding the study entrepreneurship, this approach arises as a response to the limitations of the traits' orientation. Its objective is to explain entrepreneurial behavior through cognition. Understanding the entrepreneurial thinking represents a fertile field of research that has not been well exploited.

The cognitive approach is characterized by the study of certain types of cognitions that could explain aspects such as: what defines and differentiates an entrepreneur, their behavior and success in business, among others. Researchers who use this approach believe that cognitive aspects are the elements that differentiate entrepreneurs from non-entrepreneurs, which range from beliefs to their values, cognitive styles and mental processes.

In the last decade, Cognitive Psychology has made important contributions to the field of entrepreneurship. It has studied aspects such as the cognitive styles of the entrepreneur (Boucknooghe *et al.*, 2005), entrepreneurial self-efficacy (Markman, Baron & Balkin, 2005, Oliveira, Garrido, & Sánchez, 2005), heuristics in decision-making (Mittchel, *et al.*, 2007, Tversky & Khaneman, 1973), even structures of knowledge that the entrepreneurs have about enterprising itself, the so-called scripts (Mitchell *et al.*, 2000, Smith *et al.*, 2009), etc. Knowing the mechanisms behind these cognitive elements has facilitated the task of understanding how entrepreneurs perceive and interpret information, and how they use it to start and have a successful business.

Multiple studies have highlighted the role of scripts, self-efficacy, thinking styles and heuristics in the action of start-ups. In Sánchez *et al.*, (2011) the most relevant contributions of cognitive psychology to the field of entrepreneurship are reviewed and pointed out, as well as some of the limitations and new lines of research.

In a later work, Sánchez (2014) analyzed the differences of cognitive skills in entrepreneurs from multiple levels of success with respect to their own perceived success and company growth. Their results confirm that entrepreneurs with high scores in cognitive scripts have higher levels of perceived success than entrepreneurs with low scores in cognitive scripts.

One of the most developed and successful cognitive constructs is metacognition. In the words of Schraw and Dennison (1994), *metacognition* refers to the ability to understand, control and reflect on one's own learning. It is a cognitive process of a higher order that allows to organize what individuals know about themselves, that is, about their own learning and knowledge, but also about other people (perceptions about how people think), tasks (the nature of the information acquired when performing a task), situations and the changing environment (how the information is used in various contexts); and strategy (procedures to ensure that it is adequate to achieve the desired goal), in a way that facilitates dynamic and effective cognitive functioning.

In this way, this ability to understand, control and reflect on one's learning has a relevant weight in decision-making, as it allows the subject to identify possible alternatives to carry out a task or solve a problem, thus, to make a decision according to their own motivations and the context in which they are immersed (Glasspool & Fox, 2005, Higham & Gerrard, 2005).

Several authors point out that metacognitive capacity begins to develop at a very early age, rapidly increasing during childhood and adolescence, that is, as people get older, the accuracy of the metacognitive processes also increases, becoming a key element in the processing of information in adulthood (Koriat & Shitzer Reichert, 2002). This ability varies by individuals, and there is no empirical evidence to suggest that metacognition can be developed through training (Schmidt & Ford, 2003).

Haynie (2005) expanded the concept of metacognition, adding processes of higher order, such as metacognitive awareness. The awareness that the person has about having this skill works as an important strategy for successfully dealing with different situations, since consciousness allows people to plan, sequence and follow their learning in a way that directly improves performance.

A product of metacognition is the capacity for cognitive adaptation, understood as the ability to evolve or adapt decision-making processes in an adequate and effective way, based on feedback from the context (inputs) in which cognitive processing is involved (Haynie & Sheperd, 2009). This ability

is possible through the development of strategies that serve to promote the process of thinking about thoughts, or more precisely, metacognition.

As for entrepreneurship, cognitive adaptation is a key competence. For this reason, researchers in this field are making an effort to develop instruments that measure this ability in a way that allows us to predict success in making decisions at new learning situations for business creation (Haynie, Shepherd & Patzelt, 2010).

Haynie et al (2010) conceptualize and measure cognitive adaptability as the aggregate of five theoretical metacognitive dimensions: goal orientation, metacognitive experience, metacognitive control and supervision. The main assumption is that metacognitive awareness represents a bridge to cognitive adaptability and is based on the following logic: people perceive, and subsequently assign meaning to the characteristics of the environment in the context of their own objectives. Afterwards, they add that information to their metacognitive knowledge and metacognitive experiences to generate multiple decision-making structures focused on interpreting, planning, and implementing objectives to manage a changing environment. From this set of structures, the subject selects one and carries it out (metacognitive control) eliciting some result (cognitive and / or behavioral). These results are related to the objectives of the individual, who will use review mechanisms to generate and select new decision-making contexts depending on the new circumstances.

These authors defend that metacognition represents the cognitive basis of entrepreneurial thinking, and that people who make decisions under metacognitive processes are more aware that each specific situation can be analyzed from different points of view and, therefore, that different alternatives should be considered, as well take into account feedback for future decisions. Thus, the more metacognition the person has, the more adaptive it's response in a changing environment.

As indicated by Haynie *et al.*, (2010), most of the studies on business success have focused on understanding how “success” itself comes to happen its background, especially, its relation with prior knowledge that entrepreneurs have about the business sphere, showing how business failure relates to lack of prior knowledge, or how people with no experience detect less business opportunities. Thus, while much research has been done on the influence of prior knowledge on business success, very little has been studied about the abilities and skills of people, which could dampen the negative consequences that come from this lack of knowledge. Among these capabilities, these authors highlight the capacity for cognitive adaptation.

Taking as key competence the ability to detect and adapt to uncertainty through the use of business knowledge, but that many people have little previous knowledge about business, Haynie *et al.* (2010) used MAC to study the role of metacognitive ability and feedback in the successful completion of an entrepreneurial task by people who have no previous experience in entrepreneurship. They found that metacognitive ability helps explain why some inexperienced people in the entrepreneurial process are more able to use feedback than others to appropriately adapt their decision-making processes, consistently with the decision-making process of a sample of entrepreneurial experts.

FUTURE RESEARCH DIRECTIONS

Entrepreneurship activity represents one of the most important aspects of a country's economic growth, and people who do these types of activities seem to have certain personality traits that differentiate them from other people. In general, the meta-analyzes carried out on entrepreneurship and personality make this clear, and not without certain nuances, which we will detail below.

Differentiating between specific and general personality traits can be useful to clarify the relationship between personality and entrepreneurship. Specific traits have a higher relation with the creation and success of business than more general traits.

A greater adjustment between dependent and independent variables may be useful to clarify the relationship between personality and entrepreneurship. Correlations increase if the dependent variable is highly relevant for the independent variable, and it suggests developing different hypotheses in the relationship between specific traits with specific dependent variables. For example, the need for autonomy may be more related to survival than to growth.

It is also important to consider other issues of interest such as: the level of analysis (for example, personality is usually assessed by analyzing at the individual level, while success at the company level), possible mediators or moderators in the personality-entrepreneurship relationship (general personality traits, for example the Big Five, are not directly related to success, but mediated by processes, such as motivations, cognitions, etc.), the methodological quality of research, more longitudinal studies, and other personal and non-personal (i.e. external) variables, such as cognitive ability, strategies, environment, etc. A configurational approach can be useful to explain the specific and general entrepreneurial personality structures and in this way contribute to a better understanding of the construct and improve its predictive power.

CONCLUSION

In short, the study of entrepreneurs' personality is a topic of great scientific interest, given that the influence of these traits may be stronger in this population than in other professions, as the entrepreneurial role provides, a priori, more freedom to choose and change the environment, as well to act according to personal preferences and goals.

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KEY TERMS AND DEFINITIONS

Agreeableness (Friendly/Compassionate vs. Challenging/Detached): Tendency to be compassionate and cooperative rather than suspicious and antagonistic towards others. It is also a measure of one's trusting and helpful nature, and whether a person is generally well-tempered or not.

Conscientiousness (Efficient/Organized vs. Easy-Going/Careless): Tendency to be organized and dependable, show self-discipline, act dutifully, aim for achievement, and prefer planned rather than spontaneous behavior.

Extraversion (Outgoing/Energetic vs. Solitary/Reserved): Energetic, surgency, assertiveness, sociability, and the tendency to seek stimulation in the company of others, and talkativeness. High extraversion is often perceived as attention-seeking and domineering. Low extraversion causes a reserved, reflective personality, which can be perceived as aloof or self-absorbed. Extroverted people may appear more dominant in social settings, as opposed to introverted people in this setting.

Locus of Control: The degree to which people believe that they have control over the outcome of events in their lives, as opposed to external forces beyond their control.

Neuroticism: Is one of the Big Five higher-order personality traits in the study of psychology. Individuals who score high on neuroticism are more likely than average to be moody and to experience such feelings as anxiety, worry, fear, anger, frustration, envy, jealousy, guilt, depressed mood, and loneliness.

Personality: Pattern of attitudes, thoughts, feelings, and behavioral repertoire that characterizes a person, and that has a certain persistence and stability throughout his life, so that the manifestations of this pattern in different situations have some degree of predictability.

Self-Efficacy: Is an individual's belief in their innate ability to achieve goals. Albert Bandura defines it as a personal judgement of "how well one can execute courses of action required to deal with prospective situations"

Entrepreneurial Education

9

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INTRODUCTION

The entrepreneurial spirit is an essential ingredient for guiding the economy onto paths of sustained competitive growth. To understand the relationship between entrepreneurship and economic growth, it can be useful to refer to the Schumpeterian concept of “creative destruction”. According to this concept, development is driven by the disruptive action of entrepreneurs who introduce innovations with the potential to transform the rules of the game and replace existing firms in the industry, even transforming the industry itself (Richardson, 2004).

The Green Paper on Entrepreneurship in Europe (European Commission, 2003) marked the crucial point when the European Commission began to highlight the importance of business and entrepreneurship in developing a more dynamic and competitive Europe. Based on Eurostat data from 2009, the European Commission estimated that new companies (mainly SMEs) created more than four million jobs a year in Europe (European Commission, 2013: 4). Since then, entrepreneurial creativity and new entrepreneurial initiatives have been considered as a crucial factor in boosting job creation (European Commission, 2013, 2016). Along the same lines, the White Paper titled Embracing Innovation: Entrepreneurship and American Economic Growth (NCOE, 2001) reported that 350,000 fast-growing firms accounted for the creation of two-thirds of all new jobs between 1993 and 1996. A study from the US Census Bureau (Business Dynamics statistics) (Haltiwanger, Jarmin & Miranda, 2009) estimated that without the jobs created by new companies, the average net growth of employment would have been negative in the United States during the Period 1980-2005.

The Green Paper (European Commission, 2003:8-9) noted additional benefits of entrepreneurship: wealth creation; economic growth; fostering economic and social cohesion; boosting business competitiveness, productivity and the overall competitiveness of the economy (by incentivizing greater competition, which should encourage innovation); maximizing personal potential; helping to solve social and environmental problems; and contributing to the development of social economy and social innovation.

The entrepreneurial spirit is also a quality that endows people with greater creative and innovative capacity. Gerber (1997) emphasized that entrepreneurial activity converts any situation into an exceptional opportunity, defining the entrepreneur as a visionary. Therefore, entrepreneurship is an attribute to be developed in order to promote progress towards a knowledge economy. It is also an essential component of the systemic response required of people and organizations in order to adapt to uncertain and complex future environments (Stevenson, 2004, Gibb, 2007).

However, starting up new companies or managing them in such a way as to ensure accelerated growth are in no way easy tasks. They require uncommon specific attitudes (such as positive risk confrontation or creative guidance) and skills and knowledge that are difficult to develop simply through the type of classroom study that does not involve active and participatory learning processes. In other words, the entrepreneur must possess a series of competences to be able to carry out his/her responsibilities successfully (Hisrich, Peters & Shepherd, 2005; Van Gelderen et al., 2008). Although many people believe that

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creating a new company is simply a matter of financial resources, or that we are all capable of becoming entrepreneurs, in reality it requires a wide range of financial and non-financial competences to create a viable, successful company, and most people lack such skills.

In light of the above, a series of innovative initiatives have been launched in European universities, mainly focused on sparking entrepreneurship among students and teaching the basics of how to channel the motivation for business creation (Coduras et al., 2008). The stock of aspiring entrepreneurs swells whenever a significant number of students take a special interest in gaining a complete and rigorous knowledge of economics, finance or business management, by choosing university studies focused on economic and business degrees or deciding to become self-employed through opening their own business.

However, there is a lively debate about the poor response to the growing awareness of the importance of entrepreneurial education (Matlay, 2005, Kirby, 2006, 2007, Duval-Couetil, 2013). Among the first disturbing reports was the one published in the United Kingdom by NCGE/Barclays Bank. Its conclusion was that students who wished to become entrepreneurs did not have a positive university experience; the percentage of students aspiring to be entrepreneurs fell between the first and last year of their studies (Gibb & Hannon, 2006).

Este artículo analiza qué se entiende por educación emprendedora, precisando la definición y el alcance del concepto. This article analyses what is meant by entrepreneurial education, specifying the definition and scope of the concept. El artículo también trata las competencias, actitudes y aptitudes que el emprendedor debe reunir. It also addresses the competences, attitudes and aptitudes that the entrepreneur must acquire. Por último, el análisis se extiende sobre los antecedentes, principios, modelos, experiencias y buenas prácticas que podrían inspirar la plena instauración de la educación emprendedora. Finally, the analysis covers the background, principles, models, experiences and best practices that could help to establish a comprehensive entrepreneurial education.

BACKGROUND

In spite of the potential for economic growth and improved social and individual welfare that entrepreneurship theoretically brings with it, the average citizen tends to lack entrepreneurial spirit and literacy in economics, finance or business management, with a consequent negative effect on business vocations. The Green Paper on Entrepreneurship in Europe (European Commission, 2003) and the Small Business Act for Europe have already highlighted, on the basis of Eurobarometer statistics, that Europeans prefer to be employed by others while in the United States they prefer to create their own business. Data from the period 2002-2012 indicate that 58% of the European population (EU 27) prefer to be employed by others, with a 9-point rise over the decade, compared to 37% that would like to be self-employed (a drop of 8 points over the same period). Europeans show significantly less entrepreneurial vocation than their counterparts in the United States, where the respective percentages are 46% and 51%, although there has also been a 4-point reduction in those preferring self-employment. The contrast is even greater with countries such as Turkey and Brazil, where 82% and 63% of the population, respectively, want to launch their own business.

Although the first entrepreneurial action tends to translate into the birth of a micro-enterprise, entrepreneurial capacity is also demonstrated in forging projects with high growth capacity, in which new production units quickly grow to medium or large dimensions, or are able to rapidly enter new markets. The entrepreneur is not always bounded by the glass ceiling that slows the development of nascent companies, meaning that in an entrepreneurial economy the average size of companies will be greater.

This is indicated by studies comparing Europe and Latin America (Hall & Jones, 1999), which find that European companies over 26 years old are 7 times bigger than companies under 6 years old, while Latin American companies only triple in size over the same period. Hsieh & Klenow (2014) report similar results for the comparison between U.S. and Mexican companies: U.S. companies that are over 40 years old have 8 times as many workers as companies that are less than 5 years old, whereas Mexican companies only double in size over the same age range.

The belief in the importance of entrepreneurship and entrepreneurial propensity in many countries has been weakened by numerous circumstances that limit the development of entrepreneurship and the resulting value-creating initiatives. The Green Paper on Entrepreneurship in Europe (European Commission, 2003) recognized a wide range of obstacles that made people more reluctant to start up new businesses, including financial ones. The main barriers, however, are institutional.

The current institutional framework, both formal (laws, norms and regulations) and informal (beliefs, attitudes and customs) provides incentives and opportunities that influence the behaviour of the different agents operating in the environment. Flawed regulatory design represents one barrier that should be removed in order to encourage entrepreneurial spirit. Small-scale entrepreneurs argue that the main obstacle to the creation and survival of their business is the cost entailed in fulfilling all the administrative requirements, which is disproportionately higher than the cost faced by larger companies.

But the institutional environment also defines, creates and limits aspirations, intentions and business opportunities, thus affecting the scope and speed of growth of entrepreneurial projects (Shane, 2003). The well-known study by Covin & Slevin (1989) pointed to the dominant social and cultural values in the country as a significant predictor of entrepreneurial intentions (explaining 7.5% of its variation). The first relevant attitudinal problem that hinders the entrepreneurial spirit is the image of the entrepreneur and the perception of the value of a business career. Even when it is accepted that companies are wealth generators, they tend to dissociate themselves from the entrepreneur who was the architect of their success and, therefore, deny entrepreneurs the recognition and social prestige they deserve.

Another attitudinal problem is that the unsuccessful entrepreneur is discredited by failure. It is not generally understood that an early failure is often the prelude to the success of a new entrepreneurial project. This is not an unusual situation: bankruptcy is the reason behind 15% of corporate closures and a decade ago, and therefore before the financial crisis, it already affected an average of 700,000 European SMEs annually, with 2.8 million workers.

This analysis suggests that the educational system cannot remain oblivious to the challenge of stimulating entrepreneurship. The main factor influencing the long-term development of entrepreneurial spirit is training (Lee et al., 2005). The Green Paper on Entrepreneurship in Europe (European Commission, 2003) emphasizes the great impact that the development of competences in this field in order to move towards an entrepreneurial society. Key impacts were then clearly defined in the communication Rethinking Education: Investing in skills for better socio-economic outcomes - COM (2012) 669 (European Commission, 2012:2-4).

FOCUS OF THE ARTICLE

The Importance of Entrepreneurial Education

Entrepreneurial and business training not only facilitates young people's personal growth—helping them to become more creative, informed and self-confident—it also eases their incorporation into the labour

market through self-led projects. The importance of education aimed at boosting entrepreneurial spirit is justified by the direct relationship between knowledge of the entrepreneurial process and the probability of creating a new company. The Eurobarometer survey and the British Household Survey (2002) empirically attest to the fact that people who had more contact with entrepreneurial initiatives are more inclined to work for themselves. Similarly, the GEM survey points out that people who are confident in their skills and experience are 2 to 7 times more likely to create or manage a new company; if they know someone who has recently created a company, that probability is between 3 and 4 times higher (European Commission, 2003:15-16).

The Green Paper also stresses the enormous importance of education in stimulating a positive attitude towards entrepreneurship, encouraging people to take advantage of the career opportunities offered to them, and using the knowledge they have accumulated to act entrepreneurially within companies, universities and R&D centres (intrapreneurship). Education has a powerful role to play in ensuring that the social perception of the image of the entrepreneur and his/her contribution to social well-being reflects the reality, highlighting not only opportunistic behaviour, but also the models of responsible behaviour displayed by many entrepreneurs who work to meet social needs. At this point it is worth remembering, following Baumol (1990) and Baumol & Storm (2010), that not all entrepreneurial activity is productive. It is thus crucial to differentiate between productive entrepreneurs, who contribute positively to growth, and the unproductive or even socially destructive entrepreneurs that cause economic dysfunction.

Entrepreneurial education must make future entrepreneurs aware of the role they should play in the community and their critical role in economic and social change, acting as a catalyst for development and prompting a systemic, mutually-supportive response to change (Stevenson, 2004; Kirby, 2006).

The theoretical contribution of entrepreneurial education to employability, job creation and the creation of new companies has been confirmed in several studies that reveal a wide range of positive effects. The report published by the Thematic Working Group on Entrepreneurship Education of the European Commission (European Commission, 2014B: 10), based on GEM data from 2003 to 2012, highlighted the positive effects of entrepreneurial awareness and self-perception of skills for starting a new business. Another research paper on the impact of the Youth Entrepreneurship Strategy (YES) in the United Kingdom reported a rise in entrepreneurship among young people aged 18 to 24, from 3.5% to 10.2% between 2002 and 2011 (GEM UK, 2011).

There is also an extensive literature that highlighted the positive contribution of higher education to entrepreneurial activity, in providing a sufficient quantity and quality of graduates to successfully launch and manage new businesses (Gibb, 2006; Matlay, 2006; Jones, 2010). Universities have been designated as the educational institutions that bear the greatest responsibility for channelling new generations towards entrepreneurship in future industries (European Commission, 2008, 2010, 2012). A study carried out in Denmark concluded that the percentage of students who created their own company while they were a student increased by 50% if they had received entrepreneurial education (FFE-YE, 2012:7-8). At the European level, according to GEM 2013, early entrepreneurship among young people aged 18 to 29 rose from 4.3% to 6.7% between 2003 and 2012, showing an opposite trend to that of youth employment (European Commission, 2014b: 10).

The Development of Entrepreneurship and Entrepreneurial Skills

In order to define the scope of entrepreneurial education and the skills it incorporates, it is necessary to first define the concept of entrepreneurship, since fostering this quality is the goal of such education. This is not an easy task because there is a great deal of conceptual ambiguity associated with this term

(Sexton, 1994; Nabi & Holden, 2008; Sewell & Pool, 2010) due to its multidimensional nature and the fact that it is present in very different contexts and in all kinds of organizations.

The quasi-official definition of the term entrepreneurship adopted by the European Commission, (2003:6), cited at the end of this paper, adopts an interdisciplinary approach that combines elements of its economic, sociological and psychological conceptualizations. The Green Paper (European Commission, 2003:6-7) also specifies that the entrepreneurial spirit combines an attitude marked by willingness to take risks, an attraction to independence and personal fulfilment, creativity and innovation, and a sound management ability that goes beyond daily management and affects the company's strategy. It remarks that "to turn a business idea into success requires the ability to blend creativity or innovation with sound management and to adapt a business to optimize its development during all phases of its life cycle". It is thus understood that entrepreneurship also entails a process of creating economic activity.

The universality of the concept is reflected in the fact that the entrepreneurial spirit can be found in any industry or type of business, irrespective of its nature, size and ownership structure. It should also be clarified that entrepreneurship can occur both in the creation of a new company and in existing companies. Therefore, despite its interdisciplinary nature, the fundamental axis is the economic element of the entrepreneur's role in the market.

The concept of entrepreneurial spirit refers then to two types of competences with different degrees of specificity (European Commission/EACEA/Eurydice, 2016:22; European Commission, 2004):

- The **more specific competences** are those related to professional development as an entrepreneur or promoter of a new company, whatever its size. Developing a new company requires specific knowledge and behaviours to ensure the eventual success of new productive ideas. The focus is thus on economic, business, management and financial competences.
- The **more generic competences** are those skills useful for people in any social context, including entrepreneurship. This second group of competences is much broader and more transversal than the first, since it is applicable in any social and economic context. Therefore, it particularly emphasizes the entrepreneur's personality profile, attitudes and certain skills that can be practised in any domain, including business, society at large, culture or politics (Wickham, 2006).

Recommendation 2006/962/EC of the European Parliament and of the Council of 18 December 2006 (European Parliament & European Council, 2006:17) argues that all learners should develop a sense of initiative and entrepreneurial spirit as a key generic cross-skill.

Entrepreneurial Education Concept

The approaches, objectives and content of entrepreneurial education can vary significantly according to the national and educational context in question. The range of entrepreneurial education concepts can be organized into three categories (Sánchez et al., 2017:415-416): education about entrepreneurship, education through entrepreneurship and education for entrepreneurship.

The third category has been adopted by the Thematic Working Group on Education for Entrepreneurship of the European Commission (2014A) and the Eurydice Network, which takes the framework definition agreed in Geneva on 18 January 2012 by the main source of authority on the subject: the international working group on entrepreneurial learning, comprising representatives of ETF, GIZ, ILO, UNESCO and UNEVOC.

UNESCO (2008) has followed this line by defining entrepreneurial education as a set of experiences that provide students with the capacity and vision to access and transform all kinds of opportunities using their creativity, initiative, responsibility and attitude towards risk. This skill would go beyond economic action (creation of a company); it is a transversal competence that can help students to anticipate and adapt to change.

The report of the Thematic Working Group on Education for Entrepreneurship of the European Commission (European Commission, 2014a: 6), following UNESCO and the European Training Foundation (2013), defines entrepreneurial education in the following terms:

All forms of education and training (formal, non-formal and informal) which contribute to an entrepreneurial spirit or behaviour, with or without a commercial objective

These definitions make it clear that education for entrepreneurship extends to all educational levels, from childhood education to lifelong professional development.

According to the Recommendation of the European Parliament and of the Council of 18 December 2006 (European Parliament and European Council, 2006:17-18) and the OECD (2012:12), entrepreneurial competence is understood as a set of knowledge, skills, behaviours and attitudes:

- **Knowledge** includes “the ability to identify available opportunities for personal, professional and/or business activities, including ‘bigger picture’ issues that provide the context in which people live and work, such as a broad understanding of the workings of the economy, and the opportunities and challenges facing an employer or organisation” “(Recommendation 2006/962/EC).
- **Skills** are “related to proactive project management (involving, for example the ability to plan, organise, manage, lead and delegate, analyse, communicate, de-brief, evaluate and record), effective representation and negotiation, and the ability to work both as an individual and collaboratively in teams. The ability to judge and identify one’s strengths and weaknesses, and to assess and take risks as and when warranted, is essential”(Recommendation 2006/962/EC).
- **Attitudes** are “characterised by initiative, pro-activity, independence and innovation in personal and social life, as much as at work. It also includes motivation and determination to meet objectives, whether personal goals, or aims held in common with others, including at work” (Recommendation 2006/962/EC).
- **Behaviours** are governed by the criteria of responsibility (which means active and informed participation in the market) and productive creativity (which means production of innovative ideas that help to solve economic and social problems).

SOLUTIONS AND RECOMMENDATIONS

In the international context, there are numerous examples of non-curricular initiatives to support entrepreneurial education; that is, they are promoted by institutions outside the authority responsible for the design, management and coordination of the public education system. In particular, there are a wide variety of non-curricular programmes in Europe aimed at stimulating entrepreneurship, as a result of EU institutions’ intense efforts to promote entrepreneurship over the last three decades.

In short, the European policy for entrepreneurship-building proposes considering entrepreneurship as a valuable social competence that should be protected and reinforced. The basic features of EU policy in relation to implementing a global strategy for entrepreneurial education are as follows:

1. Its main objective is to correct the entrepreneurial deficit that has been detected, in order to prevent the resulting negative consequences for Europe's competitiveness.
2. It follows an action approach to shape the market with measures that promote the improvement of the business environment, rather than actions involving direct financial aid, tax concessions and financial incentives of dubious utility that cause market distortions related to inefficient costs (Hallberg, 2000)
3. The initiatives for education and training in entrepreneurship have mainly relied on widely-differing national-level actions, with the European policy being based around the principle of subsidiarity and the implementation of concerted actions.
4. It proposes educating students to develop their entrepreneurial spirit from an early age.
5. Entrepreneurial education should foster young people's entrepreneurial vocation, but also help them to develop a valid cross-competence that is applicable in all kinds of positions and organizations, and empowers them to "turn ideas into action".
6. It must be integrated into a long-term global perspective that creates a solid and stable framework for entrepreneurship teaching.
7. It must prepare teachers in this field by providing them the required knowledge, aptitudes and attitudes, and equipping them with the appropriate didactic methods. Entrepreneurial approaches to teacher training should include the setting up of training centres for entrepreneurship teachers.
8. The development of entrepreneurial skills requires active and experiential methods that immerse students in real-life practical learning experiences. It is useful for students to gain an early knowledge of the real business world, so that they understand the role of business and its social impact. Learning should be essentially self-driven and active, with elements such as project work, games, simple case studies and visits to local companies.
9. The education for entrepreneurship agenda should extend its actions beyond the educational system to engage companies and the community at large, creating links and cooperative structures. Support systems have, therefore, an important role to play in this regard.

FUTURE RESEARCH DIRECTIONS

Wide differences can be seen between regions and countries in terms of graduates opting for entrepreneurship. Similar variations can be found in the contribution made by education to the development of the necessary skills and knowledge to manage a business, to stimulating the desire to become entrepreneur, to reinforcing entrepreneurial initiative and to acquiring a better understanding of the role of entrepreneurs in society.

A critical point in the debate about the reasons for these differences is how the educational system approaches this matter, and why the training received by the students does not successfully translate into an effective acquisition of the competences that should be incorporated into curricula. The main argument is that higher education is failing to produce graduates with a strong entrepreneurial spirit. In turn, this has generated scepticism about the suitability of universities and/or schools as breeding grounds for future entrepreneurs. However, the empirical evidence on this point is still not conclusive.

In order to tackle the low levels of entrepreneurial knowledge and experience, it is necessary to bolster the acceptance of and the demand for entrepreneurial education. We must clarify the concept (Gibb, 1993) and reinforce the conceptual framework that covers entrepreneurial training initiatives, thus providing effective support for entrepreneurs and policy makers aiming to optimize the investment of resources (Gibb, 2002, Hannon, 2006). At the level of university education, critical issues include deciding who should be offered entrepreneurial education, who should teach it, and how it should be delivered (Hatshorn & Hannon, 2005:616). Matlay (2009) advises considering the expectations of the two primary stakeholders in the process: students and teachers. To that end, both the demand and supply perspectives should be considered. On the demand side, students' perspectives should be examined in order to design and deliver an entrepreneurial education that is effective and tailored to their needs and expectations (Schwartz & Malach-Pines, 2009; Kraaijenbrink et al., 2010). On the supply side, the success of entrepreneurial education initiatives will be defined by the development of curricula designed to meet social needs, the provision of the necessary resources, and the commitment and motivation of trained teachers (Johannisson et al., 2001; Birdhistle et al., 2007; Clergeau & Schieb-Bienfait, 2007). Educational institutions should also update their methods in order to promote the ability to "think outside the box" in problem-solving (Volkmann et al., 2009:15) as well as experiential learning in which knowledge is created through the transformation of experience in a real environment (Formica, 2002).

There is thus an ongoing debate about how the educational system should be restructured in order to incorporate into its methods, contents and organization, the values that form the *raison d'être* of the entrepreneur (responsibility, recognition, creativity, initiative), and also to teach the knowledge and skills necessary to stimulate entrepreneurial initiatives. Future research should be aimed at consolidating an institutional and curricular design that includes a focus on entrepreneurial spirit, in order to strengthen economic, business and financial education.

CONCLUSION

The literature contains extensive analysis of the genesis of the entrepreneurial process. The first generation of studies was oriented at identifying the specific psychological and demographic traits of the individuals that are most likely to create a company. This approach has generated few useful results because it has failed to find a universal pattern, and it has not empirically established a relationship between the differential characteristics of the entrepreneur and the subsequent success of the start-up. These days, it is generally accepted that psychological and demographic traits are poor predictors of entrepreneurship.

A new approach comes from the so-called models of entrepreneurial intention, which predict that exogenous variables do not directly influence entrepreneurial behaviour; rather they affect the determining factors for such behaviour. According to the intention-based models, the key issue is the variables that trigger entrepreneurial intention. Three aspects that shape entrepreneurial attitude have been identified: the desirability of a behaviour (based on the beliefs of the individual), its feasibility (possibility of control over the behaviour) and the perceived social norms.

The intention-based models thus assume that the entrepreneur can be trained through an education that instils the attitudes required to transform perceived opportunities into viable business ideas. Proponents of this argument reject the idea that genetics play a role in entrepreneurial development and that entrepreneurial talent depends on innate personal traits. There is a wide range of literature explaining young people's entrepreneurial intentions and their professional entrepreneurial skills as a result of their

immersion in a participatory professional training programme. It has even been argued that the core qualities of the entrepreneur, such as creativity and innovative ability, can be learned and encouraged.

This belief has prompted multiple national and international initiatives aimed at stimulating entrepreneurial education. However, these initiatives have not yielded the desired results. There are many regulatory and institutional reasons why graduates decide not to get involved in the creation of a new company.

But above all, the key issue is how the educational system has designed the curricular content to address this question, as it may not ensure that the training received by students is being translated into an effective acquisition of the relevant competences. The empirical evidence is not conclusive, but it seems to indicate that such teaching is not successfully producing entrepreneurial graduates, and that neither university nor schools are currently effective breeding grounds for future entrepreneurs.

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KEY TERMS AND DEFINITIONS

Education About Entrepreneurship: Consists of teaching general theoretical knowledge about concepts related to entrepreneurship, but does not involve practical experiences that consolidate learning and help shape learners' attitudes.

Education for Entrepreneurship: Theoretical-practical approach to providing entrepreneurship knowledge and skills aimed at influencing the development of entrepreneurial attitudes and behaviours.

Education Through Entrepreneurship: Action-based, experiential teaching method in which potential entrepreneurs learn directly through their immersion in entrepreneurial experiences.

Entrepreneurial: Competences: A set of knowledge, skills, behaviours, and attitudes that allow the identification of existing opportunities for personal, professional, and commercial activities, and enable their transformation into viable entrepreneurial ideas.

Entrepreneurial: Education: Type of education and training that helps develop the entrepreneurial spirit, competences and behaviour, regardless of whether or not they are aimed at a commercial objective.

Entrepreneurial: Spirit: Ability to transform creative ideas into entrepreneurial actions. It is related to creativity, innovation and risk-taking, as well as the ability to plan and manage projects to achieve goals.

Entrepreneurship: An attitude that reflects an individual's motivation and capability, whether independently or within an organization, when identifying and seizing an opportunity in order to produce new economic value or achieve success.

Designing the Future of Romanian Women Entrepreneurship: Fight and Flight

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INTRODUCTION

According to the Organization for Economic Cooperation and Development (OECD), the contribution of women in entrepreneurial activities is not well known mainly due to the lack of valid and reliable data about male-female variable in entrepreneurship. In order to develop effective policies for improving equality between men and women in entrepreneurship it is necessary to collect detailed data which could be compared at an international scale (OECD, 2005).

The relatively recent interest of women for business has been observed by other specialists who have found through the studies they conducted the following fact the increase in the number of women entrepreneurs in industrial countries is recent. Before 1970 women entrepreneurs were rare. Since then, their growth has been remarkable (Coughlin & Thomas, 2002; Hallam & Zanella, 2017).

In what concerns the evolution of women entrepreneurs in the European Union, Parker (2004) mentions the fact that the percentage of self-employed in this region varies considerably from about 20% in the UK, Ireland and Sweden to 40% in Belgium and Portugal. Following the purpose of an overview on female entrepreneurship in Romania, and implicitly on females interested in creating and developing a business, a presentation of certain issues is required, such as the country's total population, the number of females, the number of women entrepreneurs (Dorobat & Topan, 2015; Gundry & Ben-Yoseph, 1998).

Regarding the number of females interested in owning their own business, developing and achieving its performance it can be said that in Romania there are over 500,000 women entrepreneurs, representing 34% of the shareholders or domestic companies (Pocol & Moldovan-Teselios, 2014).

BACKGROUND

The literature presents numerous definitions, features and typologies of entrepreneurship and entrepreneurs, and the study of entrepreneurship, in general, and of women entrepreneurship, in particular, is one of the reasons that have determined a whole series of researchers to allocate time and energy to better know this domain, to uncover new information, and to go deeper into the older knowledge (Afrin, 1999; Goby & Erogul, 2011; Kerr, 2017; Raghuram & Hardill, 1998; Savoiu, 2014).

According to some researchers (Fitz-Koch et al., 2017; Hallam et al., 2016; Landig, 2011; Marlow & Wynarczyk, 2010), women still form the most underrepresented group in entrepreneurship, and among the reasons why the number of women entrepreneurs has been reduced over time includes: social and cultural influences, education and options related to career, but also the lack of self-confidence, perceptions regarding the traditional place of women, family responsibilities, motivation and attitudes of women regarding risk. After starting the business, a number of factors such as: the lack of/the limited access to human capital and financial barriers related to network information and access to care, and also the concern regarding women oscillation between family and career have influenced women's involvement in entrepreneurship (Farmer et al., 2011; McGowan et al., 2012; Ruderman et al., 2002).

A study conducted by the Centre for Entrepreneurship and Business Research – CEBR (Driga & Lafuente Gonzáles, 2009), on female entrepreneurship in Romania that had 626 participants of which 378 (60%) men and 248 (40%) women revealed that in Romania, the male entrepreneurship prevails (the number of men involved in entrepreneurial activities exceeding that of women in all geographic regions of the country). The research also reveals that the proportion of potential women entrepreneurs exceeds that of men, that means that more women than men are involved in the actual start of a business in all regions except Western areas (Arad, Caras- Severin, Hunedoara and Timis), and in the South (Arges, Calarasi, Dâmbovița, Giurgiu, Prahova, Virginia), where the number of potential men entrepreneurs, outnumber the women. For the group of new entrepreneurs (entrepreneurs who have started a business in the past two years), the situation is as follows: the percentage of men entrepreneurs exceeds that of women entrepreneurs in the capital, the North-West (Bihor, Bistrita-Nasaud, Cluj, Maramures, Satu Mare and Salaj), the North- East of the country and in the South, and the women entrepreneurs exceeds the proportion of men entrepreneurs in central Romania (Alba, Brasov, Covasna, Harghita, Mures and Sibiu), in the West, the South-East and the South-West (Dolj, Gorj, Mehedinti, Valcea and Oltenia).

Regarding age, it can be said that in what concerns entrepreneurs, be they prospective or active, women have a slightly more advanced age than men. Thus, women who are potential entrepreneurs have an average age of nearly 42, while men in this group have a mean age of 41.

Regarding work experience, it can be said that women have on average more work experience than men. Thus, previous work experience, on average, is three years longer for potential women entrepreneurs, compared to their male counterparts (15 years versus 12 years for men), and women entrepreneurs who have started a business in the last two years have, on average, an extra year of work experience than men (10 years for women and 9 years for male entrepreneurs).

Among the motivations of women entrepreneurs in Romania we can mention: the desire to be their own boss, the desire to have their own business, finding business opportunities, the desire to improve quality of life, the desire to make a contribution to society, the desire for social status, the desire to make money, the motivation to pay less taxes, the desire to not be unemployed, the desire to follow the family tradition, the admiration for other entrepreneurs.

Regarding the profile of successful women entrepreneurs in our country, some authors (Baughn et al., 2006; Dima et al., 2011; Zellweger et al., 2012) claim that in Romania, the general idea is that a

successful woman is one who can excel in different fields, they put career first, but do not neglect their family. Also, she must be financially independent, self-confident, to assert herself and achieve success without losing femininity.

RESEARCH METHODOLOGY

An overview on women's entrepreneurship in Romania can be shaped by conducting a qualitative study that could bring together the defining profile of women entrepreneurs in Romania. For the purpose of this study that aimed at identifying the main issues related to female entrepreneurship (motivations, resources, support groups, obstacles, etc.) a direct research - based survey was used.

The study was considered a sample of 110 women entrepreneurs from South - Muntenia region of Romania that includes seven counties. The response rate was 55%.

The questionnaire used in the survey included 21 questions, divided into six sections, and responses collected using the questionnaires allowed the calculation of statistical indicators for this study, namely: the mean, median, mode, standard deviation/standard error, variance, the amplitude of the variance, the minimum, the maximum, the sum of all observations, the asymmetry coefficient Skewness, the vaulting coefficient Kurtosis and the calculation of quartiles.

Section 1 includes questions 1-2 and aims to identify the profile of women entrepreneurs interviewed, mainly to determine their age and profession.

Section 2 contains questions 3-4, which refer to the characteristics of the activities of the individuals interviewed in the entities they lead: activities mainly carried out within the company, the training they deem necessary.

Section 3 includes questions 5-9 and investigates the factors that contributed to the decision to establish a firm: the reasons that led to the specific entrepreneurial career choice, the reasons that led to the renunciation regarding the earlier profession, the choice of a company's business domain, personal qualities which, according to women entrepreneurs, have favored the creation and development of the enterprise, the support groups.

Section 4 contains question 10 to 12 and examines both the difficulties faced by women entrepreneurs and also the means to overcome them: the major difficulties encountered during the creation of the enterprise and its development, the main ways of overcoming difficulties, how to obtain the funding sources.

Section 5 is represented by questions 13 to 16 and explores the future of companies led by women entrepreneurs starting from the results so far: the factors that contributed to the smooth running of the company, anticipating future obstacles, the prediction of future opportunities, ways of overcoming obstacles.

Section 6 contains questions 17 to 21 and analyses the opinion of women entrepreneurs regarding women entrepreneurship both in Romania and in other countries, and also the perception of women regarding the labor market.

The questionnaire was applied directly or through e-mail on 200 women entrepreneurs in the South-Muntenia Region, the response rate was 55%. There were 110 completed questionnaires out of 200 submitted.

Responses were collected using questionnaires processed using the Scientific Package for Social Sciences (SPSS) 17.0 and the making of the database structure was achieved by defining variables in Variable View. It is also important to note that all completed questionnaires were checked in terms of background completeness and usefulness of data and using the statistical program previously mentioned,

data analysis was materialized through frequency tables and histograms for each item, and the centralization of all items.

In addition to the related tables and histograms, data analysis led to an emphasis of statistical indicators for this study, namely: the mean, median, mode, standard deviation/standard error, variance, amplitude of variance, minimum, maximum, the sum of all observations, the coefficient of asymmetry Skewness, the coefficient of vaulting Kurtosis and the calculation of quartiles.

The fundamental/main objective of this study is to identify key issues related to female entrepreneurship in Romania and in order to find relevant answers a series of secondary objectives of the research were established, as follows:

- O₁: Identifying the reasons that determine women to choose an entrepreneurial career.
- O₂: Establishing the necessary resources for the good of the business.
- O₃: Establishing support groups, the main actors involved in supporting and encouraging women to take the entrepreneurial function.
- O₄: Identifying barriers that hinder or could prevent women to run a business and ways of overcoming difficulties.

Regarding the link between the four mentioned objectives of this research on female entrepreneurship and the twenty-one closed questions in the questionnaire included in the survey, the following statements can be made:

- § To the first research objective, O₁: Identifying the reasons prompting women to choose entrepreneurial careers, corresponds to question number 5 of the questionnaire.
- § To the second objective of this study, O₂: Establishing the necessary resources for the good of the business, the statement number 12 of the questionnaire, corresponds.
- § To the third objective of the research, O₃: Establishing support groups, the main actors involved in supporting and encouraging women to take the entrepreneurial function, the following interrogative sentences in the questionnaire: 9, 12, 21, correspond.
- § To the final research objective, O₄: Identifying the barriers that hinder or prevent women to run a business and ways of overcoming difficulties, the following questions correspond: 10, 11, 15, 16 and 20.

The research was based on assumptions that resulted both from theoretical research in the field as well as from discussions with entrepreneurs in general and with women entrepreneurs in particular. Thus, in order to achieve the research objectives the following hypotheses were considered:

- H₁: The main reason underlying the entrepreneurial career choice is economic.
- H₂: The main source of finance business financing is represented by personal savings.
- H₃: The main difficulty faced by women entrepreneurs is competition.
- H₄: The family is the primary support group of women in their choice regarding an entrepreneurial career.

SOLUTIONS AND RECOMMENDATIONS

Following the realization of this study, it has been noticed that regarding item 5, “the reasons that have determined the choice of the entrepreneurial career” dominant is the category of women entrepreneurs

Table 1. Calculation table for the testing of hypotheses

The hypotheses	N	Mean	Std. Deviation	Std. Error Mean
H₁: The main reason underlying the entrepreneurial career choice is economic	110	2.3182	1.37428	.13103
	Test Value = 0.44			
	t	df	Sig. (2-tailed)	Mean Difference
	95% Confidence Interval of the Difference			
	Lower Upper			
	14.334	109	.000	1.87818
H₂: The main source of finance business financing is represented by personal savings	N	Mean	Std. Deviation	Std. Error Mean
	110	1.7091	1.22171	.11649
	Test Value = 0.73			
	t	df	Sig. (2-tailed)	Mean Difference
	95% Confidence Interval of the Difference			
	Lower Upper			
	8.405	109	.000	.97909
H₃: The main difficulty faced by women entrepreneurs is competition	N	Mean	Std. Deviation	Std. Error Mean
	110	5.5182	1.76994	.16876
	Test Value = 0.5			
	t	df	Sig. (2-tailed)	Mean Difference
	95% Confidence Interval of the Difference			
	Lower Upper			
	29.736	109	.000	5.01818
H₄: The family is the primary support group of women in their choice regarding an entrepreneurial career	N	Mean	Std. Deviation	Std. Error Mean
	110	1.2636	.63067	.06013
	Test Value = 0.84			
	t	df	Sig. (2-tailed)	Mean Difference
	95% Confidence Interval of the Difference			
	Lower Upper			
	7.045	109	.000	.42364

Source: own adaptation based on the data obtained following the research undertaken

who have claimed that the economic motives constituted their main impulse when they started their business (a frequency of 48 respondents out of 110 interviewees, which represents 43.6% out of the total of the respondents).

The research found that the four hypotheses of the study were confirmed (see Table 1), contributing to the scientific funding of the portrait of the women entrepreneurs in Romania.

The results showed that all the other answer variants were chosen by less than a third of the women entrepreneurs interviewed, actually it has been noticed that those who wanted to put into practice their

ideas recorded frequency of 22 out of 110 respondents, namely a weight of 20%, those that did not want to be subordinated present a frequency of 18 out of the total of the interviewees (16.4%), the women entrepreneur who claimed that the main factor in the choice of their career is the lack of a better alternative recorded a frequency of 15 out of 110 subjects (13.6%), and on the last position come the women entrepreneurs who mentioned other considerations. Namely, 7 people out of 110, representing a percentage of 6.4%, declared that the motives for choosing the entrepreneurial career were represented by: the desire of professional accomplishment, the lack of satisfaction caused by the previous job.

The main indicators (average, mean, module, standard deviation, variant, amplitude of the variant, minimum, maximum, sum of all the observations, skewness coefficient, kurtosis coefficient, quartiles) specific for the fifth item, "the motives that determined the choice of the entrepreneurial career", highlight the fact that calculated for the 110 recordings, all valid, the skewness coefficients 0.486, which indicates the fact that the distributions asymmetric to the right, and the kurtosis coefficient has the value of -1.217. The ways the capital needed to start the business was obtained allowed the delimitation of the following categories: personal savings, selling a personal asset, loan from friends, bank loan.

The study carried out highlights that most of the women entrepreneur (72.7%) used their own savings, and, at the opposite pole, only 3.6% of the subjects considered that selling a personal asset or using a loan from friends are optimal ways of obtaining the capital needed to start the enterprise.

The relatively low weight of the subjects that used bank loans (20%) was determined, in general, by their sufficient development of the financial and monetary market and especially by the difficulties encountered in the relation with the bank.

The difficulties encountered during the activity allowed the delimitation of the following categories: lack of leadership experience, lack of marketing knowledge, lack of accounting knowledge, lack/ high cost of capital, lack/ high cost of qualified personnel, competition, low demand for the respective product/ service, bureaucracy, discrimination, socio-cultural influences, yet the subjects had the possibility to also mention other categories if they have considered that the previously enumerated variants do not correspond to their situation.

Following the study, it was possible to notice that the distribution of the women entrepreneurs according to the difficulties encountered is somewhat surprising. No subject has complained of lack of leadership experience or of the sociocultural influences. The research also highlighted the fact that half (50%) of the women entrepreneurs consider competition as a main obstacle, while 12.7% of the subjects consider bureaucracy to be a real difficulty and 11.8% claim that the main obstacle is discrimination. The lack/ high cost of capital, lack/ high cost of qualified personnel and the excessive taxation of the economic agents are considered obstacles by a low percentage of the interviewees (5.5% each).

At the same time, one can say that on the last positions come factors such as: lack of accounting knowledge, low demand for the respective product/ service (3.6% each) and lack of marketing knowledge (1.8%). The main activity in which women entrepreneurs work is trade, product sales being mentioned by 57 respondents, representing 51.8% of the women entrepreneurs surveyed.

In order to highlight the support groups, the people with a favorable impact on the activity of the women entrepreneurs, the following answer variants were proposed: family, friends, specialists, but the subjects were also given the possibility to mention other categories if they considered that the variants enumerate previously do not correspond to their situation.

On the distribution of the women entrepreneurs according to their support groups, one can say that it is remarkable that a significant proportion of the interviewees (92 subjects out of 110, namely 83.6%) have been supported in their entrepreneurial career by their family, while a relatively small percentage of the respondents (10%) have declared that the specialists (economists, lawyers) have represented the main

support group in their activity, and on the last position come the subjects who have declared that a favorable role in the creation and development of their business came from the support from friends (6.4%).

Regarding the calculation of the main indicators pertaining to this item one can say that it has been noticed that calculated for the 110 recordings, all of them valid, the skewness coefficient is 2.186, which indicates the fact that the distribution is asymmetric to the right, the kurtosis coefficient has the value 3.196, namely the distribution is leptokurtic/ has a sharp peak.

FUTURE RESEARCH DIRECTIONS

Through the goals set, this chapter has touched its target. The presented and analyzed issues are a synthesized part of the vast amount of information that has been developed by the authors to create the framework for understanding Romanian women entrepreneurship. Therefore, there are new directions of future research such as:

- § The analysis of the influence of women entrepreneurship on business and the impact of sustainable development on the mentioned notions;
- § Since the sample of the study was selected from Romania, this study can provide precious data for those interested in studying this region, but a kind of vigilance must be kept in mind when generalizing the results to other countries.
- § Analyzing and interpreting the dilemma situations faced by women entrepreneurship from the former socialist countries that have not been analyzed in this chapter.

CONCLUSION

Women entrepreneurship as a science, practice and as art designates the involvement of women in the creation and development of a business and its history began relatively recently. Due to the positive influence exerted by entrepreneurship in general, and especially by women entrepreneurship, on the stimulation of the economy and on the general progress of the society, it is advisable that the domain of women entrepreneurship and the women's involvement in business should be considered and used for what they really are, a truly valuable resource.

The study wanted to identify relevant aspects of females in specific business practices and focused its attention both on the main traits of women entrepreneurs, the key qualities needed in this area and also on the obstacles encountered, on the gender barriers subjects encountered along their entrepreneurial career, their perceptions regarding their business and how they want their business to evolve in the future.

The research results revealed a profile of female entrepreneurs aged between 31 and 50, an age group which combines some of the characteristics of young age (optimism, initiative, dynamism) with specific strengths of the mature age (experience and maturity in thinking). Usually a female entrepreneur has a university diploma, mainly in the economic field and believes she needs legal training, but does not complain about the lack of management experience, marketing or accounting knowledge.

The study also shows an accomplished female entrepreneur who possesses a strong sense of entrepreneurship, working mainly in trade, she believes that women are discriminated slightly in the labor market, claims that at the basis of their entrepreneurial career there have been economic reasons and she is supported by her family in her entrepreneurship career.

The study realized brings to light a woman entrepreneur who claims that at the basis of their entrepreneurial career there have been economic reasons, the too small salary being the main reason for giving up the previous job. She relied on her own savings to start a business; she is supported by her family in her entrepreneurship career and considers the competitors as the main threat for the business she is running.

An important role for the functioning of entrepreneurship in general and female entrepreneurship in particular, and also for encouraging and creating favorable conditions for the business, is played by the legal and institutional framework. In other words, awareness regarding women's entrepreneurship not only for economic growth but also for the overall progress of society has led to the development of certain laws, as well as bodies, organizations, institutions and programs involved in supporting the business sector, in promoting and stimulating the women's entrepreneurship and also the entrepreneurship in general, in this sense a series of activities that fall in this category could be mentioned: providing advice and assistance in the organization of courses, facilitating the connection to domestic and foreign networks of similar business organizations etc.

The need to support women is not only important for business development, the labor market and the economic environment in general, but also to improve all areas of activity. Although a large proportion of respondents view more opportunities for the future in terms of improving the legal system and the granting of tax incentives and less by the emergence of business opportunities, there are Romanian women entrepreneur who believe that a number of factors are the real determinants of family business development (the possibility to access EU funds, the emergence of new market counterparties and the possibility of expanding the business, but also to diversify products and services).

The importance of sustaining female entrepreneurs is supported also by specialists (Alsos et al., 2014; Tiwari & Tiwari, 2007; Wiklund et al., 2012) who say that women are the core of a nation. They are the true builders and modelers of the destiny of a nation. Position and status of women in any society are indicators of civilization and progress of that specific society.

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KEY TERMS AND DEFINITIONS

Entrepreneurship: A person who takes risks, because buying products with a certain price and sells them to one another, so deploying a risky activity.

Motivation: Is a problem of temperament: on one hand, we will always meet individuals that are more passionate than others, who are more dedicated to their work, and on the other hand, there are methods likely to contribute to changes in attitude towards work, decisive, both for the success of the individuals in organizations, and for the organization's success on the market..

Organization: A system, which includes employers and employees aiming at achieving common objectives.

Personality: The totality of individual's character traits, temperament, education, and behavior.

Avatar–Based Intellectual Managing for Innovation Technologies Transfer in Nationals Entrepreneurships of Armenia

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INTRODUCTION

The economy of the digital age is an economy, based on collection and use of knowledge. Significant gains, the necessary breakthroughs over the past decades, is understanding of the relationship between knowledge and growth, on the one hand, and entrepreneurship and growth, on the other one. Also one can find research results shown how entrepreneurship, innovation and knowledge are interrelated. In the same time, deep understanding of a connection between all these variables - knowledge, innovation, entrepreneurship and growth - does not exist. The relationship between the variables is very complex and depends on forces that can simultaneously influence all of them; at least, partially. Therefore, the relationship between the microeconomic origin of growth and the macroeconomic state is still too unobvious to cover the entire width of these complex and overlapping variables.

The state support of entrepreneurship acquires special features in the digital economy and should be based on several principles.

1. More does not mean better. Financing (investing, subsidizing, etc.) should have a strictly adjusted focus and volume. Naturally, firms, focused on innovation, on deepening existing knowledge and their practical application, should be in the priority. However, their “overfinancing” may be, in the best case, senseless. *The relationship between investments and results is not linear; it must be considered carefully and taken into account.*
2. The digital age is characterized by the availability of huge amounts of information (so called “big data”), its storage, searching and analytic tools (Chang et al., 2008; Ramzan et al., 2018). Any effective management decision should be based on analysis of *all* available data on the subject. In the case of innovation economic activity, such data includes the history of the field in aspects both of innovative ideas (previous successful/unsuccessful similar business projects) and of project performers (open personal data of participating people/firms their economic success in the past,

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- etc.) *Collection of sufficiently complete information, related to the specific business project, is one of the critical components of the decision-making process concerning the project support.*
3. Analysis of large amounts of information that have become available only recently has been one of the challenges of our time. The human brain, in general, is not capable of solving such problems and needs substantial “algorithmic” support. As a minimal basement, these are the standard data mining and graphical data representation methods. However, for effective management, this is usually not enough. Algorithms of “artificial intelligence” can come to the rescue; first of all, it is methods of machine learning (neural networks, genetic algorithms, etc.). *Without computer algorithms of “artificial intelligence”, appropriately “trained”, effective processing big data is impossible.*
 4. The task of “training” of artificial intelligence systems is a special problem. The most natural and “economising” way is the creation of universal “avatars”, focused on solving a wide range of business plan evaluation tasks and trained gradually during the step-by-step use for a number projects. *Avatars should become the core of “intelligent expert systems”, which should replace the traditional expert systems.*
 5. “Intelligent” avatars, working with large data sets, face the problem of composing used information, which is constantly growing set (Deissenberg et al., 2008; Kohler et al., 2009). In addition, if there is a “population” of avatars, which are focused on solving slightly different tasks, they can “exchange” by their individual “experience”. The solution of both the problems can be based on the blockchain technologies. *The blockchain organization of distributed data storage creates a flexible and efficient knowledge base about business projects, used by the avatars.*
 6. Considering the “intellectual expert system” as a dynamic, constantly developing system, one can speak of the underlying computer “imitation model”, which has a special theoretical and practical value. External information sources, the blockchain-based knowledge base, the avatar population, external actors (people-users) and a software environment, uniting all these elements, are in constant nontrivial interaction, the result of which cannot be predicted theoretically, but can be obtained in a course of computer simulation. *In addition to being used directly for the project evaluation, the simulation model can be used to solve a much wider range of tasks: forecasting (of final budgets of projects, their possible profit, etc.); risk assessment; determining projects’ and their performers’ rating; calculating parameters of an “ideal” project, etc.*
 7. There is a significant variation of conditions, prevailing at the time, in different countries and even regions of the same country. There is an ontological problem of distinguishing “common” and “individual” features of environment, when analyzing projects and making decisions. Probably, *each avatar should be targeted to a specific region; at the same time, the entire avatar population should use a joint blockchain base.*

Below these principles are considered in more detail. Mainly, it will be discussed about a single avatar; study of avatar populations is planned as a next step of the research. When this is essential, the Republic of Armenia will be used as a “model” region.

The authors in this chapter show the essence, dignity, current state and development prospects of avatar-based management using blockchain technology for improving implementation of economic solutions in the framework as help system of entrepreneurs of sharing economy. The authors of the chapter set out to avoid examining the avatars-based model for policy advice, but to try to assess the merits, identify the model as a new basis for policy advice based mainly on work and experience as part of a recently completed project “Triple H Avatar an Avatar-based Software Platform for HHH University, Sydney,

Australia which was carried out 2008-2018” (Mkrttchian et al., 2016). The main goal of this project is to create such a model based on avatars where there is a link between macro and micro levels that provides a single platform for solving problems in various areas of the digital economic system that is designed to assist entrepreneurs. This project was the first to create such a model implementation that allows you to scale simulations for a large number of economic avatars and provide graphical user interfaces that allow researchers at the user level not familiar with the technical details of the implementation to implement for the design of individual parts of the model, engineering and economic experiments and analysis of modeling results for the system of assistance to entrepreneurs.

BACKGROUND

In conditions of the digital economy, dynamic processes (their theory, models, nodes, blocks), although they have been understood quite deeply, still do not take into account a private influence of the entrepreneur, who acts as an independent innovator and has his direct impact on the dynamics of economic performance. Expert knowledge in the form of accumulated human and/or physical capital, can no longer explain the significance of economic development. Since Adam Smith also proposed the introduction of innovations and entrepreneur for profitable transformation of the above resources (Andersson & Tollison, 1982).

The phenomenon of “development” in the digital economy has shown that there is a non-standard, adaptive-individual relationship between knowledge, innovation and entrepreneurship. These links are becoming more noticeable in the dynamics of economic development in the process of digitalization of the economy. The current view is that the introduction of innovations in the field of knowledge is always a linear process related to activities, research and development. Our research (Mkrttchian et al., 2016) has showed that many various processes, such as learning, cognitive abilities, network interaction, combinatorial ideas, etc., limit public knowledge, turning the whole process of innovation into a non-linear process. It turns out that uncertainty, search and experiments are key elements of the innovation process. It has been shown that activities to create knowledge about entrepreneurs and small firms are spreading across a range of different functional areas. Failure to comply with these aspects means that several studies ignore a significant part of the creation of knowledge relevant to innovation and economic growth. This requires a new approach, thus open software products, available to all. But at the same time there is no guarantee that new knowledge with commercial potential will immediately be transformed into entrepreneurial initiatives and these effects are based on these knowledge may not appear at all or appear with a delay (Mkrttchian et al., 2016). It means that deep, case-oriented methods of estimation and modeling of the innovative entrepreneurship development should be proposed.

Extensive literature is devoted to the study of the prospects and effectiveness of business projects (and, in particular, innovative start-ups). A review of publications, devoted to this topic with a focus on the introduction of current scientific achievements, can be found in the articles (Natalichio et al., 2017; Spender et al., 2017).. Most of the proposed methods are not focused on the use of large data tables, but they contain interesting approaches, sometimes implemented in the form of ready-made algorithms (Cegarra et al., 2015; Gambal et al., 2018; Sjödin et al., 2018; West, Bogers, 2014). The ideas of this field of knowledge are the basis of the logic of the functioning of avatars.

Development of computer intelligent agents (which can be called as avatars in the context) is a special branch of computer science that has been booming in recent years (Dawid & Fagiolo, 2008; Ferber, 1999). Avatar-based approach to decision-making process in economy and politics became popular last

years (Arifovic et al., 2010; Dawid & Fagiolo, 2008; LeBaron & Winker, 2008). The specific inputs/outputs of the avatar and its specification are determined by a specific application area; for the considering problem, the basic model was proposed in (Mkrttchian, 2013). It is so called “Triple H Avatars”.

The blockchain method of creating and maintaining distributed databases has spread widely due to the recent popularity of crypto currency computer systems. However, the potential of this approach are much higher; at present it is gaining popularity for elaboration of “self-developing” information systems of various profiles (Maiyya et al, 2018; Mohan, 2017). The use of intelligent avatars is based on semantic analysis of distributed information is analyzed, so we need in blockchain-*knowledge* base, not just data base. Knowledge Base is a separate and also rapidly developing part of the computer science (Krishna, 1992; Natalicchio et al, 2017). Its ideas were used for the development of the basic avatar model, and will be actively used to improve the model in the future.

Our research (Mkrttchian & Aleshina, 2017) is the first to identify the application potential of blockchain technology to sliding mode in intellectual control and communication, for help the technological challenges and created tools. The intelligent avatar is based on a trigger switch that allows you to connect interorganizational processes to web services and implement internal processes. These triggers serve as a bridge between the block chain and enterprise applications. This concept provides the ability to implement intelligent control and built-in control at certain points in the process where it is desirable and possible (Mkrttchian, et al, 2016). The engineering realization of this advance is still nascent at this stage, although some early efforts can be found in our previous works. For example, intelligent visualization techniques that enforce a process execution in a trustworthy way can be generated from sliding mode process models (Mkrttchian, and Aleshina, 2017).

Multi-agent models and methods of computer simulation are another trend in computer science development (Ferber, 1999; Gilbert & Troitzsch, 2005). Its results are also part of the considered technique. It is useful, first of all, in solving the following problems: forming an “environment” algorithm, which unites a set of agents into a system; organization of an effective computational process, including the choice of a software tools; and planning simulation experiments to select rational process parameters and to identify possible key development scenarios.

The first steps towards elaborating the described computer systems for analyzing innovative business plans and making managerial decisions were implemented in the works of the authors (Bershadsky et al., 2018; Mkrttchian, 2013, 2015; Mkrttchian & Aleshina, 2017).

MAIN FOCUS OF THE CHAPTER

Issues, Controversies, Problems

The main objective of the proposed approach has already been described above: it is support of decision-making process concerning innovative startups by special software. The main issue is the possibility of developing intelligent information systems (Weikum & Vossen, 2002), that can significantly improve the state and regional policies in the field of innovation support. The idea of using ICT in the claimed area is evident; however, there are countless ways of its implementation. The describing approach is an attempt to bring to the solution several modern methods from the most advanced sections of computer science. Possible objections to such an approach could be a statement about the excessive complexity of the method, which leads to: a) too expensive and time-consuming development of the information system; b) its expensive and unreliable support; c) problems with effective use of the system because

of difficulty understanding by users of system's abilities and methods of its control. It can be a problem, but it is possible to give examples of successful development and operation of systems of not less complexity. In any case, the observed explosive development of artificial intelligence systems makes them increasingly accessible; and the development of the theoretical base takes considerable time and, naturally, must precede practical implementation. In terms of user friendliness of the system, it is clear that conducting theoretical studies, it is necessary to constantly keep in mind the practical specificity of the problem and the effective ways of system's practical use.

The practical use can be quite different for different places and time moments (Belk, 2007). Theoretical achievements and empirical studies seem to confirm the view that the processes of generating knowledge, innovation and entrepreneurship are localized processes. Nevertheless, no matter what flows of knowledge are largely limited in space, one can observe how knowledge, innovation and entrepreneurial initiatives are exchanged between functional urban areas and even countries. Thus, despite the fact that the regions are characterized by different internal economic and infrastructure networks, they are also connected by a multitude of such networks. Obviously, there is an important interaction between localized processes of knowledge generation, innovation and entrepreneurship, but at present there is practically no understanding of the relative importance of interregional and international networks. An increasingly global knowledge base serves to expand and diversify the local knowledge base, i.e., what was invented by "local noise and global pipelines".

Collected data and computer simulation can reflect features of different local situations. The intellectual tradition mentioned above and similar observations on the role of entrepreneurship in the success of the city on the example of the Republic of Armenia showed that the shortage of entrepreneurs in mining areas reflected its historical concentration in industry, which had a significant return on scale and potentially displaced more entrepreneurial activity. We expect that this evaluation of entrepreneurship is associated with both static factors (for example, with access to investment, and with financial capital for new enterprises) and dynamic factors (for example, the transfer of skills and attitudes from parents to children). In contrast, there was a vivid impulse of entrepreneurship, coming down from the city's early work in the decentralized mining industry, and we can argue that this industrial genealogy helped explain why one region grows faster than another neighboring one. Although his analysis pointed to the strength of local cultures of entrepreneurship, we refrain from making any strong policy recommendations related to this conclusion.

Moving from entrepreneurship to innovation, the relationship between innovation and efficiency of the city was focused on the model. This model especially explains the economy of cities, why cities grow or shrink, and also the movement of industries in different cities. The premise of the model is that the location of industries in cities is determined by where past breakthrough inventions occurred. This conceptual model creates models that fit well with data: for example, it predicts that industries will move around cities much faster than cities will move up and down the city size distribution.

Carefully study of features of innovation in the "cities of companies", in which one large firm dominates, shows that these large firms often become insular in their innovations, relying more on past experience of the company and less studying their efforts in the field of research and development. Based on the consideration, we can state that the combination of large and small firms provides the most productive environment for innovation. The study showed that the optimal mixture for patenting growth in the local area includes at least one large innovative firm, but also a sufficient mass of many small innovative firms. This mixture best reflects the benefits of innovation that come from large firms, while preserving fertile ground for new start-ups, often created by former employees of operating firms. The existing work on entrepreneurship and local innovation does not imply any natural local policy. This,

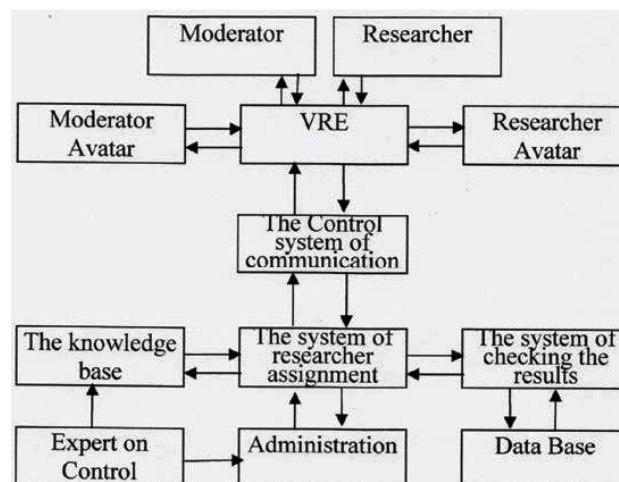
however, points to the power of small start-ups, which can collectively shape the economic destiny of the region. The study showed that in the two study areas of the Republic of Armenia there was a subsequent decline in employment. However, today, one area is flourishing, unlike another, because of the large number of local entrepreneurs, some of whom grew up in the city, and others were brought into the city from outside. The key issue for local innovation policy is whether there is something that can be done to introduce more of this local business. Clusters are seen as a tool to advance this goal, and we turn to empirical data on economic clustering.

The case for cluster policy depends on the existence of strong inter-firm side effects, which naturally generate clusters and justify a spatially oriented business policy. In order for these policies to make sense, these side effects should demonstrate an increase in returns to scale (that is, 200 entrepreneurs generate more than twice as many secondary effects from 100 entrepreneurs) or are disproportionately distributed among members of a certain industrial sector. That is, even if entrepreneurs generate secondary effects, it makes sense to group these entrepreneurs if these side effects either work non-linearly in local areas, or if only entrepreneurs benefit from clustering with each other. The clustering can represent side effects between companies or the uneven distribution of production factors throughout the space. Some branches of the mining industry of the Republic of Armenia require specialized infrastructure, including physical highways and information highways. Governments have long taken on the role of supporting the provision of infrastructure, although economists and academics have discussed the merits of financing user fees. The need for a specialized infrastructure increases the value of clustering. In contrast, industry groups that do not need specific technologies provided by governments will have fewer advantages from clustering. Even if business clusters are good for local growth, it is less clear that cities or states have the ability to generate these clusters that are the same both at the local level and at the national and global levels.

Solutions and Recommendations

Let us dwell first on the main specific solutions and recommendations concerning the algorithmic support of the process. The virtual research process can be illustrated by the diagram (Mkrttchian, 2015) in the Figure 1.

Figure 1. A scheme of interaction of the components of the avatar-based decision-making system



It is proposed to use the avatars with associated neuronal networks. As a first approximation, their inputs are forming from the information about: previous similar innovative start-ups; open data about the project executors; previous estimations and decisions about the project, particularly, from other avatars and real moderators and researchers. Their outputs are evaluations of perspectives of the project and recommendations (in different forms) concerning its support. In particular, they create, use and develop a blockchain knowledge base about all previous evaluations, recommendations and actions. The blockchain base is a main source for training the avatars' neural networks: previously generated information is compared with further collected information, and neural networks' parameters are corrected.

A special avatar output is an interface to other actors of the process, particularly, human researchers and moderators. It is part of the intelligent expert system, which includes elements of traditional expert system. The avatars contribute to the process, providing processed information, but final decisions are made by human actors. These solutions are also used to train the avatars and are written to the blockchain. The avatar continues to collect information on the progress of the supported project, which is included in the blockchain step-by-step. It is such indications as the project's effectiveness, its compliance with the originally stated parameters and so on. The neural networks will be gradually adjusted, and further all the gathered information will influence the subsequent recommendations of the avatars.

Although the method is not realized completely, some preliminary consideration of the process can be discussed. It was shown that the process of economic development in the modern digital economy can be divided into three clearly separate stages. The first stage involves the technical discovery of new things or new ways of doing things, such as invention. At the next stage, innovation occurs, that is, the successful commercialization of a new product or service, stemming from technical discoveries or, more generally, a new combination of knowledge (new and old). The final step in this three-step process - imitation - involves more general adoption and distribution of new products or processes to markets (Mkrttchian & Belyanina, 2018). The most common measure for the use of knowledge and innovation is expenditure on patents. To manage open software resources it is quite reasonable to use digital avatars (Mkrttchian et al., 2016).

Open source software has long become a ubiquitous industrial production and business. There is, for example, a tremendous amount and variety of open-source software components and third-party components that arise in every software development environment in the world. With proper use and management, these components are a huge source of energy to accelerate innovation in the digital economy. But in such successes of digital transformations there are key components. One of them is a formalized ontology, the development of which in the world today is paid the most attention. Therefore, the authors on specific examples tried to show the digital transformations in Armenia and their moving hidden springs. Because the digital economy is nothing more than the effects of additional returns on detailed knowledge of the physical world through digital data and technology, we needed a concrete example of physical placement, and we chose two the states in Republic of Armenia – Vayk and Sunik. These two neighboring states are defeated by radical digital changes. We have chosen Lidian Gold Armenia in the mining sector - complementary use of Lydian Gold Armenia's digital technologies. We have taken a number of technical and technological measures and made recommendations, which are set out below.

Formalized semantics and ontology turned out to be part of new tools for solving economic problems through innovations that ensure transparency. The mining and energy sectors, as well as the wider ecosystem of these states, have realized that innovation thrives on cooperation as well as competition. The exchange of knowledge is necessary for the development of new solutions, and it is possible only with their ontological formalization. The state is well provided with sectorial research institutes and programs; to achieve proper results, the research will require, as Armenia understands, cooperation

at the national and global levels. It is also necessary to collect formalized knowledge (Mkrttchian & Belyanina, 2018). The digital avatars, more precisely the expert knowledge generated by them, enable each member of the network, called a node, to contain a chain of blocks that makes up the history of transactions performed on the network.

Innovations in any industry depend on the ecosystem of suppliers, start-ups, research institutes, governments, service providers and asset owners. There is evidence that transformational new technologies are likely to evolve in complex, interdependent research ecosystems. The main problem of companies engaged in mining operations in states Vayk and Sunik is the lack of qualified personnel for very difficult working conditions. It is very difficult to find people who, even for a large salary (the average salary, for example, locomotive drivers there is about \$ 1,000 for a two-week watch) are willing to work in the constant stress and heat of states. Our research has shown that problems can be solved with the help of Mkrttchian's intelligent avatars (Mkrttchian & Aleshina, 2017). The proposed blockchain system can be successfully applied for Smart solutions in create Intellectual systems use Expert Knowledge. Such solutions gave such automation a processor, which led to a number of important achievements at the company's iron mines in the region. We began to use several automated heavy trucks, focused on shared GPS and video control technologies, so that this automation helped to ensure more efficient and safe movement of mining material.

We believe that there are conclusions that can be drawn at this stage: the research universities have a strong influence on local development; focusing on large-scale employers can crowd out small start-ups - we need much more information before an entrepreneurial policy can reach a relatively mature status, such as a policy on international trade and monopoly. The primary need is to experiment and evaluate, especially when randomizing. For example, if a government creates an entrepreneurial cluster that overflows, it can randomize at least some of the spaces in the cluster. Comparing the results of winners and losers in the "space lottery", the government can assess the impact of politics. If the government continues to provide loan guarantees on a sustainable basis, at least some of the loans can be randomly allocated in a way that allows for an assessment of the results of these loans. Today, experimentation is taking place throughout the Republic of Armenia, as the new government at all levels (along with numerous private and non-profit organizations) is developing a policy in the hope of creating its own national silicone bunker. The problem is that this experimentation has almost no future, and it is often unclear which outcome variables (i.e. the number of start-ups, employment, patents) are needed for this. Moreover, most policy-makers, especially when programs are relatively inexpensive, can naturally endorse such an approach, in which every potential intervention can contribute to the development of entrepreneurship, is considered simultaneously. In fact, efforts to provide entrepreneurial education, access to capital, promotion of exports, etc. are simultaneously not possible. In the region of the Republic of Armenia considered in this chapter, it is often beneficial for beginners to undertake what makes assessing any complex political interference difficult.

The described method is not developed enough and considered on small-sized real data only. Pilot testing gave the expected and correct result, but, obviously, before introducing the approach into real use, it needs to be developed and refined. Avatar interfaces (especially outputs) need to be adapted to real needs. The variety of data, on which the avatar is trained, should be significantly increased. The blockchain structure was not included in the implemented algorithm; accordingly, the blockchain model must be specified and implemented. And, naturally, at all stages of the subsequent development of the methodology, it should be tested on ever-increasing data size. When simultaneous analysis of several alternative (or related to different regions) business plans takes place, consideration of a population of avatars will be needed, and an environment of their interaction should be elaborated. The development of the technique is in progress, much work is needed to bring it to practical value.

FUTURE RESEARCH DIRECTIONS

Concerning practical applications, evaluation as a concept becomes more important for regional cluster initiatives, in particular, as well as other programs that contribute to the development of entrepreneurship. The key problem here is that plausible counterfeits against which benchmarks are measured are difficult to construct and therefore rarely considered, which makes interpretation of any results difficult. This is due to the fact that the use of randomization to create research opportunities is particularly complex in this area, where politicians often deliberately target specific areas for additional funding and where “winners and losers” are very visible.

CONCLUSION

Despite the fact that entrepreneurship is a powerful force that generates local and economic growth, it is not obvious that state policy can create entrepreneurship. Even if entrepreneurs are grouped in a small geographical unit, it is not obvious that the government should use state policy to support such clusters. While the above-mentioned business policy usually does not require large flows of funding, it is still important to consider the shortcomings of inefficient policies. At this point, we are still just beginning to acquire sufficient wisdom to create reliable policies that absorb the externalities that may come from innovations and new start-ups.

Thus, knowledge about microeconomic processes in the modern digital economy that lead to growth is still incomplete. In neoclassical growth models, the production of knowledge was exogenous - the technical remainder, whereas the dissemination of knowledge was either exogenous, stochastic or isolated to large firms that more closely resemble pharmaceutical companies in which research departments try to come up with the following combination of molecules that will turn into the next unit - booster.

But knowledge is developed, applied and disseminated in many other ways, often through smaller innovative firms and entrepreneurs. The uncertainty, asymmetry and high transaction costs inherent in knowledge also give rise to a divergence in the evaluation and evaluation of the expected value of new ideas. This discrepancy in the assessment of knowledge between economic agents and in the decision-making process of existing firms can induce agents to start new firms as a mechanism for assessing the (expected) value of their knowledge. This suggests that entrepreneurship facilitates the dissemination of knowledge in the form of creating a new firm.

To manage successfully the knowledge introduction one needs in powerful tools of “digital age”. The described methods can assist in improvement of the innovation process, in Armenia and, as well, in other part of the world.

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KEY TERMS AND DEFINITIONS

Application of Blockchain Technology: Is application multifunctional and multilevel information technology designed to reliably record various assets in Digital Economy for help the technological challenges and created tools.

Avatar Model of High Technology: Is new model with natural intelligent for Avatar introduced in 2011 from Professor Vardan Mkrttchian.

Avatar-Based Management: Is new management technology in Digital Economy introduced in 2018 from Professor Vardan Mkrttchian.

Blockchain Technology: Is a multifunctional and multilevel information technology, designed to reliably record various assets in digital economy.

Entrepreneurs to Real Using Emerging Tools: Is entrepreneurs for the real use of new tools is a new approach to the concept of entrepreneurial phenomenon in a regional digital economy that can be used both at the national and national levels introduced in 2018 from Professor Vardan Mkrttchian.

Help and Control System: Is the system of reference and control is a new system based on knowledge and used for entrepreneurial in a digital economy introduced in 2018 from Professor Vardan Mkrttchian.

Sharing Digital Resource: Is exchanged of the digital resource is a new type of cooperation between enterprises in the digital economy in the form of knowledge obtained from digital avatars introduced in 2018 from Professor Vardan Mkrttchian.

Understanding SME Techno–Entrepreneurship in Nigeria’s IT Clusters

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INTRODUCTION

The adoption of technology in everyday business and social life has created thousands of jobs in the form of micro, small, and medium enterprises (MSMEs) which have become significant contributors to gross domestic products (GDP) of several national economies. These MSMEs overtime aggregate to form business clusters that are typical of innovation hubs, technology clusters, and commercial nerves that support business and everyday lifestyle. These clusters have become integral to the development of local contents for solving indigenous problems. Waldman-Brown, Obeng and Adu-Gyamfi (2013) define a cluster as a large conglomeration of firms in related industries, located in a specific region. Entrepreneurs in information and technology clusters largely depend on informal knowledge in order to acquire skills that will enable them effectively tackle IT problems. Bakar and Zainol (2015) note that these entrepreneurs (especially those in technological clusters) have the potential to advance indigenous technology if well nurtured. Their reliance on informal knowledge continues to grow mainly because they are mostly artisans who have no formal education. Given the need to grow their competence and innovativeness, networking and collaboration among co-operators within and outside ICT clusters where they operate are have become imperative.

There is also the rapid-obsolescence of technology which means that new knowledge of emerging technologies is needed to meet service support needs. Entrepreneurs must be able to identify and absorb knowledge from the immediate and wider environments in order to meet their clients’ needs. This requires interaction with different types of actors for the accumulation, synthesis and codification of the relevant information and knowledge needed to actualize different types of innovations (Nwagwu & Ibeku, 2016; Tepic *et al.*, 2012). Innovations occur in various establishments; however, innovative technology businesses are often located in clusters (Baptista & Swann, 1998; Porter, 1998; West, 2001; David-West, Umukoro, & Onuoha, 2018) in what is typical to business incubation and acceleration setting. Similarly, collaboration or teamwork also facilitates the development of new ideas that might emanate from customers, employees and competitors. For example, feedbacks from customers on a product’s use could be considered useful in the subsequent modification or design of the product. Through this iterative knowledge reconstruction, new products (frugal outcomes) that are tailored towards customer needs begin to evolve through a frugal mindset and process (David-West, Iheanachor & Umukoro, 2019a).

Nigeria has over the years been a large consumer of information and communication technologies with low innovative and development capabilities in the IT space. The cost of technology is however often too high for the mass market, thus calling for a frugal mindset in bridging the technology divide between and within nations (Soni & Krishnan, 2014) classified as developed, developing and under-developed economies. There is also the digitisation of businesses and processes alongside the emergence of new business models that disrupt the incumbent traditional pipe businesses (David-West *et al.*, 2018).

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In response to this digital disruption, many businesses have now migrated from the traditional model for digital enterprises while some are still in their evolutionary stages. This paradigm shift has created another category of entrepreneurship known as techno-entrepreneurship that is manned by a new archetype of entrepreneurs now framed as techno-entrepreneurs or digital-entrepreneurs.

Ironically, the concept of what attributes characterise techno-entrepreneurs, how they behave, and their levels of engagements across different levels of assets, resources and capabilities (ARCs) within IT clusters is yet to be documented. This is necessary as it helps in designing capability measures that help develop the ecosystem as well as strengthen local content for meeting national information and communications for development (ICT4D) priorities. This study therefore critically examines the emergence of techno-entrepreneurship in Nigeria's IT clusters and its role in the development of information technology products and services in solving first, Nigeria's local IT demands, and Africa at large. The rest of the chapter is organized as follows. Following this introduction, a brief description of the methodology adopted is provided, and after that, an overview of the concept of techno-entrepreneurs and SME techno-entrepreneurship is provided. This is followed by a section on SME techno-entrepreneurship clusters in Nigeria; attributes of SME techno-entrepreneurship in Nigeria, its relevance to the ICT ecosystem growth as well as national development. The paper concludes with a section on challenges and opportunities of SME techno-entrepreneurship in Nigeria.

BACKGROUND

This chapter is a conceptual framing of the concepts and issues of SME techno-entrepreneurship in Nigeria's ICT clusters. While the findings reported are not empirical, they are evidence of a rigorous literature review and ecosystem observation of the SME techno-entrepreneurship ecosystem in Nigeria. Three established ICT clusters that have been major contributors to Nigeria's economy were purposively selected and observed in this study. In order to provide a conceptual framing of techno-entrepreneurship practices across ICT clusters, a review of related literature was carried out. This was used to arrive at substantive concepts and issues which were later validated through cluster observations. A literature search using internet keyword searches was performed using dedicated databases such as JSTOR, Google Scholar, Emerald Insights, Ebscohost and industry publications between November 2018 and October 2019. Using an integrative approach to objectively critique, summarize and draw conclusions (Christmals & Gross, 2017; LoBiondo-Wood & Haber, 2010), themes on techno-entrepreneurs, SME techno-entrepreneurship, SME techno-entrepreneurship clusters in Nigeria, attributes of SME techno-entrepreneurship in Nigeria, and relevance of SME techno-entrepreneurship to ICT ecosystem growth as well as national development were explored. Relevant and related themes were further clustered, analysed and synthesise for coherence using a 'Best Fit' approach (Carroll *et al.*, 2013) involving a two-phase analysis. The first phase was to cluster similar themes and synthesis of same for coherence to arrive at an academic viewpoint, while the second phase involved synchronization of the output of the first phase to arrive at the conceptual framing presented in this chapter.

Overview of Techno-Entrepreneurs and Techno-Entrepreneurship in Nigeria

Techno-entrepreneurs devise and harness new strategies of solving IT problems in a frugal manner amidst resource constraints relating to assets, resources, and capabilities. These concepts have been studied in-depth in innovation literature (Ibeku, 2018; Nwagwu & Ibeku, 2016; Tepic *et al.*, 2012; Klerkx and

Leeuwis, 2009; Nooteboom *et al.*, 2007; Reagans & McEvily, 2003 and Hansen, 1999). Specifically, techno-entrepreneurship is broadly defined as the process of creating new technological and internet-driven businesses, products, and services with the ultimate goal of driving efficiency and achieving a high return on investment (David-West, Omotayo & Umukoro, 2019b). It is the manner through which entrepreneurs draw on resources and structures to exploit emerging technology opportunities (Liu *et al.*, 2005). Van Welsum (2016) argues that techno-entrepreneurship encompasses both digital startups and existing businesses that incorporate information and communications technology (ICT) towards enhancing existing business processes and activities.

In conceptualising techno-entrepreneurship, Bailetti (2012) identifies four definitive elements. These are: the ultimate outcomes (including value creation and value capture); target of the ultimate outcome (the firms for which value is created and captured); delivery mechanism (the methods and approaches used for delivering the value created and captured); and interdependence of the delivery mechanism with scientific and technological advances that enterprises must harness to co-produce an intended output. Consequently, David-West *et al.* (2019b) posit that techno-entrepreneurship is designed to create and capture value for an enterprise by systematically aggregating assets, resources and capabilities via the intermediation of technology. The importance of techno-entrepreneurship lies in its ability to identify problems as well as apply technology to create the desired solution. Its significance also lies in the ability of techno-entrepreneurs to search for technological innovations that are capable of generating new solutions, launching new ventures, and exploiting new market opportunities. Techno-entrepreneurship can create and deliver customer value propositions more efficiently and effectively through the development of a frugal mindset by techno-entrepreneurs.

SME Techno-Entrepreneurship Clusters in Nigeria

The Otigba Computer Hardware Cluster, Lagos: The cluster otherwise known as the Ikeja Computer Village in Lagos, Nigeria evolved from trading in imported IT components and products in the early 1990s. Between 2002 and 2003, the cluster had grown to consist of 2,500 sales and repair outlets and has become a beehive of IT activities. The cluster consists of trained and untrained experts and artisans who engage in trading, supply, and repairs of IT facilities ranging from computers, telecommunication equipment, satellite technologies and services, and mobile phones. This network of suppliers, buyers, repairers, clone builders, and components traders at Otigba cluster has generated an intensely competitive environment and a local milieu that provide for a significant knowledge base for the future of Nigeria's IT revolution (Nwagwu & Ibeku, 2016; Oyelaran-Oyeyinka, 2014).

The Abuja ICT Clusters: Abuja is Nigeria's seat of government, and with heavy political presence, the city enjoys the government's most exceptional policies and initiatives. This is also true in the area of techno-entrepreneurship clustering as the federal capacity territory houses a handful of ICT clusters. There is the Abuja Technology Village (ATV) which is home to the Science and Technology Park (STP) as well as Special Economic Zone (SEZ). The ATV has the objective of becoming Africa's destination of choice for technology research, incubation, development and commercialisation in four strategic sectors vis-a-vis information and communication technology, biotechnology, minerals technology and energy technology. Operated by the federal government, there is also a proposed launch of the 'ICT Parks' that will house different clusters of technology companies in the FCT and those near universities to help nurture fledgeling technology industries by developing pools of natural, naive and evolving talent. The proposed ICT Park has an extended objective of driving the growth of existing technology-based

companies. It will also facilitate the growth of SMEs, develop digital capacity and entrepreneurial skills aimed at promoting a digital economy as well as attract significant national and international companies, thereby attracting inward investments, create world-class physical facilities and proactive support services.

Abuja also plays host to a GSM and Computer Village – a bustling market that caters for techno-entrepreneurial services such as sales, maintenance, and repairs of phones, computers alongside artisanal service offerings. The Abuja GSM Village as it is fondly called boasts of a diverse SME techno-entrepreneurs including laptop engineers, software engineers, mobile phone technicians, technology hardware vendors, and other non-techno-entrepreneurs who provide support services. Like other ICT clusters, this cluster boasts of young entrepreneurs – both university graduates and non-graduates who have gone through internship and artisanship. A tour of the Abuja GSM and Computer Village justifies its signature of being the melting pot for electronic devices in the nation's Federal Capital Territory. The high sense of ingenuity and creativity of techno-entrepreneurs exhibited through their reverse engineering, repairs, cloning, and installation activities make one question the intellectual capacity of device manufacturers.

The Yaba ICT Cluster, Lagos: Yaba has been one of Africa's rising technology hubs over the last two decades and remains the hardest evidence of an emerging technology ecosystem in Nigeria. Although the popular Otigba (Computer) Village remains the biggest ICT cluster in Nigeria, it is most known for its focus on hardware. On the contrary, the Yaba ICT cluster or Yabacon Valley as it is fondly called is a software hub that houses Nigeria's software powerhouses such as Co-creation Hub (CcHub), Andela, NG-Hub (powered by Facebook), BudgIT, Blue Lab (powered by Stanbic IBTC), Digital Lab (powered by FirstBank), PagaTech, and others that serve as incubators and accelerators to many digital star-ups. Until more recently, the ICT cluster has largely operated without much of coordination before key players came together to carve the Yaba ICT Manifesto – a framework for the Yaba ICT Cluster. The Yaba ICT cluster is conceived around seven key objectives of culture, funding infrastructure, talent and skills, policy, Yaba as a testbed for a smart city, and research & development. The cluster has been developing organically for about a decade or more with pioneer organisations such as the Co-Creation Hub (CcHub). The community is now working on an initiative that will further develop the Yaba ICT cluster as a hub for knowledge, innovation, technology and entrepreneurship. This is with the aim of creating an enabling environment which facilitates and supports the development of a technology and innovation ecosystem for Nigeria, and the rest of Africa. The Yaba ICTcluster also enjoys government participation through the Ministry of Science and Technology, the Ministry of Wealth Creation and Employment, and the Ministry of Physical Planning & Urban Development¹. The likes of Google, Microsoft, MainOne, Andela, General Electric (GE), CcHub, Flutterwave, University of Lagos, Lagos State University and Ibile Broadband make up the industry advisory board (IAB). The focus of the IAB is to improve an enabling environment that promotes infrastructure, policy regulation and governance, access to funding, access to market and demand, research & development, talent, skills & education, networks & collaboration, advocacy and marketing, and strategic partnerships.

Types of Techno-SMEs in Nigeria's ICT Clusters

Techno-entrepreneurship began with the adoption of information and communications technologies (ICTs) as time-saving and cost-reduction tools with which small business owners met their communication rather than information-processing needs (Ducomber & Heeks, 2002). The growing mobile penetration rate and its impact on today's digital economy continue to drive the adoption and application of ICTs in

many business endeavours. Micro, small and medium scale enterprises (MSMEs) also continue to exploit the business opportunities that have opened up consequent of the digital economy. The digital economy is underpinned by the power of the interconnectedness of mobile and other digital technologies with which economic activities are carried out with the ultimate goal of developing innovations from ideation, design, testing and prototyping, and the commercialisation of such innovations. In a study conducted by Nwagu & Ibeku (2016) on technology products and services operators in the Otigba Computer Village, the authors report that key activities that are undertaken in the cluster include but not limited to sales, repairs, cloning, installation, and maintenance of technology artefacts.

Techno-entrepreneurship in Nigeria's ICT clusters can be broadly classified into two archetypes. These are formalised techno-entrepreneurship and non-formalised techno-entrepreneurship. Using the typology developed by Waldman-Brown (2018) in categorising SMEs in manufacturing clusters, the two archetypes can be further described as follows:

- i. **Formalised Techno-SMEs or Techno-Entrepreneurs:** These are SMEs that have formalised business structures and registered with the Corporate Affairs Commission (CAC). They are usually into wholesale and retail of ICT hardware and software services, as well as large-scale ICT service provisionings such as repairs, maintenance, installation, and other professional IT services. They can be specialised (focusing on a particular line of IT service offering) or blended (providing a variety of ICT services that cut across different businesses). This archetype of entrepreneurs enjoys a *virtual factory* of networking with both internal and external stakeholders to be more productive. While their level of formalisation can be a driver of entrepreneurial success, Waldman-Brown (2018) argues that the virtual network of infrastructure that they enjoy is the key to entrepreneurial progress.
- ii. **Non-Formalised Techno-SMEs or Techno-Entrepreneurs:** These are SMEs with very few employees with widely-variable office space or 'workshop' dedicated to their entrepreneurial activities. They are likened to what Waldman-Brown (2018) describe as *craft SMEs*. These techno-entrepreneurs typically employ low-tech equipment and significant manual labour and are, in most cases, not formally-registered businesses. Majority of their workforce is made up of artisans who are eager to learn an ICT-related skill and would even pay apprenticeship fee. In line with what is seen in Nigeria's techno-entrepreneurship clusters, The International Labour Organisation (2016) describes this type of non-formalised entrepreneurship as one that comprises almost exclusively of informal enterprises and remains the second-largest source of jobs in emerging markets after agriculture. Waldman-Brown (2018) further notes that rather than employing automation or industrial-scale equipment, these entrepreneurs tend to lack a clear division of labour. They typically operate a *job shop style* where workers use whatever materials and equipment available to them rather than the *flow shop style* where tasks and workflows are scheduled in advance. This is because these striving entrepreneurs are constrained with the needed resources that are needed to become well established. Nwagwu and Ibeku (2016), however, note that the ability of these entrepreneurs to draw on their informal networks is a driver of their innovativeness.

Table 1 shows the different types of service offerings provisioned across these two archetypes of techno-entrepreneurship.

Table 1. Services offered by SME Techno-entrepreneurship Types

Formalised Techno-entrepreneurship	Non-formalised Techno-entrepreneurship
Sales & marketing – wholesale and retail	Sales (retail of mostly used parts and low-price accessories)
Maintenance of hardware and software (corporate clients)	Maintenance
Product development (software)	Cloning & refurbishment (mostly mobile phones, computers, accessories)
Repairs (service centres for OEMs)	Repairs (often powered by reverse engineering)
Installation (computer networks, internet, protocols, etc.)	Installation (applications, parts, etc.)
Incubation, acceleration & internship	Apprenticeship

Source: Author's compilation

Frugal Innovation and SME Techno-Entrepreneurship Nigeria

Various forms of exclusion including financial exclusion (lack of access to formal financial services), social exclusion, economic exclusion, as well as digital exclusion exist at the bottom of the pyramid (BOP) segment. This is because members of the BOP are characterised by low-income, low literacy levels, rurality, low digital self-efficacy, and such others. One of the critical advantages of techno-entrepreneurship is its role in creating technological solutions amidst resource constraints. David-West *et al.* (2019a) report that to be frugal amidst resource constraints, an innovation must address all dimensions and processes relating to the conceptualisation and production of products and services. Accordingly, Sammut-Bonnici and McGee (2015) describe the term frugal innovation as the practice of simplifying product components and manufacturing processes into basic elements, to redesign both the product and the processes to become more efficient and cost-effective. Frugal innovations are those innovative products and services specifically designed with a frugal mindset and processes to achieve a frugal outcome that promotes inclusiveness at the BOP in terms of affordability, accessibility, and usability.

Techno-entrepreneurship seeks to evolve products and services that are cost-effective and less complex in terms of usability, especially for a market segment that would have been excluded either by cost or design sophistication. Nigeria's ICT clusters are characterised by elements of frugal innovation and can, therefore, be described as frugal innovation hubs. This is because many of these techno-entrepreneurs exhibit a frugal mindset and processes that translate into frugal outcomes (low-cost and less complicated products and services) that address the economic needs of the BOP segment. The frugality of a product or service stems from three key underlying assumptions that a) it has to be conceived by a frugal mindset, b) it is driven by a frugal process, and c) the outcome must be frugal in nature. Frugal innovations, therefore, involve a combination of frugal mindset, a frugal process, and a frugal outcome.

Attributes of SME Techno-Entrepreneurship in Nigeria

Frugal Mindset

A frugal mindset depicts how a producer prudently manages meager resources to meet the development of quality products and services targeted at low-income customers. The inability of businesses to exhibit a frugal mindset towards meeting the needs of the BOP customer segment can lead to expensive products and services that are unfit for the intended market segment (David-West *et al.*, 2019a; Weyrauch & Herstatt, 2017; Lehner & Gausemeier, 2016). Techno-entrepreneurs across Nigeria's ICT clusters evolve or innovate solutions that meet the needs of the BOP through a frugal mindset. This is because, given

the resource constraints faced by these entrepreneurs, they embark on component re-use by sourcing for usable parts of non-working technological artefacts by dismantling and assembling them to evolve whole new products. Another dimension of a frugal mindset is to strip products or services of unnecessary costs and features – a process also known as value innovation. While the former is most practised in a resource constrained environment and most seen in Nigeria's frugal innovation hubs and ICT clusters, the latter is most embarked on by formalised, established and large-scale SMEs.

Using Radjou *et al.* (2013) six principles of frugal innovation, it can be argued that a frugal mindset must (i) find opportunities in adversity and transform constraints into opportunities; (ii) must do more with less; (iii) the innovation must think and act with agility; (iv) it must aim for simplicity; (v) must involve the marginal population; and (vi) follow the innovator's heart. A frugal mindset is also exhibited by Nigerian techno-entrepreneurs resource discovery ability. Most of these entrepreneurs operating out of these ICT clusters see '*things*' as resources where others do not imagine them as resources. By stretching and applying such resources in new ways, techno-entrepreneurs can utilise these resources without paying or paying much less than they are worth (Sharmelly & Ray, 2018; Ng, Grafton, Tan, & Tan, 2018). In other words, these techno-entrepreneurs exhibit a frugal mindset which Korsgaard *et al.* (2018) referred to as *spatial bricolage*².

Frugal Processes

A frugal process entails the creation of value for the end-customer with minimal wasteful efforts that would otherwise have translated into high cost-to-use. David-West *et al.* (2019a) posit that frugal innovation takes low-cost strategies that succeed by leveraging lower cost structures through economies of scale to appeal to mass markets. They further note that while the low price of frugal product or service can result in proportionately small margin per product, profitability is achieved through economies of scale that is reached at the mass-market segment. In several ICT clusters in Nigeria, especially the hardware clusters, what most techno-entrepreneurs embark on is a lean approach to product innovation, development, and service delivery. Sammut-Bonnici and McGee (2015) describe this type of frugal process approach towards innovation as constraint-based and reverse innovation. The Economist (2010) notes that beyond product redesign, a frugal process re-imagines the entire production processes and business models to be more customer-centric in terms of affordability and usability.

Frugal Outcomes

A frugal outcome is essentially an end product or service that addresses the underserved or excluded markets at the low-end of an economic system; or products and services that primarily meet the needs of developing markets. David-West *et al.* (2019a) posit that the BOP customer segment is disconnected from the formal economy due to lack of critical development infrastructure that is needed to drive businesses and commercial activities. Such challenges that constrain businesses from serving the BOP segments profitably and sustainably have also created opportunities for frugal innovations (David-West *et al.*, 2019a). Addressing this market segment calls for entrepreneurs to develop frugal outcomes (Tiwari, Fischer & Kalogerakis, 2017a&b; Tiwari, Fischer & Herstatt, 2016 Nunes & Breene, 2011; Zeschky, Widenmayer & Gassman, 2011).

How do techno-entrepreneurs operating out of Nigeria ICT cluster achieve frugal outcomes? Products and services sold and offered across these ICT clusters are people-centred, small-scale, less labour-intensive, energy-efficient, environmentally sound, and locally controlled. Soni and Krishnan (2014)

classified these features as *appropriateness of technology*. Also, products and services provided by these techno-entrepreneurs address the needs of under-served or unserved markets at the low-end of the economic system. Soni and Krishnan (2014) classified these features *bottom of the pyramid innovation*.

Networking

According to Aalst (2003), networking relates to the systematic establishment and use of internal and external links between people, teams or organisations to improve performance. Networking is an essential entrepreneurial culture in a social system. Interaction and communication with people could bring advantages such as business opportunities, improved skills and expansion of customer base among others. Business organizations, therefore, require networking with one another to grow (Nwagwu & Ibeku, 2016). Through relationships with other organisations in the same business area or other complementary areas, there is a possibility for the development of new techniques, processes, and products. Innovators in clusters collaborate to be able to attain competitiveness because participating units and individuals complement one another to retain competitive advantage and to ensure continued relevance in the sector. Also, collaboration with actors that are external to the business clusters such as knowledge-intensive institutes, universities and technology developers, among others, can contribute to new product and service delivery concepts. For techno-entrepreneurs, maintaining an active network is needed to develop a critical entrepreneurial relationship. Garnsey (1998) opines that in the initial phase of a business, entrepreneurs should be able to access, mobilise, use resources existing in the environment for gaining benefits.

These interactions among members of technology clusters are essential for the acquisition of diverse forms of new knowledge, leading to innovation and innovativeness (Tepic *et al.*, 2012; Nooteboom *et al.*, 2007; Reagans & McEvily, 2003; and Hansen, 1999). Furthermore, techno-entrepreneurs require networking as an essential means to develop relationships that could help them grow in their businesses (David-West *et al.*, 2019a; Hagedoorn & Schakenraad, 1992). Although the idea of networking is as old as history and transcends academic fields and disciplines, information technology objectifies and has expanded the meaning and application of networking because it creates opportunities for people to interact in real-time from their dispersed locations. In light of this, Garcia-Morales, Martín-Rojas and Lardón-López (2018) note that leveraging network effects and knowledge flows through the use of emergent phenomena can help firms create business value that meet customer growing needs. They also submitted that by changing the way different agents and organizations communicate, valuable connections that transform business models can be established. Techno-entrepreneurs must, therefore, engage in networking activities to acquire new skills for improved service delivery and innovation. This attribute is manifested in Nigeria's information technology clusters (Nwagwu & Ibeku, 2016).

Networking in Clusters for Innovativeness

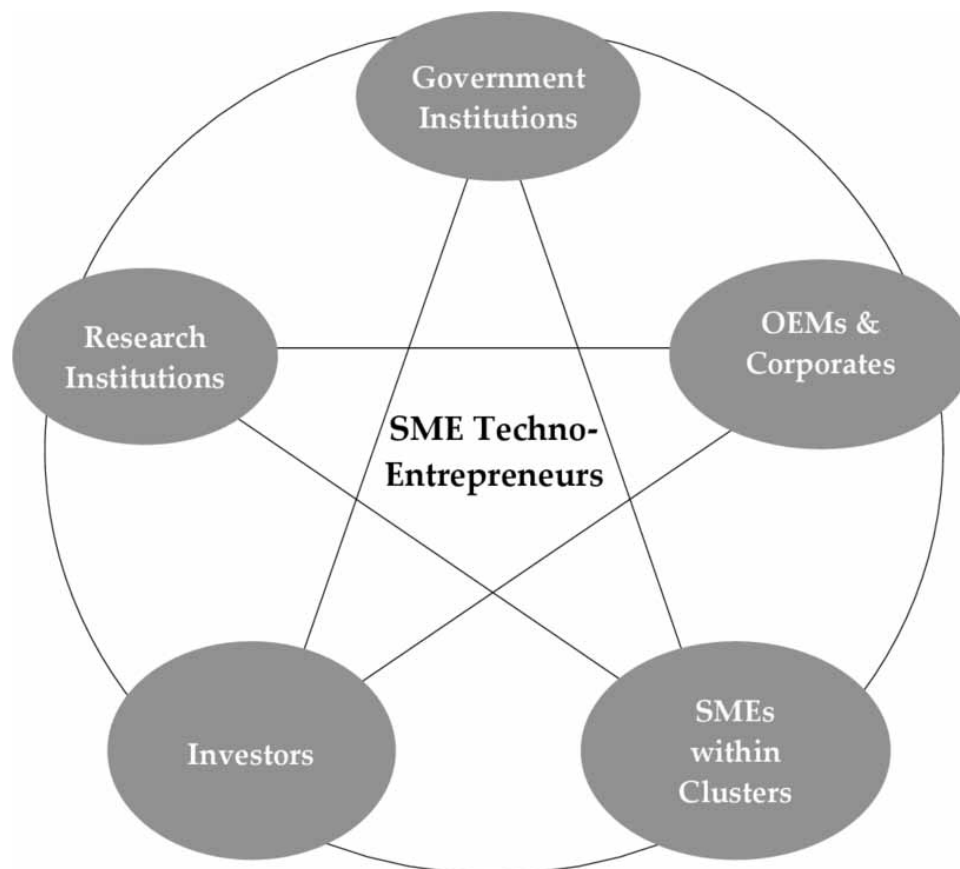
The geographical clustering of inter-networking firms continues to gain significance in the business community and attracted intense research attention (Ibeku, 2018; Ibeku & Nwagwu, 2016; Porter, 1998). It is frequent to encounter innovation networks and hubs around ICT clusters as they share non-transactional elements – an environment that is traditionally used to sharing information and knowledge indispensable for innovation (Jorge, Maria & Irina, 2004). It is widely accepted that cluster consolidation and development is intimately related to ties and linkages with other firms and institutions and is highly dependent on behavioural imitation. The importance of networking to innovativeness cannot be understated. It is in light of this that Huang and Wang (2018) stated that that weak network ties facilitate

exploratory learning, whereas strong relationships influence exploitative learning. Thus, individuals need to have the ability to interact and cooperate with other actors to reduce uncertainty and foster relevant complementary knowledge (Jorge *et al.*, 2004). Such interactions and cooperation should cut across actors within and outside clusters.

Using the description of weak and strong network ties earlier provided by Huang and Wang (2018), Nigeria's techno-entrepreneurs operating out of ICT clusters enjoy a mix of weak and strong network ties. Weak network ties exist where there is a conspicuous absence of formalised institutions (such as government ministries and agencies that are concerned with information technology and education) and businesses such as original equipment manufacturers and software companies. Strong network ties, therefore, exists where there is direct and obvious participation of formalised institutions and businesses that help catalyse the development of the needed assets, resources and capabilities required by techno-entrepreneurs to be frugally innovative yet profitable and sustainable without compromise on quality.

In specific clusters like the Yaba ICT cluster, there is a visible presence of technology firms that provide incubation and acceleration support to techno-entrepreneurs. Networking ties within such cluster is very high and does drive high innovativeness among techno-entrepreneurs. In places clusters like Otigba (computer) village, there is a mix of strong and weak networking ties. While there is a strong presence of known technology brands such as Samsung, Apple, Hewlett Packard, Dell, Techno, Infinix Mobile, and more, what is mostly witnessed is wholesale dealership with some level of technical training for local entrepreneurs that help provide after-sales support services in terms of repairs and

Figure 1. Techno-entrepreneurs' Network Ecosystem



installation. Weak networking ties becomes apparent when there is no transfer of knowledge on how to frugally innovate IT products and services for solving indigenous problems faced by the bottom of the pyramid market segment. Where there is a marked absence of strong networking ties, what most Nigerian techno-entrepreneurs result to is horizontal networking where there is a transfer of knowledge between entrepreneurs within the cluster. Oyelaran-Oyeyinka (2006) describes this kind of horizontal networking tie as inter-personal learning and collaboration between its techno-entrepreneurs. Figure 1 shows the nature of SME techno-entrepreneurial networking in Nigeria's ICT clusters.

Innovative Behaviour

The ability to introduce an innovation is one of the most important aspects of a social system's process (Nwagwu & Ibeku, 2016). Consequently, the need for techno-entrepreneurs in an IT cluster to have the capacity to develop novel ways of addressing old and new IT problems using new and existing strategies remains pertinent. This is important especially in an economy whose ICT sector relies heavily on importation to meet her IT infrastructural demands amidst the challenges of local content development. Literature evidence suggests that although, techno-entrepreneurship is still at its nascent stages of development (David-West, Muritala & Umukoro, 2019), Nigeria's techno-entrepreneurs operating within IT clusters have demonstrated various levels of innovative capabilities in order to serve their customer segments efficiently with quality home-grown solutions. Although a certain level of innovativeness characterises techno-entrepreneurship in Nigeria's ICT clusters, there is the question of whether these techno-entrepreneurs have sufficient capacity to innovate quality IT products and services.

Ibeku and Nwagwu (2016) report that there is a strong relationship between the ability to innovate within a cluster and the networking behaviour that takes place. Similarly, Oyelaran-Oyeyinka (2014, 2006) reports that the strength of clusters lies in the quantity and quality of networking ties that exist between members. He referred to networking links as the inter-personal learning and collaboration among members of the cluster. It is pertinent to note that although Nigerian ICT clusters have not recorded strong networking ties, they have continuously driven their innovative practices by leveraging horizontal networking.

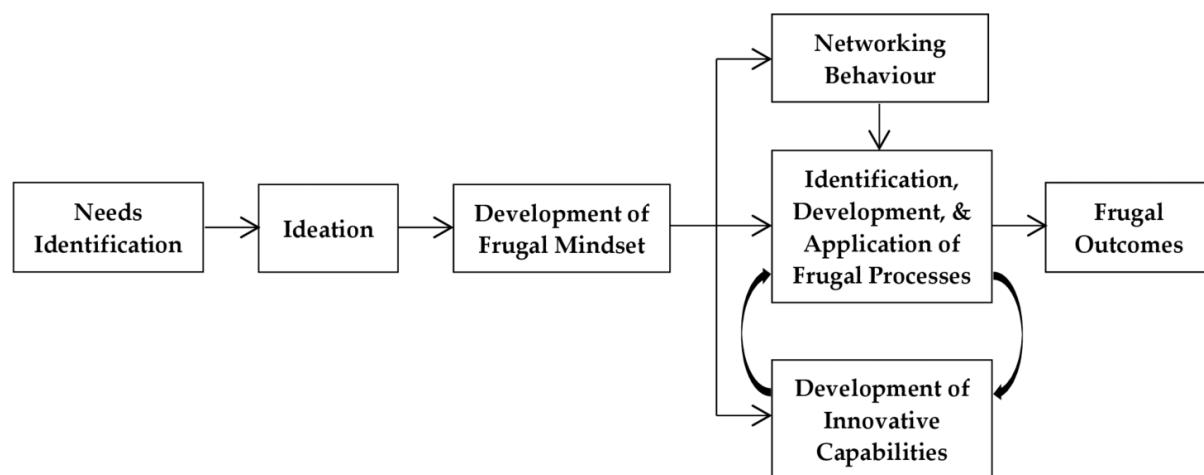
Understanding the Nature of SME Techno-Entrepreneurship Clusters in Nigeria

As earlier noted, techno-entrepreneurship in Nigeria is dominated by two distinct categories of entrepreneurs – formalised small and medium enterprises and non-formalised small and medium enterprises. The nature of SME techno-entrepreneurship can be described using the dominant attributes exhibited by techno-entrepreneurs as well as the types of activities undertaken by these entrepreneurs. The national system of innovation can be used to map the nature of SME techno-entrepreneurship in Nigeria's ICT clusters. Though nascent, David-West *et al.* (2019a) posit that frugal innovation theory negates assumptions that innovation occurs because of the existence of slack resources and supporting institutions, thus contrasting Lundvall's (1992) theory which argues that innovation occurs only in the presence of the correct components of the National System of Innovation.

In consonance, Bhatti (2012) posits that frugal innovation does not occur in the presence of organisational slack and institutional mechanisms but occurs when there is a social need, resource constraints, and intuitional voids. Techno-entrepreneurship does occur where there is a need to meet or a market void to fill. In consonance, Dodgson (2018) and Awoleye (2013) also posit that innovation is achieved

by meeting challenges in a manner in which better, more efficient, and skillful approaches are employed in the business processes. Given, SME techno-entrepreneurs exist in a cluster where both formal and informal linkages and networks can be leveraged to overcome resource constraints. As social needs arise, alongside the quest to meet such needs amidst resource constraints and institutional voids, techno-entrepreneurs develop a frugal mindset to prudently utilise meagre resources using frugal processes for the development of frugal outcomes (quality products and services) targeted at low-income customers. To address resource constraints, techno-entrepreneurs operating within ICT clusters engage in networking activities within and outside the clusters. Through this process, entrepreneurs' innovative abilities are enhanced. Similarly, Dodgson (2018) reports that networking is important as it can lead to increased scale and activities which in turn translate into wider customer base. In Figure 2, the chapter proposes

Figure 2. Proposed Model of SME Techno-entrepreneurial Practice in ICT Clusters



a model that describes the nature and flow of techno-entrepreneurial practice in Nigeria's ICT clusters.

The Relevance of SME Techno-Entrepreneurship to Nigeria's ICT Ecosystem

Techno-entrepreneurs remain critical to the development of Nigeria's ICT ecosystem as the bridges between those that are digitally included and those that are not through their frugally innovated homegrown solutions. One of the problems faced by emerging economies is the development of local ICT capacity for solving everyday problems. In light of this, Waldman-Brown (2018) submits that innovation-driven entrepreneurs have the potential of playing a significant role in supporting development, be it in the formal or informal sector. Their ability to support small-scale experimentation with novel techniques for solving ICT problems is significant to ecosystem development.

Through ecosystem partnership, networking which is a key attribute of techno-entrepreneurship can help attract industry players that will invest in ICT clusters in developing the capacity needs of local techno-entrepreneurs for an enhanced innovative culture. Such networking interactions have the capability of producing spin-off firms from research projects, as well as birthing new digital start-ups following successful incubation and acceleration programmes. Also, investment in techno-entrepreneurship can and has generated foreign direct investment (FDI) for Nigeria's ICT sector as has been witnessed by the likes of Farmcrowdy, Flutterwave, Paystack, Piggyvest, Andela, CcHub, and the likes.

Nigeria's techno-entrepreneurship, especially across ICT clusters, has contributed to the development of human capacity in the ICT sector. Many of these techno-entrepreneurs continue to remain internship centres that absorb fresh graduates and students undergoing the *student industrial work experience (SIWES)* programme that is mandatory for most programmes offered across Nigerian universities. These young individuals are provided with an environment where they get hands-on experience using a test-and-learn approach. On the other hand, it allows techno-entrepreneurs to subsidise labour cost by absorbing these inexperienced graduates and undergraduates who are in needs of practical skills. In essence, techno-entrepreneurship in Nigeria's ICT clusters can help bridge the functional skill gaps existing between the academia and industry.

Challenges and Opportunities of SME Techno-Entrepreneurship in Nigeria

While there continues to remain a debate on the quality of home-grown solutions, questions relating to what role networking behaviour plays amongst members within and outside ICT clusters, and if the members of a cluster have sufficient skills to innovate, remain unanswered. These skepticisms require immediate attention in order to drive and enhance collaboration and innovativeness in Nigeria's IT sector which is also considered as one major way to developing local contents. Although there are noticeable levels of networking, innovativeness and some elements of frugality among the techno-entrepreneurs found in Nigeria's ICT clusters, formalised techno-SMEs are more positioned to exploiting the opportunities that abound in the techno-entrepreneurship space. While the non-formalised techno-SMEs exhibit some level of the attributes identified earlier, they do need government and industry support for driving their entrepreneurial effectiveness.

In terms of opportunities that exist in SME techno-entrepreneurship, David-West et al. (2019b) identified mobile technology, broadband, the sharing economy, and digital platforms as four key areas of opportunities that will drive SME techno-entrepreneurship not just in Nigeria, but across Sub-Saharan Africa (SSA). Mobile phone ownership continues to surge across Africa and has the potential of creating opportunities in the areas of sales, repairs, maintenance, and even manufacturing as is currently witnessed in Rwanda. David-West et al. (2019a) note that the opportunities brought by mobile penetration are evident in how mobiles are being deployed in ways that have not been tested before, even in some advanced economies. The employment and income-generating opportunities remain massive and will continue to grow as smartphone adoption continues to rise. In the area of broadband, entrepreneurs that operate technology-based ventures will significantly benefit from high penetration and ease of access through the *horse speed* internet across the region which in no doubt will support innovations (De Beer et al., 2017).

Technology makes sharing possible, and with the emergent sharing economy, many entrepreneurs have begun evolving their business models to launch new technology start-ups. For resource-constrained entrepreneurs, the opportunity to share co-working spaces, hardware and software has now been made possible. This is because technology makes sharing and consumption cheaper. This is very prominent in the Yaba ICT clusters where the likes of Co-creation Hub (CcHub) are using the business incubation and acceleration models to develop techno-entrepreneurs for Nigeria and Africa at large. David-West et al. (2018) report about 675 digital platforms across sub-Saharan Africa with Nigeria having the highest (194) platform concentration. The opportunity provided by platforms is seen across Africa with other countries such as South Africa boasting having about 108, Kenya with a total of 78 platforms, Ghana with 37, while Cameroon and Tanzania have 24 platforms each (David-West et al., 2018). There are also opportunities for SME techno-entrepreneurship in the area of incubators, hubs, and accelerators.

David-West *et al.* (2019b) note that though technology hubs in Africa are still at their nascent stages, they are growing by leaps and bounds and have received sizeable amount of investment from venture capitalists and angel investors within and outside the region. Technology hubs, alongside incubators and accelerators have a potential of providing the needed support for new digital start-ups.

CONCLUSION AND RECOMMENDATION

This chapter shows the nature of SME techno-entrepreneurship across Nigeria's ICT clusters by defining the attributes that characterise techno-entrepreneurs in information and communication technology clusters. The chapter conceptualises that SME techno-entrepreneurship lies at the intersection of a frugal mindset, frugal processes, networking and innovative behavior, all of which lead to the development of frugal outcomes that meet the needs of the mass market. There is a need for networking among techno-entrepreneurs through formal and informal linkages with one another as well as institutions such as universities, polytechnics and research institutes, and industry practitioners. This can foster the development of needed assets, resources, and capabilities (ARCs) that drive techno-entrepreneurial innovativeness. When compared to the findings of Abiola (2006) on the level of networking amongst technology artisans in Nigeria's IT clusters, this chapter shows that while the level of collaboration among techno-entrepreneurs is largely informal, promoting diversity of means (vertical and horizontal linkages) through which knowledge is acquired is important for the development of frugal outcomes, and for the growth of cluster techno-entrepreneurship.

The chapter recommends the establishment of government's ministries and agencies such as the Federal Ministries of Communications Technology, Science and Technology, Commerce and Industries, and Education, the Nigeria Information Technology Development Agency (NITDA), National Office for Technology Acquisition and Promotion (NOTAP) and other stakeholders in the public and private sector that are concerned with information technology and education. This will enhance the innovative behavior of techno-entrepreneurs as well as technology start-ups in Nigeria's ICT clusters. Government must, therefore, encourage networking and knowledge transfer through establishment of knowledge hubs that will aid techno-entrepreneurs' innovativeness at enhancing local content development as well as facilitate economic growth. Furthermore, government needs to initiate and monitor the right policies that will encourage private sector participation in terms of partnerships in the areas of establishment of investment vehicles, entrepreneurial development through skills acquisition, and regulations towards enhancing global best practices.

Future Research Directions

Very few studies exist on SME techno-entrepreneurship and where such exist, the focus has been on formalized SMEs. Despite the importance and contribution of cluster techno-entrepreneurship towards solving local problems, less attention has been paid to understanding the nature of these techno-entrepreneurs operating out of ICT clusters. While this chapter has provided a conceptual framing for understanding SME techno-entrepreneurship across ICT clusters, the concepts and issues presented in this chapter need to be empirically validated as the chapter only presents evidence from literature and cluster observations. Also, the model proposed in this chapter needs to be tested and where necessary, improved upon.

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KEY TERMS AND DEFINITIONS

ICT Cluster: This is an aggregation of formalized and non-formalized businesses within a location with specialized business functions or activities focusing on a particular industry or sector.

Information and Communication Technology: This is a term used for describing all technologies that facilitate the processing, access to, storage, manipulation, use and exchange of information between a sender and receiver of information across various media.

Information and Communications Technology for Development (ICT4D): This refers to the use of technology for helping poor and marginalised individuals and communities in developing countries to bridge the digital divide and aiding economic development by ensuring equitable access to up-to-date communications technologies.

Innovative Behaviour: This refers to an entrepreneur's tendencies and practices aimed at devising new solutions or development of new products and services for solving identified problems.

Networking: This is a formal or informal interaction that is established by entrepreneurs with co-entrepreneurs or with suppliers, government, as well as other institutions and agencies within and outside a business cluster or ecosystem.

Techno-Entrepreneur: This is an individual who takes up a business endeavor that is focused on providing technology services and products with a staff strength of 2 to 100 employees.

Techno-Entrepreneurship: This is the process of creating new technological and internet driven businesses, products and services with the utmost goal of driving efficiency and high return on investment.

ENDNOTES

- ¹ Kite Yaba. Available at <https://techcabal.com/2018/11/05/kiteyaba-complete-ict-cluster-visioning-workshop/>
- ² Spatial bricolage is an art of making to do with resources within an immediate spatial context to overcome resource constraints.

The ISO/IEC 29110 Software Lifecycle Standard for Very Small Companies

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INTRODUCTION

Software development is a complex socio-technical activity and in earlier work we have examined the complex interaction between a software development process and its situational context (Clarke et al, 2015). Part of the challenge of organising the software development process involves deciding upon the specific roles involved in the process and the responsibilities of individuals fulfilling these roles. Therefore, just as the process itself is subject to regular change (Clarke et al, 2017) so too are the roles subject to change. We have therefore examined the role of the software engineer and how this has changed over time, including how it might change into the future.

Quality orientated software process approaches and standards have gained mainstream acceptance in the software development community over the year. There are many potential benefits of using standards due to the emphasizes on communication and having a shared common understanding of software lifecycle tasks.

For many small and start-up software companies, implementing controls and structures to properly manage their software development activity is a major challenge (Coleman & O'Connor, 2008c). It is commonly agreed that very small software companies, implementing management procedures, and controls to appropriately administer their software development activity is a significant challenge (Laporte et al, 2015). For example, a software company operating in Mexico may have a completely different set of operational problems when compared to a software company in the USA or Ireland. Even within a single geographical area such the range of operational issues faced by a small local firms can be radically different to those affecting a multinational subsidiary. The fact that all companies are not the same raises important questions for those who develop software process and process improvement models (Larrucea et al, 2016). To be widely adopted by the software industry, any process or process improvement model should be capable of handling the differences in the operational contexts of the companies making up that industry. But process improvement models, though highly publicized and marketed, are far from being extensively deployed and their influence in the software industry therefore remains more at a theoretical than practical level.

To help meet the need for VSE-specific systems and software lifecycle profiles and guidelines, the International Organization for Standardization and the International Electrotechnical Commission jointly published ISO/IEC 29110 “Lifecycle profiles for Very Small Entities” series of standards and guides, with the overall objective being to assist and encourage very small software organization in assessing and improving their software. These publications target VSEs, ranging from start-ups to grownups, with little or no experience or expertise in selecting the appropriate processes from systems or software engineering lifecycle standards (such as ISO/IEC/IEEE 12207) and tailoring them to a project’s needs (Laporte et. al, 2017).

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The purpose of this chapter is to provide a primer on the ISO/IEC 29110 standard focusing on two main process areas of Project Management and Software Implementation. This chapter will start with an explanation of the rationale and justification for the development of this new standard, followed by an overview of its structure and explain how to deploy ISO/IEC 29110 in a typical very small software company.

BACKGROUND

This section will introduce the problem with standards and explain the specific case of very small entities, before presenting the ISO/IEC 29110 standard as a solution specifically designed to address these problems for very small companies.

Very Small Companies (VSE)

Due to the rich variety of software development settings (for example: the nature of the application being developed, team size, requirements volatility), the implementation of a set of practices for software development may be quite different from one setting to another (Jeners et al., 2013a). Small and very small companies are the fundamental growth of many national economies. It is important to notice that the contribution from the small companies should be seen as important and significant as compare to the large one (Jeners et al., 2013b).

The context for the development of the ISO/IEC 29110 series of standard was specifically that of Very Small Companies and it is therefore necessary to examine such terms. The definition of “Small” and “Very Small” Entities is challengingly ambiguous, as there is no commonly accepted definition of the terms. The term “Very Small Entity” (VSE) had been defined by the ISO/IEC JTC1/SC7 Working Group 24 and subsequently adopted for use in the new ISO/IEC 29110 software process lifecycle standard as being “an entity (enterprise, organization, department or project) having up to 25 people” (Laporte et al, 2008).

A large majority of enterprises worldwide are VSEs. In Europe, for instance, as illustrated in Table 1, over 92% of enterprises are micro-enterprises. They have fewer than nine employees. Micro enterprises account for 70% to 90% of enterprises in OECD countries and about 57% in USA.

Table 1. Size of enterprises in Europe (Moll 2013).

Type	Number of Employees	Annual turnover	No. of enterprises (% of overall)
Micro	1-9	≤2M	92.2
Small	10-49	≤10M	6.5
Medium	50-249	≤50M	1.1

Typically, VSEs are economically vulnerable as they are driven by cash flow and depend on project profits, so they need to perform the projects within budget. They tend to have low budgets which have many impacts, such as: lack of funds to perform corrective post-delivery maintenance; few resources allocated for training; little or no budget to perform quality assurance activities; no budget for software

reuse processes; low budget to respond to risks; and limited budget to perform Process Improvement and / or obtain a certification/assessment. Typically, the VSE's product has a single customer, where the customer is in charge of the management of the system and the software integration, installation and operation. It is normal practice for the customer not to define quantitative quality requirements and for customer satisfaction to depend on the fulfillment of specific requirements that may change during the project. A close relationship between all involved project members including the customer shows that software development in small and very small companies is strongly human-oriented and communication between them is important.

The internal business process of VSEs is usually focused on developing custom software systems, where the software product is elaborated progressively and which typically does not have strong relationship with other projects. Typically, most management processes (such as human resource and infrastructure management) are performed through informal mechanisms, with the majority of communication, decision-making and problem resolution being performed face-to-face.

Issues with Software Standards

Although commercial SPI models have been highly publicized, they are not being widely adopted and their influence in the software industry therefore remains more at a theoretical than practical level (O'Connor and Coleman, 2009). For example, in the case of Capability Maturity Model Integration (CMMI), an Australian study found that small organizations considered that adopting CMMI would be infeasible (Staples et al, 2007) and an Irish study found significant resistance due to negative perceptions surrounding levels of bureaucracy and required documentation (Coleman and O'Connor, 2006). Further investigation of the CMMI by Staples and Niazi (2006) discovered, after systematically reviewing 600 papers, that there has been little published evidence about those organizations who have decided not to adopt CMMI.

There is evidence that the majority of small and very small software organizations are not adopting existing standards / proven best practice models because they perceive the standards as being developed by large organizations and orientated towards large organizations, thus provoking the debate in terms of number of employees, size does actually matter (O'Connor and Coleman, 2008a). Studies have shown that small firms' negative perceptions of process model standards are primarily driven by negative views of cost, documentation and bureaucracy. In addition, it has been reported that SMEs find it difficult to relate standards to their business needs and to justify the application of the international standards in their operations. Most SMEs cannot afford the resources for, or see a net benefit in, establishing software processes as defined by current standards and maturity models (O'Connor and Coleman, 2008b).

The ISO/IEC 29110 Standard as a Solution

Accordingly there is a need to help such organizations understand and use the concepts, processes and practices proposed in the ISO/IEC JTC1/SC7's international software engineering standards. The ISO/IEC 29110 standard "Lifecycle profiles for Very Small Entities" is aimed at addressing the issues identified above and addresses the specific needs of VSEs. The approach (Laporte et al, 2013a) used to develop ISO/IEC 29110 (2001) started with the pre-existing international standard ISO/IEC 12207 (2008) dedicated to software process lifecycles. The overall approach consisted of three steps: (1) Selecting ISO/IEC 12207 process subset applicable to VSEs of up to 25 employees; (2) Tailor the subset to fit VSE needs; and (3) Develop guidelines for VSEs.

Furthermore, in late 2009, the International Council on Systems Engineering (INCOSE) Very Small and Micro Entities Working Group (VSME) was established to evaluate the possibility of developing a standard, using the Generic profile group scheme of the ISO/IEC 29110 series, based on ISO/IEC 15288 (2008), for organizations developing systems. Late 2011 saw the launch of the official development of the systems engineering ISs and TRs for VSEs. In August 2014, ISO published the ISO/IEC 29110 systems engineering and management guide of the Basic profile ISO/IEC TR 29110-5-6-2:2014 (2014). The systems engineering and management guide of the Entry profile has been published in 2015 as ISO/IEC TR 29110-5-6-1:2015 (2015). Similar to the existing set of software ISO/IEC 29110 TRs, the Management and Engineering Guide for systems engineering should also be made available at no cost by ISO (Laporte et al, 2014).

For example a more recent study (Sánchez-Gordón and O'Connor, 2016). Understanding into software developers' use of software development processes in actual practice in the specific context of very small companies and highlighted three areas of concern: customer, software product and development tasks coordination and tracking, where small companies were lacking specific guidance (Sanchez-Gordon et al, 2017).

A full history of the evolution of the ISO/IEC 29110 series of software process lifecycle standards is given in O'Connor & Laporte (2017).

The Structure of ISO/IEC 29110

The basic requirements of a software development process are that it should fit the needs of the project and aid project success. And this need should be informed by the situational context (Marks et al, 2017) where in the project must operate and therefore, the most suitable software development process is contingent on the context. The core situational characteristic (Clarke and O'Connor, 2012) of the entities targeted by ISO/IEC 29110 is size, however there are other aspects and characteristics of VSEs that may affect profile preparation or selection. Creating one profile for each possible combination of values of the various dimensions introduced above would result in an unmanageable set of profiles. Accordingly, VSE's profiles are grouped in such a way as to be applicable to more than one category. Table 2 illustrates a Profile Group, which contains three profiles (labeled A, B and C) that are mapped to nine combinations of business models and situational factors (Giray et al, 2018).

Table 2. Allocating VSE characteristics to profile groups.

Business Models	Profile Situational Factors		
	Critical	User Uncertainty	Environment Change
<i>Contract</i>	<i>Profile A</i>	<i>Profile A</i>	<i>Profile A</i>
<i>In-House</i>	<i>Profile C</i>	<i>Profile B</i>	<i>Profile A</i>
<i>Commercial</i>	<i>Profile B</i>	<i>Profile A</i>	<i>Profile A</i>

Profile Groups are a collection of profiles, which are related either by composition of processes (i.e. activities, tasks), or by capability level, or both. The “Generic” profile group is applicable to a vast majority of VSEs that do not develop critical software and have typical situational factors (Clarke & O'Connor, 2015). This profile group does not imply any specific application domain, however, it is envisaged that in the future new domain-specific sub-profiles may be developed in the future. Table 3

illustrates this profile group as a collection of four profiles, providing a progressive approach to satisfying the requirements of profile group. To date the Basic Profile has been published, the purpose of which is to define a software development and project management guide for performing one project at a time.

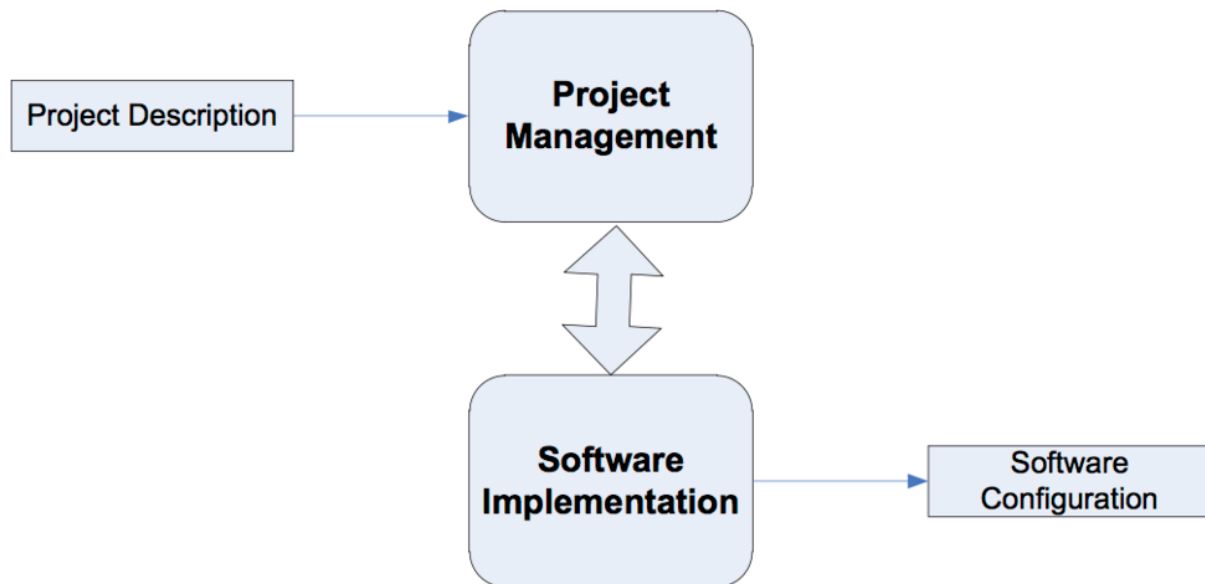
Table 3. Graduated profile of the Generic profile group.

	Generic Profile Group		
Entry	Basic	Intermediate	Advanced

Engineering and Management Guide

At the core of this standard is a Management and Engineering Guide, officially known as ISO/IEC TR 29110-5-1-2 (2011), which focuses on *Project Management* and *Software Implementation* as illustrated in figure 1. The purpose of the Basic Profile is to define Software Implementation (SI) and Project Management (PM) processes from a subset of ISO/IEC 12207 (2008) and ISO/IEC 15289 (2011) appropriate for VSEs, as illustrated in figure 1.

Figure 1. ISO/IEC 29110 Project Management and Software Implementation Relationship.



Project Management Process

The purpose of the Project Management (PM) process is to establish and carry out the tasks of the software implementation project in a systematic way, which allows compliance with the project's objectives in terms of expected quality, time, and costs (O'Connor and Laporte, 2012). The seven objectives of the PM process are listed in table 4.

Table 4. Objectives of the Project Management process of the Basic Profile (ISO/IEC TR 29110-5-1-2 (2011)).

Objective	Description
PM.O1	The Project Plan for the execution of the project is developed according to the Statement of Work and reviewed and accepted by the Customer. The tasks and resources necessary to complete the work are sized and estimated.
PM.O2	Progress of the project is monitored against the Project Plan and recorded in the Progress Status Record.
PM.O3	The Change Requests are addressed through their reception and analysis. Changes to software requirements are evaluated for cost, schedule and technical impact.
PM.O4	Review meetings with the Work Team and the Customer are held. Agreements are registered and tracked.
PM.O5	Risks are identified as they develop and during the conduct of the project.
PM.O6	A software Version Control Strategy is developed. Items of Software Configuration are identified, defined and baselined. Modifications and releases of the items are controlled and made available to the Customer and Work Team including the storage, handling and delivery of the items.
PM.O7	Software Quality Assurance is performed to provide assurance that work products and processes comply with the Project Plan and Requirements Specification.

Figure 2 illustrates the 4 activities of the project management process as well as their input and output product. The four activities of the Project Management Process are:

- **Project Planning** - The primary objective of this process is to produce and communicate effective and workable project plans. This process determines the scope of the project management and technical activities, identifies process outputs, project tasks and deliverables, establishes schedules for project task conduct, including achievement criteria, and required resources to accomplish project tasks.
- **Project Plan Execution** - To implement the actual work tasks of the project in accordance with the project plan. Ideally when the project plan has been agreed and communicated to all teams members, work of the development of the product, which is the subject of the project, should commence.
- **Project Assessment and Control** - purpose is to determine the status of the project and ensure that the project performs according to plans and schedules, within projected budgets and it satisfies technical objectives.
- **Project Closure** - typically involves releasing the final deliverables to the customer, handing over project documentation to the business, terminating supplier contracts, releasing project resources and communicating project closure to all stakeholders.

For illustration purposes, two tasks of the Project Planning activity are listed in Table 5. The project manager (PM) and the customer (CUS) are involved in these 2 tasks. The customer is involved, during

Figure 2. ISO/IEC 29110 Project Management Process.

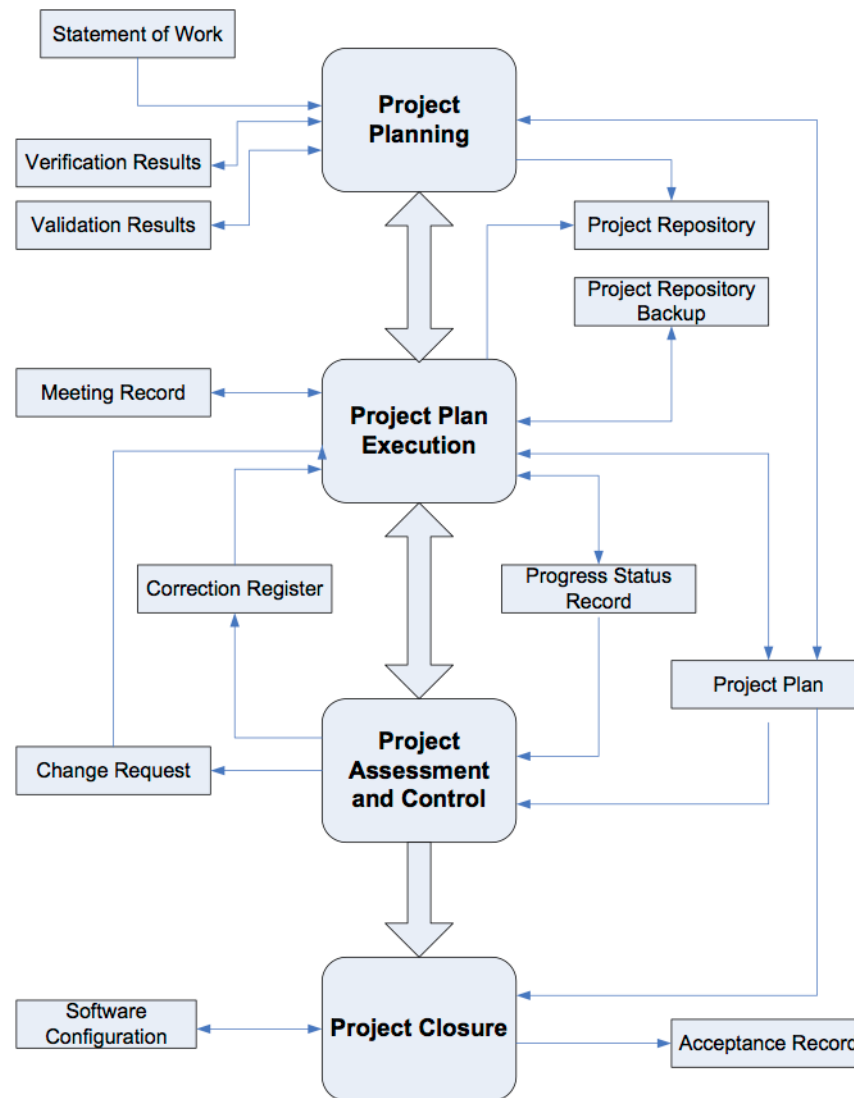


Table 5. Example of 2 tasks of the Project Planning Activity (ISO/IEC TR 29110-5-1-2 (2011)).

Role	Task	Input	Output
PM CUS	PM.1.2 Define with the Customer the Delivery Instructions of each one of the Deliverables specified in the Statement of Work.	Statement of Work [reviewed]	Project Plan Delivery Instructions
PM CUS	PM.1.14 Review and accept the Project Plan. Customer reviews and accepts the Project Plan, making sure that the Project Plan elements match with the Statement of Work.	Project Plan [verified]	Meeting Record Project Plan [accepted]

the execution of the project, when he submits change requests, during project review meetings, for the validation and approval of the requirements specifications and for the acceptance of the deliverables.

Software Implementation Process

The purpose of the Software Implementation (SI) process, illustrated in figure 3, is to achieve systematic performance of the analysis, design, construction, integration, and test activities for new or modified software products according to the specified requirements. The seven objectives of the SI process are listed in table 6.

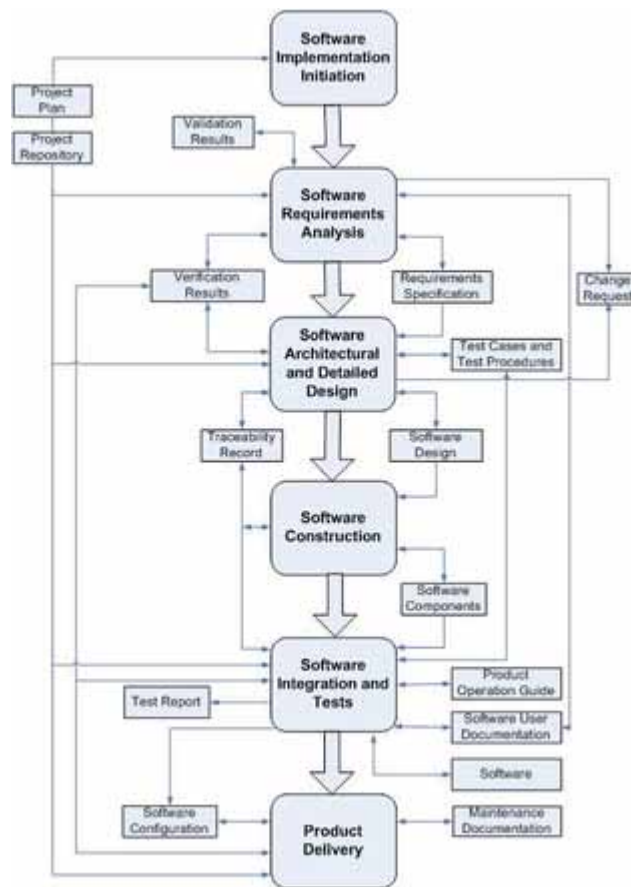
Table 6. Objectives of the Software Implementation process of the Basic Profile.

Objective	Description
SI.O21	Tasks of the activities are performed through the accomplishment of the current Project Plan.
SI.O2.	Software requirements are defined, analyzed for correctness and testability, approved by the Customer, baselined and communicated.
SI.O3.	Software architectural and detailed design is developed and baselined. It describes the Software Components and internal and external interfaces of them.
SI.O4.	Software Components defined by the design are produced. Unit test are defined and performed to verify the consistency with requirements and the design. T
SI.O5.	Software is produced performing integration of Software Components and verified using Test Cases and Test Procedures. Results are recorded at the Test Report.
SI.O6.	A Software Configuration, that meets the Requirements Specification as agreed to with the Customer, which includes user, operation and maintenance documentations, is integrated, baselined and stored at the Project Repository.
SI.O8.	Verification and Validation Tasks of all required work products are performed using the defined criteria to achieve consistency among output and input products in each activity.

The activities of the Software Implementation Process are:

- **Software Implementation Initiation** - ensures that the Project Plan established in Project Planning activity is committed to by the Work Team
- **Software Requirements Analysis** - analyzes the agreed Customer's requirements and establishes the validated project requirements. The activity provides:
- **Software Architectural and Detailed Design** - transforms the software requirements to the system software architecture and software detailed design
- **Software Construction** - develops the software code and data from the Software Design.
- **Software Integration and Tests** - ensures that the integrated Software Components satisfy the software requirements.
- **Product Delivery** - provides the integrated software product to the Customer.

Figure 3. ISO/IEC 29110 Software Implementation Process.



IMPLEMENTING THE ISO/IEC 29110 STANDARD

Guidance on Implementation

In order to facilitate the implementation, by VSEs, of a Profile, a set of Deployment Packages (2013) are available. A deployment package is a set of artifacts developed to facilitate the implementation of a set of practices, of the selected framework, in a VSE. A deployment package is not a process reference model (i.e. it is not prescriptive). The elements of a typical deployment package are: description of processes, activities, tasks, roles and products, template, checklist, example, reference and mapping to standards and models, and a list of tools. Deployment packages are not intended to preclude or discourage the use of additional guidelines that VSEs find useful.

The elements of a typical deployment package are: technical description, relationships with ISO/IEC 29110, key definitions, detailed description of processes, activities, tasks, roles and products, template, checklist, example, references and mapping to standards and models, and a list of tools. The mapping is only given as information to show that a Deployment Package has explicit links to Part 5, ISO standards, such as ISO/IEC 12207, or models such as the CMMI developed by the Software Engineering Institute. Hence by deploying and implementing a package (O'Connor and Sanders, 2013) a VSE can see its concrete step to achieve or demonstrate coverage to Part 5.

The working group (ISO/IEC JTC1/SC7 WG 24) behind the development of this standard is advocating the use of pilot projects as a mean to accelerate the adoption and utilization of ISO/IEC 29110. Pilot projects are an important means of reducing risks and learning more about the organizational and technical issues associated with the deployment of new software engineering practices. Pilot projects are based on the ISO/IEC 29110-5 Management and engineering guide and the deployment package(s).

Sample Implementations

Worldwide, hundreds of VSEs have implemented ISO/IEC 29110. For instance, in Thailand, an early adopter of ISO/IEC 29110, more than 350 public and private organizations have achieved the ISO/IEC 29110 Basic Profile certification. In addition, 33 other VSEs are certified in other states of Mexico in the state of Zacatecas in Mexico, industry, academia, and government came together in 2017 to promote ISO/IEC 29110 (Laporte et. al, 2016). In Zacatecas, approximately four Mexican VSEs and four software development centers of academic institutions are certified for the Basic Profile. In addition, 33 other VSEs are certified in other states of Mexico. Researchers in Canada have led numerous field trials with early-stage adopters of ISO/IEC 29110 (Laporte et. al, 2017).

For example, Ribaud et al. (2010) have documented the results of one pilot project that conducted with a 14-person VSE based in France, which successfully implemented ISO/IEC 29110 processes practices utilizing the available Deployment Packages. From which they have identified some potential additional infrastructure and support process activities and suggestions for future evolution of ISO/IEC 29110 Process Profiles. A further series of pilot projects are currently underway in research laboratories and enterprises in Canada, Ireland, Belgium and France, with further pilot projects planned in the near future.

The results from one pilot study in Canada concluded that the tools developed to support the project management processes proved very useful and helped the project managers rapidly integrate the knowledge required to execute the processes (Laporte et al, 2013b). In the case of this trial company, for the first time, the company has documented management processes for small-scale projects. Besides, some project managers have joined forces to promote project management practices within this engineering firm's division. The improvement programme was so successful that managers of the company's other divisions have shown an interest in learning this approach in order to implement it within their respective divisions.

Laporte et al (2015) report on two successful trials of ISO/IEC 29110, that demonstrate it was possible to properly plan the project and develop the software product using proven software practices documented in standards as well as not interfering with the creativity during the development of their web site. People who think that standards are a burden, an unnecessary overhead and a treat to creativity should look at this start-up project and revisit their results.

VSEs that have implemented ISO/IEC 29110 management and engineering guides have improved in one or more aspects of competitiveness including quality, cost, and schedule (Laporte & O'Connor, 2016). For example, projects using ISO/IEC 29110 for the first time had only 10 to 18 percent of rework as opposed to about 40 to 50 percent of rework typical of a majority of software developers (Laporte & O'Connor, 2017).

CONCLUSIONS

For most enterprises, but in particular for VSEs, international certifications can enhance credibility, competitiveness and access to national and international markets. Brazil has led the development of an ISO/IEC 29110 certification process. An ISO/IEC 29110 auditor should be competent in auditing techniques, have expertise in ISO/IEC 29110 and have experience in software development. For VSEs, such a certification should not be too expensive and short. The certification process has been successfully piloted in a few VSEs.

Finally, research studies have been undertaken to understanding the perception of VSEs towards the adoption of process standards (Basri et al, 2010) (O'Connor & Basri, 2018.) and also to evaluate management sentiment towards ISO/IEC 29110 (O'Connor, 2012) and management commitment to SPI and ISO/IEC 2910 in particular in Europe (O'Connor et al, 2010) and South America (Sanchez-Gordon et al, 2015). These revealed that the acceptance level of any type or model of software quality or lifecycle standard in VSEs is a very low priority item, but the level of awareness of standards and potential benefits was high. Furthermore, these studies showed the main reason for not adopting standards was a lack customer requirement, a lack of resources and the perceived difficulties in defining an organizational process. Furthermore, this analysis reveals a pattern that indicates that the acceptance level of quality standard such as ISO among VSEs are still low even though the staff and management are knowledgeable and aware the benefit of adopting such standards. The main reasons are more related to the lack of the customer requirement and the limited resources in the company. In addition, the perception a heavy-weight process especially in terms of documentation, cost and non- alignment with current development process are among the reasons why the companies did not plan to adopt a lifecycle standard in the short to medium term. However from the analysis, VSEs may still be interested in lifecycle standards if certain important criteria are met and such standards are closely related to their needs. Therefore, it can be concluded that the market and demand for ISO/IEC 29110 in VSEs has a positive outlook.

Future Research

In terms of future work, as ISO/IEC 29110 is an emerging standard there is much work yet to be completed (O'Connor and Laporte, 2014). The main remaining work item is to finalize the development of the remaining three profiles: (a) Entry – a six person-months effort project or a start-up VSEs; (b) Intermediate - Management of more than one project and (c) Advanced - business management and portfolio management practices. In addition, the development of additional Profile Groups for other domains such as critical software, game industry, scientific software developments are being studied.

Whilst work is currently underway on an assessment mechanism for ISO/IEC 29110, a clear niche market need is emerging which may force the process assessment community to change their views on how process assessments are carried out for VSEs. In particular there is a strong need to ensure that VSEs are not required to invest the anything similar in terms of time, money and other resources on process assessments, as may be expected from their larger SMEs (small and medium enterprises), or even MNC (multinational corporations) counterparts. Indeed, some form of self-assessment, possibly supported by Internet based tools, along with periodic spot-checks may be suitable alternative to meet the unique needs of VSEs.

Furthermore, work is underway to integrate accessibility design patterns with the software implementation process of ISO/IEC 29110 (Sanchez-Gordon et al, 2019) and to examine the impact of cultural issues on the software process of very small entities (Nonoyama et al, 2018). Also, from an agile pro-

cess perspective, research is being conducted into the compliance of the ISO/IEC 29110 Entry Profile with the Project Management process in the main agile methodologies (Galvan-Cruz et al, 2017a) and SCRUM in particular (Galvan-Cruz et al, 2017b). Finally, the area of serious games (Olgun et al, 2017) is being applied to the ISO/IEC 29110 and ISO/IEC 29110 project management process of basic profile (Calderón et al 2017).

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KEY TERMS AND DEFINITIONS

Process Assessment: The disciplined examination of the processes by an organisation against a set of criteria to determine capability of those processes to perform within quality, cost and schedule goals.

Project Implementation: Is defined as a specified set of activities designed to put into practice an activity or program of known dimensions.

Project Management: This is the process and activity of planning, organizing, motivating, and controlling resources to achieve specific goals.

Software Process: A set of activities, methods, practices, and transformations that people use to develop and maintain software and the associated products.

Software Process Improvement (SPI): Aims to understand the software process as it is used within an organisation and thus drive the implementation of changes to that process to achieve specific goals such as increasing development speed, achieving higher product quality or reducing costs.

Very Small Entity: An enterprise, organization, department, or project having up to 25 people.

Design of a Strategic Knowledge Management Model to Evaluate Sales Growth in SMEs

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INTRODUCTION

The increasing importance of knowledge as an intangible asset or intellectual capital (CI) for companies, has encouraged managers to pay greater attention to knowledge management (KM) strategies (Hansen, Nohria & Tierney, 1999; Earl, 2001), allowing companies to capture, conserve, organize and manage the knowledge and experiences that are generated, for further dissemination and maintenance of sustainable development, through the use of the acquired IC (Nonaka & Takeuchi, 1995; Pasternack & Viscio, 1998; Pfeffer & Sutton, 1999; Ruggles & Holtshouse, 1999).

Although there is evidence that large companies have invested in initiatives and information systems for KM, which enables them acquiring and improving the use of IC (Sarvary, 1999). However, previous studies have shown that in many SMEs there is an absence of systematic KM (McAdam & Reid, 2001; Wong & Aspinwall, 2005). This fact is supported on some other studies that have identified some factors leading to this absence, such as SME managers assume a central position (Bridge, O'Neill & Cromie, 2003), thus limiting the planning and decision-making processes to a single person (Culkin & Smith, 2000). Therefore, it is shown that some SMEs fail to identify knowledge as an intangible business asset. Which like any other asset, must be valued, processed and be systematically organized, since only people (such as competitors, customers, suppliers, vendors, etc.) are the only agents capable of learning and creating knowledge in an organization, through their individual and collective experience.

Therefore it could be inferred that companies, whether large or small must have continuous learning as a process for the organization to identify its best practices, in order to avoid repeating errors and producing a decrease in entropy (Sharma et al., 2007). Senge (1990) states that organizational learning occurs when people frequently increase their ability to create in order to achieve objectives, designing new patterns for distributing thought and also, where people are continuously learning observing the whole process. In addition to that, Senge affirms that when an organization learns, it can be defined as groups of people that collaborate with each other, to collectively strengthen their capacities and achieve truly important results. According to this, the learning process must start from management, identifying knowledge as a critical element in business strategies. Fernández, Junquera & Del Brio (2009) pointed out that the competitive advantage is not within the individual as a generator and a possessor of knowledge, but in the ability of the company to transfer personal knowledge to different contexts, integrating it into the routines and foundations of the organization, in order to improve its innovative capacity, to achieve a sustainable competitive advantage. Consequently, the success of business learning is based

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on the transformation of the knowledge related to human and relational capital (tacit knowledge) into knowledge of structural capital (explicit knowledge) (Sharma et al., 2007).

Consequently, being business success directly related to growth, especially to sales growth, this responsibility is in general delegated to the marketing department, which is responsible for developing and implementing strategies necessary to achieve the company's objectives; but: Is it possible to measure the level of growth in sales of an SME through the implementation of a KM strategy? The objective of this paper is to answer this question, through the study of the variables that intervene in the generation of knowledge in the marketing area, specifically in the internal KM between the sellers and the management personnel, proposing a KM model that can be implemented by the management personnel.

This paper is organized as follows: First, a background of the papers related to the research topic is carried out. Next, the methodology that was used is presented describing the hypothesis, research design, data collection instruments, and the description of the design of the model. Then, the results are shown with an analysis of descriptive data, multiple regression and correlations. After that, some future research directions are proposed. Finally, the conclusions of the paper are stated.

BACKGROUND

For the construction of this study, some tools were used to obtain a clearer answer of the evolution of KM and its different perspectives, such as these two electronic resources: *Web of Science* and *Tree of Science* (Robledo, Osorio & Lopez, 2014) as well as this search string, that was used in the Web of Science:

The first search title was: (*knowledge management*) AND subject: (*intellectual capital enterprises*) Refined by: Web of Science categories: (*Management or Business or Operations Research Management Science*) AND Document types: (*Article or Proceedings Paper*) Period of time: 2009-2018. Indexes: *SCI-EXPANDED, SSCI, A & HCI, ESCI*.

From this search, we obtained 367 results, which were the basis to us the *Tree of science* (ToS) tool, in order to build the state of the art from the searches carried out in WoS. Since the ToS algorithm is based on graph theory, the papers are represented as nodes and the citations between them as links. In this way, each node represents a knowledge unit located within the network. The most important nodes are identified from their determined positions, according to the links that connect to other nodes. Therefore, the papers located in the root are the most cited on the KM subject, the papers of the trunk are the papers that quote the root and are cited in the leaves. Finally, the leaves are papers that cite both: the root and the trunk. In this way, scientific information can be visualized in the form of a tree (Robledo, Osorio & Lopez, 2014).

Once this structure is finished, the most important papers of each part of the tree are analyzed and selected, choosing only from three to five papers in each area. This visualization allows us to have an overview of the theoretical foundation and current developments on the knowledge management, aiming to fulfill the main objective of the research.

With the results obtained in ToS, it was possible to chronologically select and organize the literature related to the research topic, analyzing the most important concepts of knowledge management.

The papers located on the root of the ToS can help identifying a type of research that allows conceptualizing the two types of knowledge. First, Tacit knowledge, which refers to valuable and highly subjective ideas and intuitions that are difficult to grasp and share because people have them in their minds. Secondly, Explicit knowledge which can be expressed through formal language by using words and numbers, and can be easily transmitted and shared through data, scientific formulas, codified proce-

dures or universal principles, being usually expressed in some physical support (Polanyi, 1966; Nonaka, Byosiere, Borucki & Konno, 1994).

From the differentiation of these two types of knowledge, the spiral model was designed (Nonaka et al., 1994) leading to four basic ways of knowledge creation in a company, which are: socialization, externalization, combination and internalization. Socialization is when a member of the group starts with the creation of a new knowledge; Externalization is a dialogue or collective reflection, which is made by using appropriate metaphors or analogies; Combination is the distribution of knowledge made through the different social and organizational networks; and Internalization is how knowledge begins to spread throughout the organization, causing other employees to start using it and internalizing it, so they can use it to expand their tacit knowledge.

Some of the papers on the root show antecedents, definitions and elements that conform the notion of intellectual capital (Edvinsson & Sullivan, 1996). Some of these papers also show the importance of intellectual capital or intangible asset, as a competitive advantage in organizations and how to measure it, taking as an example the Swedish financial services company Skandia, which in 1995 published the IC's first annual report (Edvinsson & Malone, 1997). Likewise, within research, the KM is incorporated as a discipline that reveals that in practice, only the 20% of the knowledge available in the company is used. The aforementioned opened a space for greater efficiency, growth, benefits and competitive margin, making the intellectual capital of the company grow (Stewart, 1997; Brooking, 1997; Lynn, 1999). Hence, three dimensions of the IC are identified:

- Human capital: Defined as a generator of value and a potential source of innovation for the company (Bontis, 1998).
- Structural capital: It is the knowledge that the company has been able to internalize and that remains in the organization, whether in its structure, in its processes or in its culture, even when the employees leave it (Bontis, Chua & Richardson, 2000).
- Relational capital: Draws on the consideration that companies are not isolated systems, on the contrary, they are related to the outside world. This type of capital includes the value generated by the company's relationships, not only with customers, suppliers and shareholders, but with all its stakeholders, both internal and external (Bontis et al., 2000; Stewart, 1997; Ordóñez, 2003; Alavi & Leidner, 2001; Bartol & Srivastava, 2002).

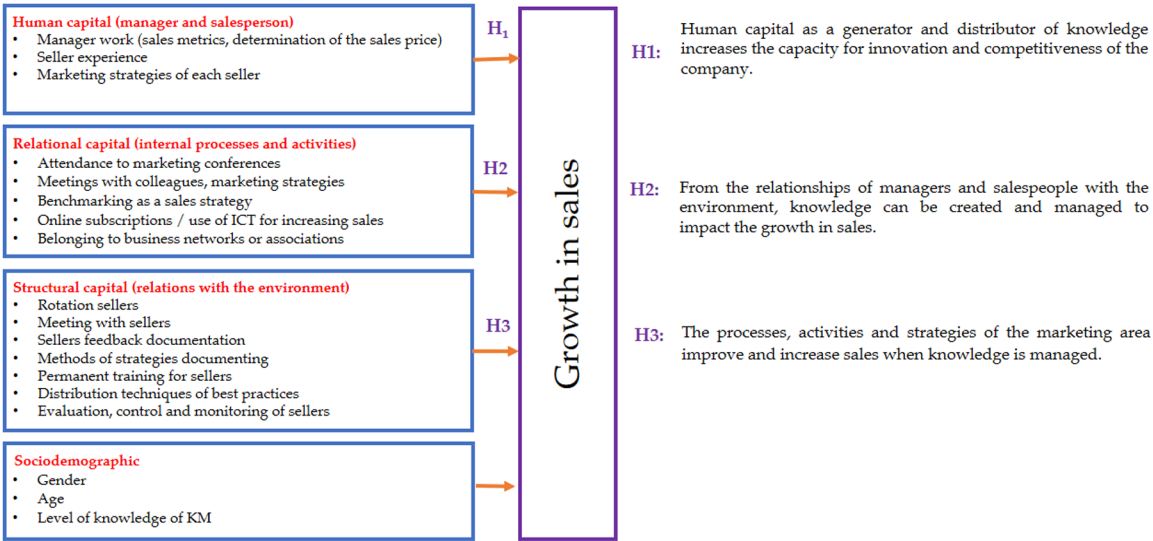
As for the papers that are on the trunk, it could be stated that they give solidity to the theory of KM from different perspectives. For example, Bollinger and Smith (2001) proposed that human behavior is key for achieving success or failure of KM activities, since KM implies culture, teamwork, promotion of learning and the exchange of skills and experiences. DeTienne, Dyer, Hoopes & Harris (2004) and Mehta (2008), identified technical factors as key elements in an effective KM. Some papers examine models of KM systems constructed as a measure of how context knowledge exchanges and reuses activities, that are internalized by organizations (Kulkarni, Ravindran & Freeze, 2006). Other studies such as the case of (Hsu & Wenchang, 2009) show the relationship between intellectual capital and organizational learning capacity in the development of new products, through the use of interviews and surveys. The results were based on empirical data from Taiwan's IC design industry, which are generated by the method of partial least squares. Likewise, authors such as (Donate & Guadamillas, 2011) analyze how organizational factors such as cultural values, leadership and human resources practices influence the practices of exploration and exploitation of knowledge, as well as innovation through empirical study.

In the part of the leaves, there are researches which unify criteria such as KM encompasses processes and structures, used by companies to support different stages of knowledge, such as: transfer, storage and creation (Durst & Edvardsson, 2012). Additionally, there are other research projects that show designs/implementations of delimited KM systems, taking into account: the size and the specific sector of the company; the research approach (competitiveness, innovation or process improvement) and the type of knowledge conversion. An example of this type of research was the one carried out by Burton, O'Connor & Roos (2013) involving five manufacturing companies, that participated in a series of action learning workshops and particularly, in the workshop focused on using the IC Navigator approach. The aforementioned study examines the utility of this model as a tool, to reconfigure the resources of a company, taking into account the results and the perception of the five companies under study. Other research pointed in this part seeks to update a global classification of academic journals of knowledge management and intellectual capital, as is the case of Serenko, A. & Bontis (2017).

METHODOLOGY

This study defines three hypotheses to be demonstrated (see Figure 1).

Figure 1. Hypothesis



- Hypothesis 1: Human capital as a generator and distributor of knowledge increases the capacity for innovation and competitiveness of the company.

To demonstrate this hypothesis, the human capital of the company specifically the manager and the salespeople, will be studied. From the perspective of management, variables such as sales metrics and sales price determination are included. From the seller's perspective, variables such as the seller's experience and the marketing strategies of each seller are included.

- Hypothesis 2: From the relationships of managers and salespeople with the environment, knowledge can be created and managed to impact the growth in sales.

To demonstrate this hypothesis, the relational capital (internal processes and activities) will be studied, taking into account the attendance to marketing conferences, meetings with colleagues, establishment of marketing strategies, benchmarking as a sales strategy, online subscriptions / use of ICT for increasing sales and also, belonging to some type of business network or association.

- Hypothesis 3: The processes, activities and strategies of the marketing area improve and increase sales when knowledge is managed.

In order to demonstrate this hypothesis, the structural capital (relations with the environment) was studied through variables such as sales agents, meeting with sellers, documentation of the sellers' feedback, methods of strategies documenting, permanent training to sellers, distribution techniques of best practices and evaluation, control and monitoring of sellers.

KM studies are approached with both, quantitative and qualitative approaches. In this study, a qualitative approach was the fundamental core, integrating quantitative data from the information collection instruments. The quantitative research allowed a rigorous treatment of the information and the statistical processing of the obtained data. The objective of this study is to design a KM strategy in the marketing area, to evaluate the growth in sales in SMEs.

The data collection was done through surveys, like this: First, a sample of SMEs must be selected from a certain city. For selected SMEs, a survey was developed to measure the level of knowledge and application of techniques aimed at KM in the marketing area. Then, a SME was selected as an object of study, where its manager was interviewed with closed questions about the internalization process of marketing knowledge, taking into account aspects such as: resources used by their best sellers, knowledge of the competition, specific marketing techniques, perception of the product / service to be sold, experience of sellers and customers, use of technological tools and relations with customers.

Through this study, it was expected to define a set of independent variables and a dependent variable. The dependent variable corresponds to the total of sales (Y) that is defined as the total amount of money obtained from the sale of products / services of a SME.

The independent variables are related to knowledge management, since they are strategies oriented to the conversion of knowledge such as: rotation sellers (X_1); meeting with sellers (X_2); documentation feedback sellers (X_3); attendance to conferences related to marketing (X_4); meetings with colleagues to establish marketing strategies (X_5); use of benchmarking as sales strategy (X_6); permanent sales training (X_7); online subscriptions and use of ICT to increase sales (X_8); documentation of marketing policies of the company (X_9); identification of marketing strategies used by sellers (X_{10}); documentation methods used in the company (X_{11}); existence of a model of metrics (X_{12}); full confidence in the experience of the seller (X_{13}); the company belonging to some type of business network or association (X_{14}); importance of the product price in sales (X_{15}); distribution techniques of best practices (X_{16}); and, evaluation, control and monitoring to sellers (X_{17}).

The model that relates the independent variable with the identified dependent variables is:

$$Y = A_1 * X_1 + A_2 * X_2 + A_3 * X_3 + A_4 * X_4 + A_5 * X_5 + A_6 * X_6 + A_7 * X_7 + A_8 * X_8 + A_9 * X_9 + A_{10} * X_{10} + A_{11} * X_{11} + A_{12} * X_{12} + A_{13} * X_{13} + A_{14} * X_{14} + A_{15} * X_{15} + A_{16} * X_{16} + A_{17} * X_{17}$$

Where

Y = Is the Total of sales

X_i = Are the Independent variables

A_i = Are the Weights of influence of the independent variables regarding to sales.

RESULTS

For the analysis of results, it was used a multiple regression model in R (software for statistical data analysis). The results that were obtained will be explained as follows: first, there is an analysis of the descriptive statistical data; then, we can find the correlations and degree of significance or reliability between variables; after that, there are displayed the results of the multiple regression analysis; and finally, we can see the strategic model that is proposed based on the hypothesis test.

Analysis of Descriptive Statistical Data

A diagnostic survey was conducted with a 1000 marketing managers of SMEs through Internet, the 30% of this population were women and the 70% men. The average age of the respondents was 40 years old, with age ranges from 35 to 44 years old, according to the standard deviation. In this analysis there were considered the following perspectives: management and their perception of knowledge management; seller as knowledge generators; and a statistical graph to identify the strategy that was most frequently used, to generate knowledge regarding marketing.

Figure 2. Means, standard deviations and correlations with intervals of significance or reliability

Note. * indicates $p < 0.05$; ** indicates $p < 0.01$. M and SD are used to represent the mean and the standard deviation, respectively. The values in brackets indicate the 95% confidence interval for each correlation. The confidence interval is a plausible range of population correlations that could have caused the sample correlation.

Variable	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1. sales	55.42	5.02																				
2. gender	0.30	0.46	.01																			
			[-.05, .08]																			
3. age	39.94	4.77	.05	-.01																		
			[-.02, .11]	[-.07, .06]																		
4. concepts.management	1.00	0.70	.09**	.01	.01																	
			[-.03, .15]	[-.05, .08]	[-.05, .07]																	
5. turnover.sellers	60.13	5.07	.70**	-.04	.05	-.04																
			[-.67, .73]	[-.11, .02]	[-.01, .11]	[-.10, .02]																
6. meeting.sales	1.63	0.97	.12**	-.03	-.05	-.03	-.02															
			[-.05, .18]	[-.09, .03]	[-.11, .02]	[-.10, .03]	[-.08, .04]															
7. documentation	0.29	0.45	.04	.02	-.02	.08*	-.00	.03														
			[-.02, .10]	[-.04, .08]	[-.08, .04]	[-.02, .14]	[-.06, .06]	[-.03, .09]														
8. attendance.conferences	2.81	0.90	.09**	.02	.00	-.02	.03	-.05	-.01													
			[-.02, .15]	[-.04, .08]	[-.06, .07]	[-.08, .04]	[-.03, .09]	[-.11, .02]	[-.07, .06]													
9. meetings.colleagues	1.99	0.99	.04	.02	-.01	.05	.02	.02	-.01	.02												
			[-.02, .10]	[-.04, .08]	[-.07, .05]	[-.01, .11]	[-.04, .08]	[-.04, .08]	[-.08, .05]	[-.04, .08]												
10. benchmarking	2.35	0.97	.21**	.01	-.00	.00	.03	-.01	-.02	-.05	.03											
			[-.15, .27]	[-.05, .07]	[-.07, .06]	[-.06, .07]	[-.03, .09]	[-.07, .05]	[-.08, .04]	[-.11, .01]	[-.03, .09]											
11. training.sellers	3.19	0.80	.07*	-.02	-.02	-.00	-.03	.01	-.01	.01	.05	.03										
			[-.00, .13]	[-.08, .04]	[-.08, .04]	[-.07, .06]	[-.09, .03]	[-.05, .08]	[-.07, .05]	[-.06, .07]	[-.02, .11]	[-.04, .09]										
12. experience.sellers	2.83	0.92	.08*	.00	-.06	-.04	-.02	.01	.02	-.01	.00	-.04	-.03									
			[-.01, .14]	[-.06, .06]	[-.12, .01]	[-.10, .02]	[-.08, .05]	[-.05, .07]	[-.04, .08]	[-.07, .06]	[-.06, .06]	[-.10, .02]	[-.09, .03]									
13. suscriptions	1.24	0.90	.18**	.03	-.03	-.00	.02	.06	-.02	.01	-.03	.03	-.01	.01								
			[-.12, .24]	[-.03, .09]	[-.09, .04]	[-.06, .06]	[-.04, .08]	[-.00, .12]	[-.08, .05]	[-.06, .07]	[-.09, .04]	[-.04, .09]	[-.07, .05]	[-.05, .07]								
14. strategies.marketing	0.79	0.41	.08**	.04	.00	.01	.02	-.06	-.03	.00	.04	-.02	.04	-.01	-.03							
			[-.02, .14]	[-.02, .11]	[-.06, .06]	[-.05, .07]	[-.04, .08]	[-.12, .00]	[-.10, .03]	[-.06, .06]	[-.02, .10]	[-.08, .05]	[-.02, .10]	[-.07, .05]	[-.10, .03]							
15. strategies.sellers	0.29	0.46	.10**	-.00	.03	.04	.06*	.03	-.03	.07*	-.02	-.01	.07*	.04	-.07*	-.02						
			[-.04, .16]	[-.07, .06]	[-.04, .09]	[-.03, .10]	[-.00, .12]	[-.03, .09]	[-.09, .03]	[-.01, .13]	[-.08, .05]	[-.07, .05]	[-.01, .13]	[-.02, .11]	[-.13, .00]	[-.09, .04]						
16. methods.documentation	0.80	0.40	.05	-.05	-.01	.01	.03	-.07*	-.01	-.01	-.02	.03	-.04	.03	-.03	-.06						
			[-.01, .11]	[-.11, .01]	[-.07, .05]	[-.05, .07]	[-.03, .09]	[-.13, .01]	[-.07, .05]	[-.08, .05]	[-.08, .05]	[-.03, .09]	[-.11, .02]	[-.10, .03]	[-.04, .09]	[-.09, .03]	[-.12, .01]					
17. metric.sales	0.79	0.41	-.03	-.05	.03	.03	-.03	.00	-.03	-.02	.03	.00	-.00	-.04	-.02	.08*						
			[-.09, .03]	[-.12, .01]	[-.04, .09]	[-.03, .09]	[-.10, .03]	[-.07, .06]	[-.09, .04]	[-.08, .04]	[-.08, .05]	[-.03, .09]	[-.06, .06]	[-.06, .06]	[-.10, .02]	[-.09, .04]	[-.01, .14]	[-.04, .08]				
18. network.organizational	0.79	0.40	-.01	-.02	-.05	.01	-.02	-.01	.03	.05	.04	-.05	-.04	.01	-.01	.05	.00	-.02	.00			
			[-.07, .05]	[-.08, .05]	[-.11, .01]	[-.05, .07]	[-.08, .05]	[-.07, .05]	[-.04, .09]	[-.02, .11]	[-.02, .10]	[-.11, .01]	[-.10, .02]	[-.05, .07]	[-.07, .05]	[-.01, .12]	[-.06, .07]	[-.08, .04]	[-.06, .07]			
19. price	4.26	1.09	.05	-.01	.07*	-.02	.06*	-.00	-.03	-.02	-.02	.04	.01	-.01	.01	.00	.01	.00	-.00	-.00		
			[-.02, .11]	[-.07, .05]	[-.01, .13]	[-.08, .04]	[-.00, .12]	[-.06, .06]	[-.09, .03]	[-.08, .04]	[-.08, .04]	[-.02, .11]	[-.05, .07]	[-.07, .05]	[-.05, .07]	[-.06, .06]	[-.05, .07]	[-.04, .08]	[-.06, .06]	[-.07, .06]		
20. techniques.distribution	0.63	0.65	.12**	.00	.04	.02	-.01	.03	.00	.04	-.00	-.02	.03	.02	-.04	.01	.03	-.05	.02	-.01	-.04	
			[-.06, .18]	[-.06, .07]	[-.03, .10]	[-.04, .08]	[-.07, .05]	[-.03, .09]	[-.06, .06]	[-.02, .10]	[-.06, .06]	[-.08, .04]	[-.03, .09]	[-.04, .08]	[-.10, .03]	[-.05, .07]	[-.03, .09]	[-.11, .01]	[-.04, .08]	[-.07, .05]	[-.11, .02]	
21. evaluate.sales	0.42	0.49	.06	.07*	.00	.07*	-.03	.04	-.01	-.05	-.05	-.02	-.03	-.01	-.00	-.02	.00	.05	-.03	-.06	-.10**	.04
			[-.01, .12]	[-.01, .13]	[-.06, .06]	[-.01, .14]	[-.09, .03]	[-.02, .10]	[-.08, .05]	[-.11, .02]	[-.11, .02]	[-.08, .04]	[-.09, .04]	[-.08, .05]	[-.06, .06]	[-.08, .04]	[-.06, .07]	[-.01, .11]	[-.09, .04]	[-.12, .01]	[-.16, .03]	[-.02, .10]

1. Management and their perception of KM:

Figure 2 shows the mean, the standard deviation, the correlation and the degree of significance between variables.

From this survey, we see that 50% of respondents said they had heard about KM. The answers of the rest of the respondents dispersed among managers who did not know about the topic, and managers for whom KM concepts were familiar, but they did not apply them in their company (variable *concepts.management*). Only 29% of the managers surveyed document the feedback information with their sellers, but taking into account the standard deviation that they do not perform it frequently (variable *documentation*). The 79% of managers document the strategies or marketing policies of their companies (variable *strategies.marketing*).

The 80% of managers prefer to have written documentation, physically filed, of marketing processes and strategies (variable *methods.documentation*). The 79% of the SMEs surveyed belong to a group or business association (variable *network.organizational*). When asking managers to value from 1 to 5 the degree of influence that the price has on sales, this was a 4.3 (variable *price*). The 63% of managers do not apply knowledge distribution techniques in their company (variable *techniques.distribution*).

2. The management - Seller relationship as generators of knowledge:

The survey showed that the sellers turnover rate is high (60%) and taking into account the standard deviation, this rate ranges between the 55% and the 65% (variable *sellers.turnover*). It was also observed that, the frequency of meetings between management and sellers is once a week, although dispersion is usually present in these meeting periods (daily, weekly or biweekly) according to standard deviation (variable *meetings.colleagues*). Only 29% of managers know the marketing strategies or best practices carried out by their salespeople (variable *strategies.sellers*). The 79% of managers have evaluation criteria (metrics) to measure the performance of their salespeople (variables *metric.sales*), but only the 42% make this evaluation effective (variable *evaluate.sales*).

3. Statistical figure to identify the most frequently used strategy to generate knowledge in marketing:

Figure 3 shows that, the most frequently used strategy for acquiring knowledge in marketing is sales training. But, most of the time the managers trust and discharge the responsibility of sale in the empirical experience of the sellers. In most cases, managers attend to conferences to be aware of marketing trends. Half of the time, managers use benchmarking tools or attend meetings with colleagues, to learn about the best marketing strategies. Sometimes or almost never, they make use of online subscriptions as a learning tool.

Correlations and Degree of Significance or Reliability Between Variables

In Table 1, it is observed that despite there is a low degree of correlation (r) between the variables, there are significant relationships in the correlations between variables, because p -value takes values less than .05; allowing the selected sample to be valid for this research. Table 2 indicates that, there is a 79% of positive correlations between variables (values indicated with normal text) being $0 < r < 1$. And a 21% of negative correlations between variables (values indicated with cursive) being $-1 < r < 0$ between variables. In both cases, although the degree of correlation is low, the degree of significance is high. It

Figure 3. Statistics on KM strategies in marketing

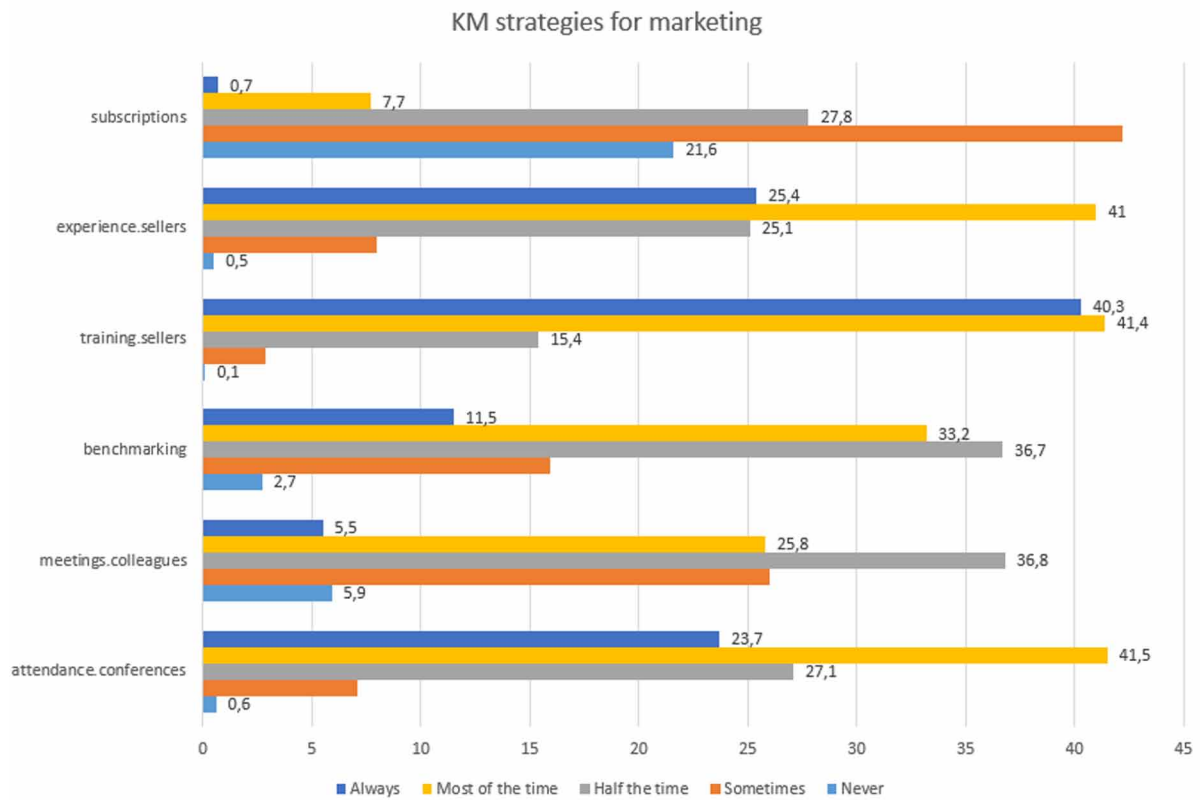


Table 1. Correlations and significance between variables

Variables	sales	strategies.sellers	documentation	price	methods.documentation	metrics.sales	evaluate.sales
concepts.management	.09**	.06*	.08*				.07*
turnover.sellers	.70**	.07*		.06*			
meetings.sales	.12**				-.07*		
attendance.conferences	.09**						
benchmarking	.21**						
training.sellers	.07*	.07*					
experience.sellers	.08*						
subscriptions	.18**	-.07*					
strategies.marketing	.08**						
strategies.sellers	.10**					.08*	
techniques.distribution	.12**						
gender							.07*
age				.07*			
price							-.10**

Note. * indicates $p < 0.05$; ** indicates $p < 0.01$. Values that indicate the degree of significance or reliability for each correlation.

is also observed that the sales variable is the one that most relates to the rest of the variables; and it is also noted that the highest correlation is between the *sales* variable and the *seller's turnover* variable, with a significant correlation level of .70 **.

Results of the Multiple Regression Analysis

The influence of the independent variables and the standardized regression (beta weights) is showed on Table 2.

Table 2. Regression results using uncertainty as a criterion

Predictor	<i>b</i>	<i>b</i> 95% CI [LL, UL]	<i>beta</i>	<i>beta</i> 95% CI [LL, UL]	<i>sr</i> ²	<i>sr</i> ² 95% CI [LL, UL]	<i>r</i>	Fit
(Intercept)	0,32**	[-0.29,0.36]						
sales	-0.00	[-0.00,0.00]	-0.03	[0.12, 0.06]	.00	[-.00, .00]	-.05	
gender	-0.01*	[-0.01,-0.00]	-0.07	[0.12, -0.01]	.00	[-.00, .01]	-.07*	
age	0.00	[-0.00,0.00]	0.03	[-0.02, 0.09]	.00	[-.00, .00]	.04	
concepts.management	0,00	[-0.00,0.00]	0.02	[-0.04, 0.07]	.00	[-.00, .00]	.02	
turnover.sellers	0.00	[-0.00,0.00]	0.02	[-0.06, 0.10]	.00	[-.00, .00]	-.01	
meeting.sales	-0.01*	[-0.01,-0.01]	-0.21	[-0.26, -0.15]	.04	[-.02, .06]	-.23**	
documentation	-0.00	[-0.01,0.00]	-0.05	[-0.10, 0.01]	.00	[-.00, .01]	-.05	
attendance.conferences	0.01*	[0.00,0.01]	0.15	[0.10, 0.21]	.02	[-.01, .04]	.18**	
meetings.colleagues	0.00*	[0.00,0.00]	0.06	[0.00, 0.11]	.00	[-.00, .01]	.08*	
benchmarking	-0.00	[-0.00,0.00]	-0.03	[-0.09, 0.03]	.00	[-.00, .00]	-.05	
training.sellers	0.01**	[0.01,0.01]	0.18	[0.12, 0.23]	.03	[.01, .05]	.19**	
experience.sellers	-0.01**	[-0.01,0.00]	-0.12	[-0.17, -0.06]	.01	[.00, .03]	-.13**	
suscriptions	-0.01**	[-0.01,0.00]	-0.16	[-0.22, -0.11]	.02	[.01, .04]	-.20**	
strategies.marketing	0.01**	[0.01,0.02]	0.13	[0.07, 0.18]	.02	[.00, .03]	.16**	
strategies.sellers	-0.00	[-0.01,0.00]	-0.02	[-0.07, 0.03]	.00	[-.00, .00]	.00	
methods.documentation	-0.00	[-0.01,0.00]	-0.04	[-0.09, 0.02]	.00	[-.00, .01]	-.05	
metric.sales	-0.00	[-0.01,0.00]	-0.01	[-0.06, 0.05]	.00	[-.00, .00]	.00	
network.organizational	-0.01*	[-0.01,-0.00]	-0.05	[-0.11, -0.00]	.00	[-.00, .01]	-.04	
price	-0.01**	[-0.01,-0.01]	-0.23	[-0.28, -0.18]	.05	[-.03, .07]	-.22**	
techniques.distribution	-0.01**	[0.01,0.01]	0.14	[0.09, 0.20]	.02	[.00, .03]	.16**	
evaluate.sales	-0.01**	[-0.02,-0.01]	-0.14	[-0.19, -0.08]	.02	[.00, .03]	-.13**	
								R ² = .288**
								95% CI [.23,.32]

Therefore, we have that:

- a) Influence of the independent variables: Taking into account the value of $p < .05$, the independent (explanatory) variables that are significantly related to the sales dependent variable were selected. These variables are: *gender*, *meeting.sales*, *assistance.conferences*, *meetings.colleagues*, *training.sellers*, *experience.sellers*, *subscriptions*, *strategies.marketing*, *network.business*, *price*, *techniques.distribution*, *evaluation.sales*.
- b) Beta standardized regression weights: Of the independent variables selected, the one that most influences or explains the behavior of sales is the *price* variable (-0.23), because it is the furthest one from zero. The negative sign indicates that the lower the price of the products is, the greater the increase in sales is. Other relevant variables, in the behavior of the sales dependent variable are: *meeting.sales* (-0.21), which means that the fewer the meetings are with the salespeople, the higher the sales will be. This result seems to be counterintuitive, but it could be explained from the view that when managers perceive that the sales are representative, they do not require meetings with the sellers. *Training.sellers* variable (0.18) implies that the greater the salespersons are trained, the greater the sales are. *Subscriptions* variable (-0.16) means that the lower online subscriptions are, the lower the sales are. This behavior could be explained from the perspective that management does not consider ICT as a sales-generating element. *Attendance.conference* variable (0.15) implies that the more attendance of managers and salespeople to conferences related to marketing is, the greater the sales are. *Techniques.distribution* variable (0.14), which means that the greater the distribution of knowledge and best practices within the company are, the greater the increase on sales is. *Evaluate.sales* variable (-0.14) implies that sellers are evaluated less when the company's sales increase. *Strategies.marketing* variable (0.13), when the marketing strategies are improved, the sales increase. *Experience.sellers* variable (-0.12), when the responsibility for sales lies solely in the experience of sellers, sales tend to decrease. This could be interpreted as requiring other control and monitoring strategies for sellers. *Gender* variable (-0.07), this means that male managers have a greater impact on sales than women, but this impact is very low. *Meetings.colleagues* variable (0.06) implies that, if there are more meetings with colleagues in the same economic sector to discuss and implement marketing strategies, there will be an increase in sales but, they will have little impact. *Network.business* variable (-0.05), when sales increase, it is less necessary for the company to belong to associations.

This study showed that the three hypotheses defined in the study were demonstrated, according to the degree of significance of the variables (see Table 3).

Table 3. Hypothesis supported

Hypothesis	Definition	Supported
H ₁	Human capital as a generator and distributor of knowledge increases the capacity for innovation and competitiveness of the company.	Yes
H ₂	From the relationships of managers and salespeople with the environment, knowledge can be created and managed to impact the growth in sales	Yes
H ₃	The processes, activities and strategies of the marketing area improve and increase sales when knowledge is managed.	Yes

FUTURE RESEARCH DIRECTIONS

Future studies may consider the use of objective indicators, to further evaluate the hypotheses that were proposed. They could also try to evaluate other mediators in the relationship between the KM and the growth in sales. This study tested hypotheses with a survey that only provided cross-sectional data. Future studies may include obtaining longitudinal data, to observe changes throughout the process when implementing a strategic KM model. Another line of future research could be to validate the proposed model in a real environment of an organizational unit of a real SME.

CONCLUSION

The results indicate that the price and seller's turnover variables are the ones that have a greater relationship with sales. It can also be deduced that managing knowledge significantly influences the marketing area of companies and therefore, it influences the growth in sales. The research explains that the 56% of the variables under study have a significant relationship with sales, showing that the management initiative in human capital investment (salespeople and other marketing personnel) in a company promotes the growth of sales. The lack of initiative from both, management personnel and sellers, affects the marketing strategies and therefore the sales. The variables related to KM in the activities of the management, as well as in the activities of the sellers generate innovation and competitiveness. However, acquiring knowledge to correctly select and apply marketing strategies (relational capital) influences the 67% of sales.

The following relationship could be established as:

Sales + Organizational Learning Capacity = Human Capital + Relational Capital + Structural Capital

Human capital includes ideas, initiative, manager and seller's activities. Relational capital includes feedback and knowledge creation between manager and sellers. Structural capital includes relations with the environment to increase marketing strategies.

It could be inferred that most managers prefer written and physically filed documentation, due to the lack of knowledge of the use of ICT. Being unaware that the use of these strategies could help an organization to expand its range of knowledge and to increase the speed of knowledge transfer.

The results of this study have some limitations, and some points need further research. First, this study focuses on the activities and processes of the manager and the sellers as generators of knowledge, without examining the activities concerning customers and suppliers, which may be the subject of future research studies. Second, the relationships between the variables in this study are valuable for further study in other contexts. Third, this study employs subjective measures of the interviewed staff, managers, making their subjective assessments may differ from the objective data.

This paper evaluates activities related to the intellectual capital of the marketing area of a company and the interactive relationships between its different dimensions: human capital, relational capital and structural capital. Providing KM managers with a theoretical model that demonstrates the relevance of organizational learning in innovation and competitiveness, generating an increase in sales. This study also allows managers to assess the strength and weakness of the intellectual capacity of their company, and to determine if it is necessary to invest or not in it.

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KEY TERMS AND DEFINITIONS

Explicit Knowledge: It is the knowledge that can be readily articulated, codified, stored, and accessed. It can be easily transmitted to others.

Intellectual Capital: Sum of human capital, structural capital, and relational capital. It is any factor that contributes to the value generating processes of the company.

Knowledge Management: It is about getting the right knowledge to the right person at the right time. It implies a strong tie to corporate strategy, understanding from where and in which types knowledge could be found, in order to create processes that span organizational functions.

Marketing: The promoting and selling of products or services.

Organizational Learning: It is a process that enhances its collective ability to accept and respond to internal and external change.

Sales: The exchange of something for money.

Small and Medium Enterprise: It is a business or company where there are less than 250 employees; and which has an annual turnover not exceeding 50 million euro.

Tacit Knowledge: It is the knowledge that is difficult to transfer to another person by means of writing it down or verbalizing it.

A Theoretical Approach Exploring Knowledge Transmission Across Generations in Family SMEs

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INTRODUCTION

Although family business is a well-developed field of research, scholars are not unanimous in defining a family firm. This chapter follows Chua et al. (1999, p25), by defining a family business as: “a business governed and/or managed with the intention to shape and pursue the vision of the business held by a dominant coalition controlled by members of the same family or a small number of families in a manner that is *potentially sustainable across generations* of the family or families” (italics added for emphasis).

However, regarding such sustainability, family firms show a long-term survival problem: approximately 40% make a positive transition to the second generation and only 12% to the third (Bridge et al., 2003). De Massis et al (2008), in their review, summarized the main causes preventing intra-family succession, identifying individual, relational, contextual, financial and even process factors. Thus business transmission seems, without doubt, to be the most critical event in a family firm’s life. This event is a process, rather than a moment: the founder slowly hands over the management of the business to the successor, who gradually becomes an entrepreneur (Chirico, 2008). Transferring, sharing and creating knowledge between people who are involved in succession plays a fundamental role in this delicate and uncertain process (Cabrera-Suarez, 2001; Cope, 2005; Koiranen, Chirico, 2006; Le Breton-Miller, 2004), but this knowledge transfer does not occur automatically (Boyd et al. 2015; Del Giudice, 2011; Konopaski et al., 2015). Indeed, an important reason for the failure of organizational processes to facilitate knowledge sharing is the lack of consideration for how the organizational and interpersonal context influences knowledge sharing (Carter & Scarbrough, 2001; Voelpel, Dous, & Davenport, 2005). Organizational Learning Theories applied to family business (Moore, 2009) assert that knowledge is a fundamental asset in ensuring a firm’s development and survival (Durst & Edvardsson, 2012; Grant, 1996; for a review see Wang & Noe, 2010). However, although business transmission is maybe the most investigated issue by family business scholars, to date the process through which knowledge is created, shared and transferred across generations has not been comprehensively examined (Chirico, 2008). A little research has focused on specific factors (e.g. leadership style: Cunningham et al., 2016), but current research is far from being completed. Therefore, the main purpose of this chapter is to suggest a theoretical framework for addressing investigation of family firm heterogeneity in knowledge sharing.

Literature suggests that succession is largely in the control of the incumbent leader of the family firm (Lansberg, 1988; Malone, 1989; Rubenson & Gupta, 1996) and in SMEs in particular seniors, (often tacitly), share their knowledge and expertise with juniors day-by-day. Although literature acknowledges the relevance of knowledge sharing to organizational performance (for a review see Wang & Noe, 2010), research shows that one of the main causes, that occurs recursively, of firm failure is the successor’s

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business incompetence (Carter, Van Auken, 2006; Gibb, Webb, 1980), thus suggesting that knowledge is not always properly transferred between generations. In particular, current literature has not until now fully investigated individual and organizational factors which affect knowledge sharing during business transmission, both formally and tacitly. Hence, drawing on Organizational Learning Theories (Argote, 1999; Kogut & Zander, 1992, 1996; Spender, 1996), this chapter highlights how knowledge sharing and transferring processes should be not properly implemented during business transmission.

Structural, (i.e. permanent and ongoing), processes aimed at sharing and managing organizational knowledge are however not enough to ensure successor's business competence. In this sense planned and specific training processes play a fundamental role in junior's firm-specific skills development, especially if the next generation does not have a 'proper' or well-rounded CV and/or shows a lack of motivation for their (future) entrepreneurial role. Indeed, literature shows that training is a key component in leadership development (e.g. Collins & Holton, 2004), and another factor (that is) integral to corporate success. The organizational process aimed at increasing the available knowledge is not in the control of the incumbent leader exclusively, but also involves the next generation and non-family members. Literature (Lave, 1993; Gherardi & Nicolini, 2004) suggests that the 'peripheral legitimated participation' of the junior ensures the best outcomes in terms of knowledge sharing and development, due to the Situated Learning process (Boyd et al. 2015; Hamilton, 2011; Lave, 1993). From this point of view, it is maybe more appropriate to consider the next generation's skill development as a learning rather than a training process. SMEs usually present informal training processes (Cardon, Stevens, 2004), hence for overcoming the limitations of the traditional on-the-job-training, (poor methodology, lack of strategic vision), it is necessary that the next generation plays an active role in developing entrepreneurial skills. However, little research (Murphy, Lambrechts, 2015; Stavrou, 1999) has investigated the role played by the offspring during the business transmission process until now. Thus, learning and training processes should be properly implemented and carried out actively by the involved generations, also with the involvement of non-family members. However, drawing on a situated learning approach to knowledge sharing and development, this chapter highlights both organizational and individual factors undermining next generation's skills development.

THEORETICAL BACKGROUND

In the field of organizational literature, *knowledge* is defined as information processed by individuals including ideas, facts, expertise, and judgements relevant for individual, team, and organizational performance (e.g., Alavi & Leidner, 2001; Bartol & Srivastava, 2002; Durst & Edvardsson, 2012). For instance, Alavi & Leiner define knowledge as "information possessed in the mind of individuals (2001, 109). *Knowledge sharing* refers to the provision of task information and know-how to help others and to collaborate with others to solve problems, develop new ideas, or implement policies or procedures (Cummings, 2004; Pulakos, Dorsey, & Borman, 2003). Family Capital Theory (Moore, 2009; Hoffman et al., 2006; Danes et al., 2009), and the Knowledge-Based View (Càbrera-Suarez et al., 2001; Hatak, Roessl, 2015) offer copious suggestions regarding how to share and transmit firm-specific knowledge in organizations. Both approaches provide useful insights into assessing and explaining strengths and weaknesses of the knowledge sharing process, and are very suitable for investigating business transmission processes. In this sense, in the context of family firms, succession planning refers to the deliberate and formal process that facilitates the transfer of management control from one family member to another (Sharma, 1997). However in order to ensure a positive outcome of business transmission, succession planning should provide indications of the specific knowledge and expertise areas which should be transferred

to the next generation. Furthermore, transferring knowledge internally sets the basis for innovating and improving efficiency, thus realizing the potential value of that knowledge (Davenport & Prusak, 1998).

Regarding this knowledge sharing process, small family firms seem to be in a favourable position, due to their (small) size and strong everyday relationships among family members. Bjuggren et al. (2001) point out that there is a form of idiosyncratic family knowledge (and loyalty), that makes intergenerational succession within the family more profitable than other types of succession. Repeated (and frequent) interactions make the development of bilateral knowledge transfer easier and it is intensified through “close-knit groups” whose members identify themselves with a larger collective (Kogut & Zander, 1992), therefore knowledge transfer is favoured in family firms (Sirmon & Hitt, 2003). However, in spite of this favourable situation, statistics show (Cabrera-Suarez, 2001; Koironen, Chirico, 2006; Le Breton-Miller, 2004) that next generation failure could be explained by the scarce knowledge and skill levels of the successor. In particular, the involved generations’ lack of capacity and/or willingness to create, share, transfer and acquire the appropriate ‘knowledge’ from generation to generation (Szulanski, 1996; Kellermanns & Eddleston., 2004). Therefore catastrophic statistics in business transmission failure lead researchers to take a pessimistic stance, and force them to try to investigate if organizational knowledge is really shared in business transmission and/or transmitted to the next generation.

An important reason for the failure of knowledge sharing is the lack of consideration for how the organizational and interpersonal context as well as individual characteristics influence knowledge sharing (Carter & Scarbrough, 2001; Voelpel, Dous, & Davenport, 2005). In the same way, Cunningham et al. (2016; 2017) suggested that knowledge sharing is not something that happens organically, but instead relies on careful leadership approaches in order to foster a culture of sharing and training (Srivastava, Bartol, & Locke, 2006).

Other authors suggest one major inhibitor of knowledge sharing is that knowledge can be considered a source of power and superiority (e.g., Gupta & Govindarajan, 2000; Kim & Mauborgne, 1998; Szulanski, 1996), and this fact could trigger conflicts/rivalries in senior-junior relationships (Lansberg, 1988; De Massis et al., 2008), in turn boycotting the next generation’s skills development. Similarly, due to the fact that Chrisman et al. (1998) and Sharma and Rao (2000) both found that family firms consider integrity to be the most important attribute of a potential successor, a lack of trust in the successors could undermine knowledge transmission.

Finally, having a clear transitional role for both the incumbent and the successor is vital (De Massis et al., 2008; Lansberg, 1988; Le Breton-Miller et al., 2004; Sharma et al., 2001). Thus, not clearly defining the roles of the incumbent and the potential successor(s) is another well-known cause of failures in business transmission.

In summary, current research addresses the issue of heterogeneity in small family firms in terms of a knowledge sharing approach. However empirical research providing an explanation for such SME specific features is still scarce. Due to ambiguous available evidence, and the current lack of research, setting up a theoretical framework for collecting empirical data about knowledge sharing in family business becomes an urgent requirement in order to shed light on organizational factors undermining business transmission success. Hence it is possible to formalize the first theoretical proposition:

P1: In family firms, specific factors affect organizational knowledge sharing and transmission during business succession.

Although both belong to the organizational learning field of research, knowledge sharing and management and training processes are theoretically different. Before being shared and transmitted, organizational knowledge should be created and made explicit. Furthermore, training processes follow and support knowledge sharing processes (and vice versa), but remain separate. At its most basic level, training can

be thought of as “the planned activities designed to promote the acquisition of knowledge (i.e., need to know), skills (i.e., need to do), and attitudes (i.e., need to feel)” (Salas et al., 2012, 77). The small size typical of SMEs does not in itself guarantee the activation of planned training paths for juniors, who could experience frustration and exclusion dynamics in their professional growth. For instance, in spite of the relevance of knowledge sharing and training processes, sometimes family members find difficulty in informally transmitting knowledge, even purposefully centralizing such knowledge in one or a few individuals (Cabrera-Suarez et al., 2001; Zahra et al., 2007), typically the founder. In a small business, the entrepreneur does not often have time (or even the skills) to train the next generation, who therefore must play an active part in the process of acquiring organizational knowledge (themselves). Moreover, current literature suggests that SMEs scarcely use formalized training practices, due to their size and lack of sufficient economic resources to invest in the development of human resources (Cardon, Stevens, 2004). Furthermore, seniors with a high level of performance goal orientation may feel that training depletes the time and effort available for other work activities that can result in greater personal benefits and rewards by exceeding expectations on performance goals (Szulanski, 1996). Additionally, the available empirical evidence (Ferrari, 2017; 2019; 2019a) suggests that often the juniors, (the daughters especially), do not have a technically adequate CV, and this could be an additional obstacle to their training participation.

This scenario suggests that, in order to investigate training and learning processes in SMEs, it is advisable to apply theoretical models that emphasize the on-the-job transmission of tacit and firm-specific knowledge in particular. As a consequence, a Situated Learning approach seems to be better suited to investigating if and how the next generation play a strategic role in developing their entrepreneurial skills and knowledge (Hamilton, 2011).

Literature emphasizes that not only knowledge sharing, but every learning process including the development of professional skills is a social process (Boyd et al. 2015). It is the specific dynamics of the group that help to define these skills and apply them to the organizational context. This approach is rooted in cultural psychology (Vigotskji, 1990), and continues to provide a fundamental model of design and intervention in organizational contexts. More recently, the theoretical roots are from the field of Situated Learning (Boyd et al. 2015; Hamilton, 2011; Lave, 1993; Lave, Wenger, 2005), which identifies the so called Peripheral Legitimate Participation as a way to develop the junior’s skills in a specific organizational context. It is the junior’s active participation in a community of practice (i.e. a formal/informal enduring group sharing interests, practices, values: Lave, Wenger, 1991), made up of family and non-family members, that fosters knowledge sharing and the improvement of contextual skills. Given this theoretical scenario, it is now possible to formalize the second theoretical proposition:

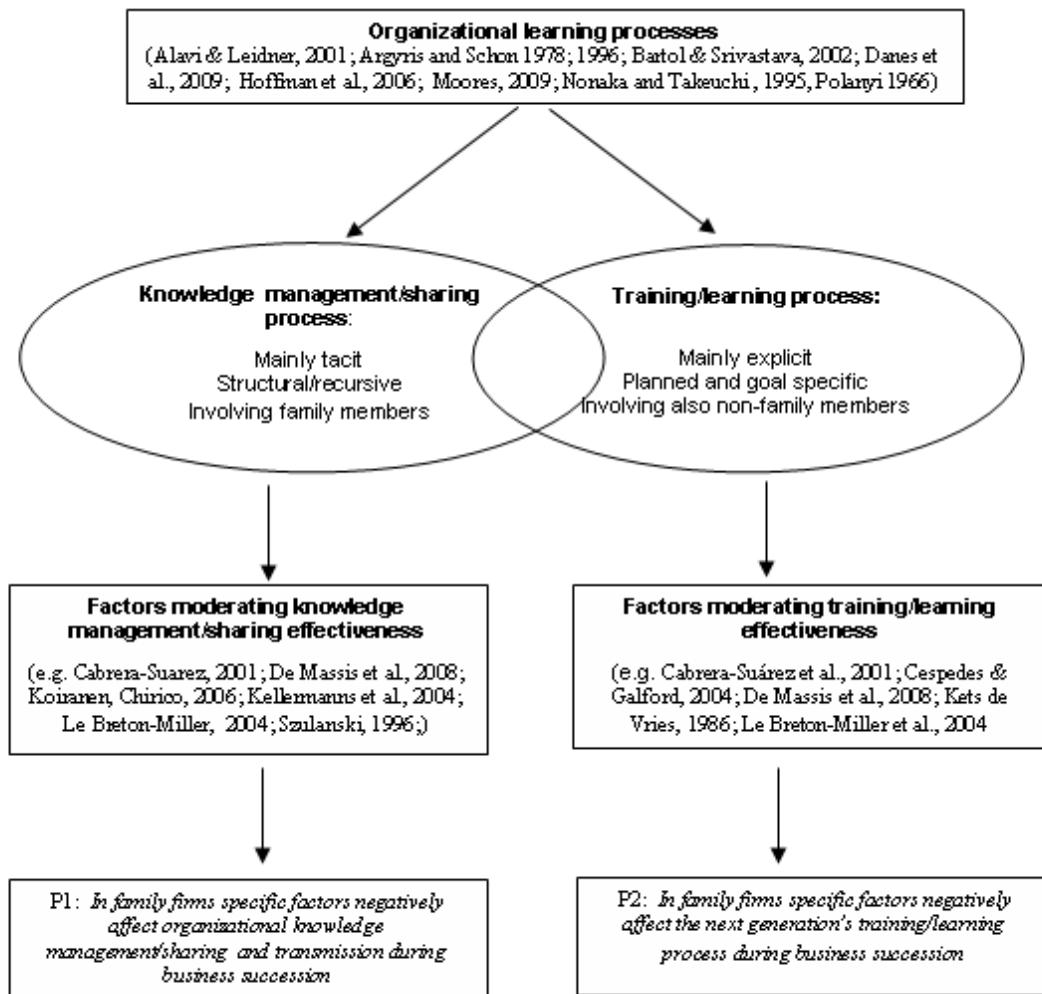
P2: In family firms, specific factors affect the next generation’s training/learning process during business succession.

Figure 1 provides a breakdown of the structure of the theoretical framework drawn on current literature.

THEORETICAL DEVELOPMENT

The first proposition suggests that in a sample of SMEs, the knowledge sharing and transmission process could show some weaknesses and evoke some criticism. Available family business literature (e.g. Koiranen, Chirico, 2006; Kellermanns et al., 2004; Le Breton-Miller, 2004; Szulanski, 1996) highlights many factors could undermine knowledge sharing and transmission:

Figure 1. Theoretical model - Key aspects in organizational learning processes during business succession
Source: Author's own construct



- lack of planned formal/structural knowledge sharing processes (Cabrera-Suarez, 2001; De Massis et al., 2008).
- conflicts/rivalries/competition in parent-child relationships (Sharma et al., 2001; Sveen & Lank, 1993; Venter et al., 2005).
- hazards/risks associated with the strong need for consensus among family members or to a lack of successor (s)'s legitimization (Schein, 1983; Walsh, 1994; Ward, 1988).
- lack of clear role definition of the incumbent and potential successor(s) (Le Breton-Miller et al., 2004; Organ, 1990; Rosenberg, 1991).

Therefore, drawing on existent literature (for a review, see De Massis et al., 2008, Ferrari, 2017), investigation process should consider several attention points, as suggested by Table 1.

Table 1. Intergenerational knowledge sharing and transmission – Synoptic representation of organizational features and related attention points

Investigated features	Attention points
Existing formal/structural knowledge sharing processes	• Official knowledge management procedures usually don't exist, knowledge sharing happens/occurs during everyday discussions and informal meetings. • This different approach makes effective knowledge sharing difficult
Conflicts/rivalries/competition in parent-child relationships	Knowledge is a power source in intergenerational turnover
Hazards associated with the strong need for consensus among family members or to a lack of successor (s)'s legitimization	• High level of centralization in decision process • Juniors show great difficulty in being legitimated in stakeholders' opinion, and consequently to access to external knowledge • Seniors manage directly (without substantial delegation) the relationships with the most important stakeholders
Lack of clear role definition of the incumbent and the potential successor(s)	• The distance (especially physical, but also 'logical' and hierarchical) between a senior's and a son/daughter's job is almost always notable. • Senior and Junior usually carry out different jobs substantially • Ample junior autonomy in carrying out his/her job, but not in decision-making

Source: Author's own construct

Available family business literature (Del Giudice, 2011; De Massis, 2008; Konopaski et al., 2015) highlights knowledge sharing is usually poor within family firms. The distance (especially physical, but also 'logical' and hierarchical) between a senior's and a son/daughter's job is often consistently notable. Usually juniors perform their job in a different sector or function/role as the founder. No daughter does the same job as the founder, even when the founder is the mother (Ferrari, 2017; 2019a). Juniors face considerable difficulty in introducing innovation, especially in process rather than in product. Re-organizations and new management methods are systematically hindered by the seniors. Finally, seniors look after the most important clients and providers directly, showing low delegation orientation, with the exception of the daily routines. In summary, the lack of an adequate knowledge sharing process to bridge the gap in technical skills of the next generations is the basis of a paradoxical system. Juniors usually show total autonomy but not in decision-making, they don't have the opportunity to change the current situation, especially with regard to organizational procedures. Next generations often have more managerial skills, they attend courses willingly, but they have great difficulty in applying what they have learned to the job. Knowledge sharing therefore faces a double obstacle: seniors don't share their experience, and juniors are not able to transfer their managerial skills to the job. These results suggest situation involving family firms are in contrast to what is described in the literature on organizational learning, and could help at least partially explain why, in most cases, the family firm does not survive the one who founded it.

The second proposition suggests that in SMEs, also the training/learning process could show some weaknesses and evoke some criticism. Available family business literature highlights many factors could undermine such participation;

- conflicts between incumbent/potential successor(s) and non-family members such as lack of trust (Cespedes and Galford, 2004).
- lack of commitment to the potential successor(s) by non-family members (Cespedes & Galford, 2004; Kets de Vries, 1986).

- late or insufficient exposure of the potential successor(s) to the business (Cabrera-Suárez et al., 2001).
- not giving the potential successor(s) sufficient feedback about the succession progress and incorrectly evaluating the gaps between the potential successor's needs and abilities (Le Breton-Miller et al., 2004).

Therefore, drawing on existent family business literature (for a review, see De Massis et al., 2008; Ferrari, 2017), investigation process should consider several attention points, as suggested by Table 2.

Table 2. Training/learning process involving the next generation – Synoptic representation of organizational features and related attention points

Investigated features	Attention points
Conflicts between incumbent/potential successor(s) and non-family members (e.g. lack of trust)	• The junior perceived him./herself as 'the son/daughter of...' • In order to appear fair, the seniors often treat the juniors more strictly than non-family members • On-the-job training is often provided by non-family members
Lack of trust in the potential successor(s)	Senior shows a lack of trust in successor's entrepreneurial rather than managerial attitude, especially when the junior is the daughter.
Failure to train potential successor(s)	• Junior training is consistent with senior experience: nevertheless, it doesn't transmit core competencies • In the founders' opinion, the daughters almost always present a lack of entrepreneurial attitude and skills, nevertheless training is not provided.
Late or insufficient exposure of the potential successor(s) to the business;	• University background and early experiences are the basis of the male juniors' activities. • The daughters show a skill mismatch due to their educational path • The daughters usually join the family firm later, after job experiences in a different sector
Lack of next generation's career planning	'Blind career'; career steps as makeshift solution
Not giving the potential successor(s) sufficient feedback about the succession progress.	A feeling of frustration often arises among the second generation, due to the fact that they attended university, thus their theoretical background is more up-to-date.
Incorrectly evaluation of the gaps between the potential successor's needs and abilities	The sample consider their current job consistent with the type of university course they attended, but with notable differences between males and females

Source: Author's own construct

In spite of the small dimensions of the firms, both training and learning processes seem to fail in supporting knowledge sharing between generations. Literature suggests the first generations of entrepreneurs are strongly focused on the business, and their children seem quite disheartened and confused, and often with a distinct lack of future orientation. The entrepreneurs do not help their children to become the future bosses: the prominent idea seems to be that the son or the daughter must grow up autonomously, inside the family firm of course, but without formal training or a defined/relevant career path - just like their father/mother did when they founded their own firm.

In particular, literature suggests (Hamilton, 2011) in family firms the peripheral legitimated participation is often hindered. For example, Boyd et al. (2015) highlight that a certain "transactional atmosphere" (family cohesiveness, commitment, traditions and underlying values) is needed so that the knowledge

transfer is realized. Often, juniors are perceived as doubtful by seniors, while they would instead like to feel appreciated and valued. The junior's attention to managerial aspects like finance and accounting is often not appreciated by the senior, who complains about their children's scarce entrepreneurial attitude and low risk-orientation instead. Juniors feel constantly under examination, they have difficulties in the legitimization process and the senior does not help them, because they do not want to create suspected favoritism.

Literature suggests there is a lack of managerialisation in family firms (Ward, 1987; 2004): in these firms everything seems to happen spontaneously, without guidance. SMEs should counterbalance the lack of this managerialisation with the physical sharing of work-spaces, and thus encourage knowledge sharing. However, this counterbalancing often does not happen.

In brief, the overall evidence shows firms which are scarcely future-oriented, and this lack of strategy affects the training policies negatively. Empirical data shows strong limitations in the knowledge sharing process between generations involved in business transmission. The founders do not share and/or discuss (or share very little of) the strategic decisions with their children. Finally, and maybe more prominent, the second generation (in particular the daughters) show a low level of skills, especially in the core business of the firm, and especially if this core business operates in a technical sector, such as mechanics or electronics. Daughters often show a mismatch between carried out educational path and current job. Training/learning strategies do not help the transmission of strategic knowledge between generations in order to fill this skill gap.

DISCUSSION

A theoretical framework should also explain a phenomenon 'from the inside', rather than statistically describe it (Norqvist et al. 2009). Therefore, in order to discuss the results, it is necessary to move from the 'How' of the organizational learning process to the 'Why'. This chapter suggests that seniors pay little attention to the knowledge sharing process during business transmission. Furthermore, the next generation does not play an active role in searching for knowledge, legitimising itself and more in general shows a lack of 'strategic thought'. This could be due to both personal characteristics of the involved generation (e.g. see Schlepphorst, Moog, 2014) and contextual/environmental influence (e.g. see Overbeck et al., 2015). Regarding the former, cognitive and personality factors should be considered, such as successors' skill mismatch and seniors' abandon resistance. Regarding the latter, cultural factors (for example, gender stereotypes and social expectations) can affect future orientation which, in turn, affects every strategic organizational training and learning decision .

Dispositional Factors: Skill Mismatch and Abandon Resistance

Incorrectly evaluating the gaps between needs and potential successor's abilities and failing to train potential successor(s) (Fischetti, 1997; Fleming, 2000; Le Breton-Miller et al., 2004) are negative factors well-known by scholars. Literature suggests this fact could be due to the different jobs carried out by the involved generations, and could result in a skill shortage and/or skill mismatch between skills required by the entrepreneurial job and skills possessed by the next generation. Furthermore, seeing as the distance (especially physical, but also 'logical' and hierarchical) between a senior's and a son/daughter's job is almost always notable, this could undermine knowledge sharing, especially 'tacit knowledge' (Chirico, 2008; Cabrera-Suarez, 2001; Chirico, Salvato, 2008) related to everyday experiences and grounded on

practical skills rather than theoretical ones. Due to its nature, tacit knowledge could not be formally taught to the next generation, but it should be shared with them (Nonaka, 1991). Therefore, the next generations' careers should be carried out side-by-side with the first generation, in order to develop entrepreneurial and managerial skills. If this does not happen, second generations' careers could easily result in a skill shortage/mismatch. Cunningham and colleagues (2017) show that a perceived shared and common organizational environment is a pre-requisite for triggering a knowledge sharing process. Thus, job mismatch could be the cause of poor investment in training due to a vicious circle: different carried out jobs hinder knowledge sharing, which increases the distance (both real and perceived) between the possessed skills. This difference in turn leads to further differentiation of the jobs and so on ... The case of daughters is suggestive, of when the job is often designed, (or maybe even invented) from scratch, due to their CV/skill gap (Ferrari, 2017).

The available empirical evidence (Cadieux et al., 2002; Vera, Dean, 2005) shows the seniors' extreme reluctance in leaving their job to their children, even once they retire (Cadieux et al., 2002). Literature also suggests a strong abandon resistance shown by the senior, which results in a procrastination of the knowledge sharing process. The consequence of this reluctance is an incomplete succession (i.e., the founding or succeeded generation retains a significant role in the organization post-succession). Some authors (Davis, Harveston, 1999) called this situation the *founder's shadow*, defining it as "a prior generation's excessive and inappropriate involvement in an organization, possibly causing social disruption in the organization" (Davis, Harveston, 1999, 311; see also Harvey, Evans, 1995).

Several authors (Barnes, Hershon, 1976; Kets de Vries, 1977, 1993; Lansberg, 1988; Peay, Dyer, 1989; Rubenson, Gupta, 1996) confirm that some sources of resistance to business transmission could originate from characteristics of the entrepreneur. For instance, the founders' will to retire is perhaps the most important feature in order to ensure a positive outcome of business transmission (Doud, 1999, Mazza, 2001). A long and undetermined waiting period before taking over the job from a parent, could likely result in a successor's loss of interest in the business (Stavrou, 1999). Such resistance, and the consequent lack of knowledge sharing, can be explained by psychological motivations: the fear of the loss of power and the denial of the approximation of the biological end of life (Ferrari, 2005; Scabini, Iafrate, 2003).

In summary, research has previously focused on the cognitive attributes of the next generation of entrepreneurs suggesting that often the successor is 'left in the dark' (Schlepphorst, Moog, 2014), without guidance and without an explicit understanding of job requirements and family expectations. This situation seems widespread also among family SMEs and more severe when involving the daughter.

Contextual Factors: Gender Stereotypes and Social Expectations

Beyond a cognitive explanation, cross-cultural studies show differences in facing business succession depending on the specific culture (Gupta, Levenburg, 2010). Following this stream of research, a number of studies (for example, Tàpies, Navarra, 2010; Thomas and Mueller, 2000; Valdez, Richardson, 2013; Welsh, Raven, 2006) have explored the connection between contextual characteristics and entrepreneurial activity. For instance, empirical evidence suggests that business transmission processes face major criticism when a daughter is involved (Dumas, 1989, 1990, 1992; Curimbaba, 2002; Ferrari, 2015; 2017; Lozano et al., 2011; Vera and Dean, 2005).

The companies invest little in their daughters, as they will be the business owners but not the CEOs, because they do not have the appropriate technical background: they will have to hire external managers or the company will be sold. However, of course, the daughters have no proper training because their

school choices are the result of gender stereotypes, as well as their career. As a result, in family firms there is a dearth of daughter successors (Overbeck et al., 2013).

This female successor shortage could be due to the complexity of gender norms and vision that could even lead to covert sexism. Sexism refers to discriminatory practices (against a particular gender), including overt and nuanced or subtle forms of sexism (Benokraitis and Feagin, 1986; Benokraitis, 1997; Jandeska and Kraimer, 2005). Covert sexism influences education, politics, religion, law, and other environmental factors (Benokraitis, 1997) that may influence daughter succession (Overbeck et al., 2015). Covert sexism could easily result in ‘daughter’s invisibility’ as successor, or gender stereotypes in job assignment. Many women in non-traditional jobs find themselves being ignored, without role models, or excluded from discussions and/or training activities (Benokraitis, 1997), and this seems to be the case of several of daughters.

In addition, social expectations regarding the entrepreneur and his social identity, (i.e. the categorization of oneself as a member of a group: Tajfel, Turner, 1986; Ferrari, 2014; De Massis, 2012), after retirement play an important role in explaining resistance to abandon. Thus, it is also possible that the entrepreneur is unaware of the problem, due to institutional normative pressure. This fact could have historical motivations. In its history, Italy has always been characterized by elderly males dominating all the key positions: to desert a top position means to desert the only source of social legitimization. Hence emerges, at a normative level, a sort of imposition in defending the possessed position. From the entrepreneurs’ point of view, passing the torch is perceived as the same as passing away. As reported by a son (Ferrari, 2015a): ‘When we argue about a future, hypothetical business transmission, my father (an 83 year old grandfather) always says: ‘I’m still not ready for the playground with my grandchildren...!’

CONCLUSION

The deductive insights suggested by this chapter can be finally presented according to suggestions drawn from the above mentioned organizational literature. This helps to better clarify the relevance of this framework, both for theory and practice and to go beyond the theoretical nature of this study. In particular, it’s possible to identify several critical areas in knowledge transmission and sharing process, which are summarized as follows and could undermine organizational performance.

Business Transmission Process

Research shows that one of the main causes of firm failure occurring recursively is the successor’s business incompetence (Carter, Van Auken, 2006; Gibb, Webb, 1980). Furthermore, statistics show (Cabrera-Suarez, 2001; Koiranen, Chirico, 2006; Le Breton-Miller, 2004) that second generation failure could be explained by the scarce will/desire to or skills of the involved generation in sharing knowledge and transmitting it from one generation to another. Given this widespread evidence in literature, the failures in knowledge sharing described in this chapter could lead to negative outcomes of process transmission, due to the successor’s business incompetence.

Organizational Reliability and Resilience

Literature shows that, even in SMEs, the founders often work independently from their children. Consequently, both develop significant knowledge, routines, and experience severally, that increase the likeli-

hood of solutions being found quickly and at reasonable costs. This fact, of course, is an organizational strength because it leads to maximum efficiency and skills development; but could also lead the founders to become indispensable, and the cost (both psychological and economical) of their replacement increases. Furthermore, a problem of reliability arises, due to this fact that the founder is irreplaceable. Consistent with High Reliability Organizations Theory (Weick, 1995; Weick, Sutcliffe, 2007), failures in knowledge sharing could lead to a firm's unreliability due to negative effects of unexpected external shocks like the death or severe illness of the founder.

Knowledge Sharing Process Based on Systemic Approach

The relative isolation of the seniors in their activities and the difficulties experienced by juniors in legitimate peripheral participation testify to the solitude of the next generation in enriching the process of creating and transmitting knowledge. Therefore it becomes necessary (Ferrari, 2005, Scabini, Iafrate, 2003) to make it clear to the involved generations that the ability to cope with the transmission process arises from the collective ability to see the resources available, to organize and use them for the purposes desired. Resources/knowledge must be considered not as possessing an objective good or personal data of members, but as a result of the organizational ability of the family.

Development of a Future-Oriented Family System

Literature shows a strong resistance to abandonment by the senior: this fact jeopardizes the probability of survival of the firm itself (Piantoni, 1990). Thus, the last but perhaps most difficult goal in a business transmission process is to make the founder aware of the fact that, from a psychological point of view, the second generation are grateful for their inheritance of the business only with a future-oriented view (Scabini, Iafrate, 2003). The successors, striving autonomously for the future survival of the firm, acknowledge the value of the inherited firm, and will also eventually acknowledge the worth/value of the previous generation's work. Removing the founder, and taking care of the firm, is the successor's only way to say 'Thank you'.

FUTURE RESEARCH DIRECTIONS

The here presented model has several future implications for organizational learning field of research, from a methodological point of view mainly. For instance, in order to go beyond theoretical position and apply this theoretical model to empirical research, a qualitative protocol is advisable: this kind approach is relevant for describing and/or explaining social phenomena "from the inside" (Gibbs, 2007), providing a rich and in-depth examination of the organizational context in which knowledge sharing occurs. The choice of this methodological option is due to the fact that available literature reviews highlight that quantitative research about knowledge sharing suffer from several significant limitations (Wang, Noe, 2010). Firstly, the majority of studies measured knowledge sharing using either willingness (or intention) to share knowledge or self-reported knowledge sharing behaviours. In addition, several measures combined knowledge sharing with utilizing knowledge and/or seeking knowledge (e.g., Cabrera et al., 2006; Lee et al., 2006). Secondly, all variables were based on a questionnaire completed by a single source in one time period. Furthermore, a qualitative approach is advisable because the research addresses 'sensitive' issues, which are not very suitable for quantification, and searches for the meanings that lie behind

actions focusing on understanding rather than measuring (Nordqvist, Hall, & Melin, 2009; Silverman, 2010). Moreover, while on one hand it's relatively easy to collect data about best practices, it seems very difficult to obtain data about failures (e.g. psychological barriers like 'jealousy', tacit competition, sabotage etc.) in knowledge sharing within the family, and often the elicited responses are biased, if not explicitly denied. For all these reasons, this theoretical model suggests to use a qualitative protocol, collecting interview data that would otherwise have been difficult to obtain through other means, such as questionnaires (Astrachan, Jaskiewicz, 2008; Zellweger, Astrachan, 2008).

Finally, as suggested by De Massis and colleagues (2008, 193) "an approach to solve the access problem would be to collect data from or through family business consultants". Thus, in order to overcome resistance and collect comparable data, data should be gathered (for instance) by a consultant during an ample multi-firm institutional project.

The limitations of this model should be considered, and overcome by future research. Although theoretically, this chapter suggests that Organizational Learning Theories and Family Capital Theory do not show a good fit in explaining the dynamics of family firm knowledge sharing in all national contexts. In the developing economies of Asia and Africa as well as the developed ones in North America, Europe, Australia, and New Zealand there is little case study research in the existing literature on cross-cultural gender issues in family firm ownership and succession (Halkias et al., 2008; 2010). The notion of a "country institutional profile" was introduced by Kostova (1997). This profile must be directed towards a specific sphere of activity or field and cannot be generalized across multiple domains (Busenitz et al., 2000). Thus, future research could provide a contribution in order to understand business transmission in specific national context from an institutional point of view, answering the following question: 'Do geographical, cultural and even religious factors affect the strategic decisions about business succession and the related managerial practices, like knowledge management? '

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KEY TERMS AND DEFINITIONS

Community of Practice: A formal/informal enduring group sharing interests, practices, values.

Knowledge Sharing: In the field of organizational literature, knowledge sharing refers to the provision of task information and know-how to help others and to collaborate with others to solve problems, develop new ideas, or implement policies or procedures.

Peripheral Legitimated Participation: Describes how newcomers become experienced members and eventually old timers of a community of practice or collaborative project. LPP identifies learning as a contextual social phenomenon, achieved through participation in a community practice

Situated Learning: Situated learning is a theory on how individuals acquire professional skills, extending research on apprenticeship into how legitimate peripheral participation leads to membership in a community of practice.

Industry 4.0:

A Strategy of the European Union and Germany to Promote the Manufacturing Industries – Opportunities and Challenges of Digitization

Immo H. Wernicke

German Government (Retired), Germany

INTRODUCTION

The German Government and the European Commission have launched the strategic initiative named Industrie 4.0 for a re-industrialization in Germany and Europe, and for achieving more competitiveness and sustainable growth. The top down strategy promotes the implementation of digital technologies especially at Small and Middle Sized Enterprises (SMEs) of the traditional manufacturing industries (Novakova, D. 2017). Digital technologies include Cyber Physical Systems, Cloud Computing, Robotics, 3D-printer-technology, Smart Factories, Additive-Manufacturing, and Artificial Intelligence. The impact of digitization on the economy, on employment, and on business results of SMEs is not yet clear due to insufficient availability of business data and results of pilot projects on enterprise level. Balasingham, K. (2016) argues in his thesis that Industrie 4.0 is still a very recent topic. The confidentiality of business data is to be taken into account, too.

Thus the methodological framework of a SWOT-Analysis normally used to assess organizations and projects might be most convenient (Investopedia, 2018) to discuss the strength, weakness, challenges, and opportunities of the strategy and the threats on its implementation by SMEs. The contribution is addressed to politicians, academics, media, startups and managers of SMEs that are less familiar with Industrie 4.0.

BACKGROUND

The term Industrie 4.0 is the “name given to the German strategic initiative to establish Germany as a lead market and provider of advanced manufacturing solutions“, explains the German Trade and Invest Association (2018). In 2011, at the German International Fair on Industries in Hanover (2018) the concept Industrie 4.0 and its technologies have been presented to the public by the German Government and by digitally leading enterprises like Bosch and Siemens. The term is also a German “brand” of a digital platform being founded by the Government in collaboration with large enterprises and company associations in 2013 (Banthien, H. 2017).

Then President of the EU Commission (2014, 2017), Claude Juncker, is supporting the strategy by the European version Industry 4.0. To promote the “re-industrialization” the EU Commission (2018) has also launched the Digitizing European Industry Program. After the financial crisis SMEs in industries contributed significantly to economic stability (Du Plessis, C.J. 2017). The Industrie 4.0 - programs

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are funding public and private research and development (R&D) and investment to boost the digital infrastructure and to strengthen competitiveness and economic growth.

The strategy refers to the vision of Rifkin, J. (2015) a former adviser to the German Chancellor Angela Merkel. Rifkin recommends the promotion of Information and Communications Technology Industries (ICT), digital startups and SMEs for establishing a demand driven intelligent production in smart factories: “By digital innovations and renewable energy a digital industrial revolution is on the way in Germany and Europe”.

THE IMPACT OF THE INDUSTRY 4.0 INITIATIVE

National and International Publications

A review of publications on Industrie 4.0 approves the concept has spread world-wide and influenced other sectors, e.g. health, Logistics 4.0, and Agriculture 4.0. Similar programs have been established in the United States, Japan, China, India, South Korea, Brazil, and in many developing countries by taking into account specific national perspectives (Zhong, R.Y., Xu, X., Klotz, E., Newman, S.T. 2017). Masdefiol, R., del Mar, Ståvmo, F. (2016) have checked the feasibility to implement Industrie 4.0 in Sweden. The academic community is committed to stimulate R&D, conferences, studies, and publications on implementing digital technologies in economic sectors (Gausemeier, J., Klocke, F., 2016).

Balasingham, K. (2016), however, emphasizes in his thesis that the implementation of the new technologies in SMEs “is not discussed excessively”. Most companies and organizations have not yet implemented the new digital technologies. The bulk of publications is still provided by the German Government, the EU Commission, and public research institutes. Academic publications focus on reports and analyzes of official papers on this topic and on technical descriptions of the innovations. (Friedrich-Ebert-Foundation, 2018)

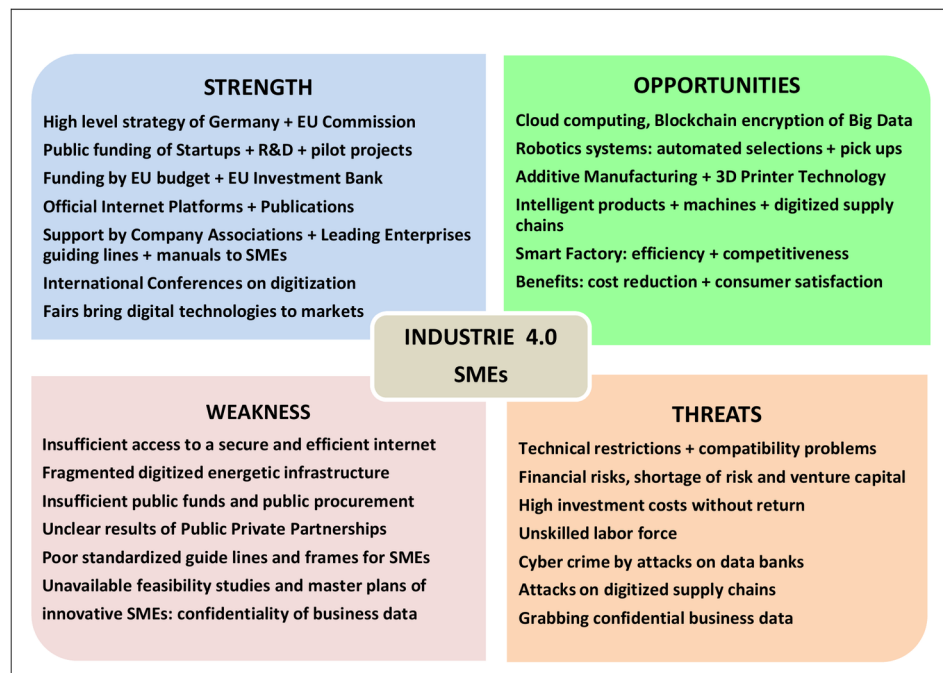
Impact of Digitization on the Economy

The impact of digitization on the economy is controversially disputed. Quantitative information about and from innovative SMEs is poor. Trade unions criticize the expected risks of unemployment caused by the digital transformation and robotics and the substitution of labor force. A positive impact on the economy is proposed by the World Economic Forum surveying managers and their investment plans for digitization (Schwab, K., 2018). The EU Commission (2018) estimates the benefits reach “more than €110 billion of annual revenue for our industry until 2020“. The Boston Consultant Group (2015) estimates a 1% per year contribution to Germany’s GDP (Gross Domestic Product) over ten years and the creation of 390,000 jobs, but “the full digital transformation will take 20 years”. Time and cost savings are proposed in consultancy reports of Deloitte and McKinsey (Nilsen, S., Nyberg, 2016). Experts of Roland Berger (publ. 2016) forecast positive results in general.

All estimates are only based on small samples of surveyed managers planning the digitization of their companies. Approved findings about business results on firm level are poor. Price Waterhouse Consulting (2015) and the German Mechanical Engineering Industry Association (2017), are admitting only 15-20% of German SMEs have implemented digital technologies in industrial manufacturing.

The transformation is still at the beginning, and accountant data are confidential (Nilsen, S., Nyberg, 2016). Before digitization, innovative managers have to conduct company assessments, SWOT-analyses,

Figure 1. SWOT-Analysis on the official concept Industrie 4.0 to support SMEs



Sources: Collected from different articles on the concept Industrie 4.0

feasibility studies and master-plans. The methodological framework of the SWOT-analysis will be applied in this article to analyze the strength, weakness, challenges, and the potential opportunities of Industrie 4.0 and its threats on SMEs (Investopedia, 2018). Figure 1 describes the components of the SWOT-Analysis for the discussion of the strategy Industrie 4.0

STRENGTH, OPPORTUNITIES, WEAKNESS, CHALLENGES, AND THREATS OF INDUSTRIE 4.0

THE STRENGTH OF THE STRATEGY INDUSTRIE 4.0

Public Support for Implementing Industrie 4.0 and for Modernizing The Infrastructure

The strength of the high level strategy Industrie 4.0 is due to the market-oriented funding and the promotion of its implementation. The German Government and the EU Commission have increased public budgets for public procurement to modernize the digital and energetic infrastructure, and to support R&D and innovations. EU Commission President Claude Juncker (2014) and the European Investment Bank (2015) have set up the European Investment Fund for Strategic Investments. The fund will mobilize Euro300bn of public and private investment on “the areas of infrastructure, notably broadband and

energy networks, transport infrastructure in industrial centers, education, research and innovation, and renewable energy and energy efficiency“, (Macary, J.P. 2018, Siemens, 2018). For transforming old industrial sites the EU Commission (2017) provides financial means by the European Structural and Investment Funds worth over €450bn.

The German Internet Platform Industrie 4.0 Promotes the Digitization of SMEs

The German Government has set up a digital Plattform Industrie 4.0 as an internet market place for the promotion of the new High Tec strategy. The Secretary General of the platform Banthien, H. (2017) encourages managers of traditional SMEs to use the platform as a market for negotiations and collaborations with digital startups and technical universities. The internet platform is being operated by business associations, trade unions, technical universities, research institutes, and political organizations. Developers and suppliers of digital technologies like Bosch, Daimler, SAP, Siemens and Thyssen-Krupp take part, too. It is one of the largest networks and has links to the EU Commission and to the G20 countries. The stakeholders of the platform cooperate with the Industrial Internet Consortium (USA), the Alliance Industrie du Futur (France), and with countries like Italy and China for digital standardization issues (Banthien, H. 2017).

For acquiring financial investors a separate internet platform is run by the German Digital Hub Initiative (2018). This internet platform enables private investors and venture capital companies to get into contact with digital Startups and SMEs for matchmaking and for checking business opportunities.

International Fairs and Company Associations Set up Strong Institutional Frames

A further institutional strength is built by the world's largest International Fair on Industries in Hanover. The fair is a strong institutional frame and real market place for suppliers and SMEs. It presents all technologies of Industrie 4.0, e.g. Additive manufacturing, Digital twins, 3D printing, Cloud computing, and Robotics. Managers of SMEs can negotiate with leading enterprises that are offering innovative industrial machinery, manufacturing facilities, products, equipment, software, and services. (International Fair on Industries Hanover, 2018)

An important institutional frame is also built by the German Mechanical Engineering Industry Federation (VDMA) organizing the International Mechanical Engineering Summits (2014, 2017) in Berlin. The association provides information on business models and digital innovations in industrial manufacturing also via the internet for SMEs.

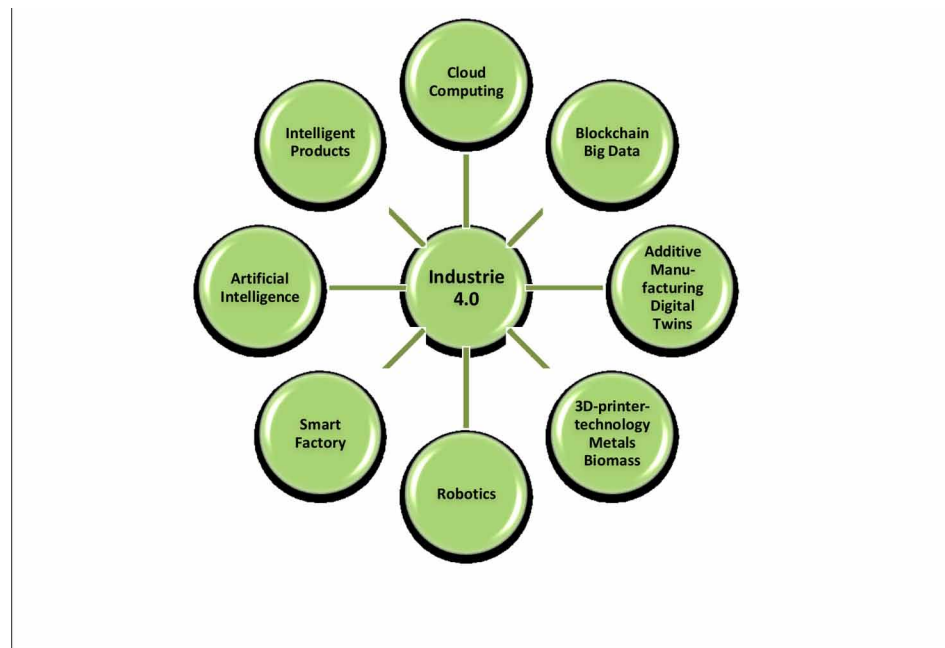
BUSINESS OPPORTUNITIES FOR SMES BY DIGITAL TECHNOLOGIES OF INDUSTRIE 4.0

Cloud Computing, Big Data, Blockchain, and Algorithms

Rifkin's vision of a digital industrial revolution is becoming a new reality in industrial production. Digital technologies have been put on the market and provide business opportunities for SMEs.

Hanover Industry Fair Manager Köckler, J. (2017) emphasizes “The technologies needed for the successful digitalization of industrial production are fully developed and ready to go.” (Figure 2)

Figure 2. Technologies of Industrie 4.0 put on the market for SMEs



Source: International Fair on Industries Hanover (2018, 2019)

A basic technology of Industrie 4.0 is Cloud computing for sharing digital platforms and data exchange. Beal, V. (2018) from the National Institute of Standards and Technology defines Cloud computing as a digital system “for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources”. Cloud computing provides managers the access to applications, software, data storage centers and services also in-house. It also allows a remote information exchange between digital and manufacturing SMEs outside the SMEs’ firewalls via the internet (IBM, 2018). Figure 2 presents the main technologies of Industrie 4.0.

Additive Manufacturing, Digital Twins, 3D-Printer-Technology, and Robotics

A prior opportunity to SMEs is provided by Additive Manufacturing, being defined as an innovative digital engineering process applicable in manufacturing (Anderl, R., and Fleischer, J., 2017). This technology is based on Computer Aided Manufacturing (CAM) providing graphical data for the creation of digital twins. Digital twins are linking digital and physical 3D Computer Aided Design (CAD) models. The digital models are virtual representations of physical machines, products, production facilities and of logistics warehouses. They represent all the properties and functions of the planned real entities being equipped with sensor systems. Manufacturers are enabled to a real time combination of digital designing and the modeling of single physical products or complete production facilities. Companies are enabled to optimize the function of machinery, equipment, products and processes.

3D-Printer-Technology for a Decentralized Production

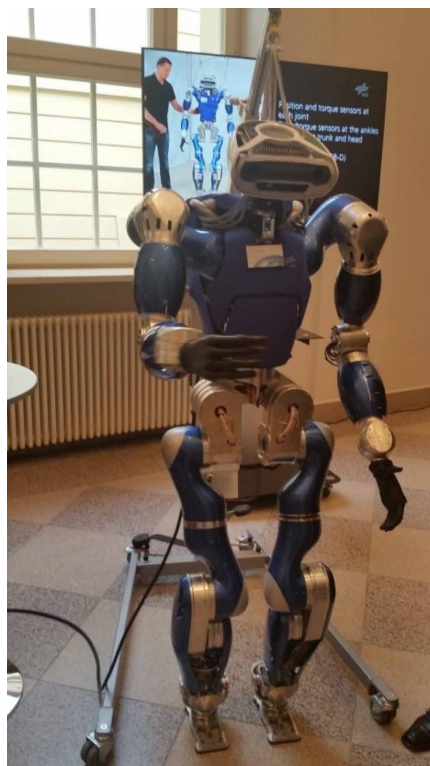
Additive Manufacturing can be connected with the 3D-printer-technology for a customer and demand driven production. 3D printers brought to the market are ready for printing a broad scope of physical products also in size, such as dishes, toys, textiles, and multimedia sets (International Fair on Industries in Hanover, 2018). Users can meanwhile apply all types of pulverized solid materials, including metals, and biomass.

The International Energy Agency (2018) point out the main advantages of 3D printing besides energy and resource savings “reduction of scrap materials, lower inventory costs, less manufacturing complexity, reduced floor space and the ability to deliver manufactured pieces with complex shapes and geometries.” Startups and traditional SMEs can benefit from these customer oriented and cost saving technologies for setting up smart decentralized production sites.

Robotics

Robotics deals with the design, construction, operation, and application of robots and computer systems. The International Organization for Standardization (2018) defines an industrial robot as an “automatically controlled, reprogrammable multipurpose manipulator programmable in three or more axes, which can be either fixed in place or mobile for use in industrial automation applications”. Robots are automated machines that can substitute labor force in the manufacturing process and in dangerous environment. Industrial robots support the production process by handling, forging, metal casting, palletizing, picking, and packaging of products of different sizes. (International Federation of Robotics, 2016). Figure 3 presents a robot as a main component of Industrie 4.0

Figure 3. Will robots substitute officers at the German Economic Ministry Soon?



Source: Photo taken by author during the conference on Industrie 4.0 in the Ministry

At the International Fair on Industries Hanover (2018) the Festo-company has brought an innovative Robot-prototype-system to the market. This Bionic Workplace unifies Self-learning systems, Artificial Intelligence and automation solutions. The human operator works with a light weight bionic robot arm using hydraulics. The robot is controllable by movement, touch or speech. Similar digital innovations support the new initiative of Gates, B. (2018) presented at the Grand Challenges Meeting in Berlin to achieve progress and efficiency in the health sector.

“Intelligent” Products, Digitized Processes, and Artificial Intelligence

Digital technologies support the manufacturing and transportation of physical products by imbedding digital elements such as microchips in products (Qin J., Liu Y. and Grosvenor R. 2016). Sensors and processors collect and transmit data along the logistic chain as a feedback to the manufacturing machines and to the manufacturers. “Each raw product will contain a small embedded system equivalent to a miniature Web server with a wireless interface that serves as its digital product memory,” explains Wahlster, W. (2017) from the German Research Center for Artificial Intelligence. The transmitted results “learned by machines” allow immediate changes of the manufacturing process for improving products better covering the customers’ needs.

The intended industrial revolution in manufacturing will lead to a digitized system named the Internet of Things (IoT). Machine production will be networked by the use of Artificial Intelligence into a self-learning system. Product design, production planning and engineering, and the provision of services will be steered decentralized. (Nilsen, S., Nyberg, E. 2016)

Smart Factories

Industrie 4.0 technologies transform traditional factories and production sites to Intelligent or Smart Factories where all manufacturing resources like sensors, actuators, machines, robots, and conveyors etc. are interconnected. Information is automatically transmitted and increases technical and economic efficiency for the whole supply chain (Wahlster, W. 2017). The Smart Factory uses all information and is enabled to predict and maintain the machines working, to control the production process, and to manage the whole factory system. (German Trade and Invest Association, 2018)

At the Hanover Fair the Bosch Company has presented a prototype of a Smart Factory which is working with assembly lines in a modular structure thus being enabled to react automatically on new orders from customers. The automation concept is using a 5 G communication technology and receives energy from the ground via an inductive charging system (International Fair on Industries Hanover, 2018).

CHALLENGES FOR SMES DUE TO THE WEAKNESS OF THE STRATEGY

Financial Strains as a Basic Weakness of Industrie 4.0

For investing in digital reengineering the managers need additional financial funds. The Association for Financial Markets in Europe (2018, p.15) criticizes the “shortage of risk capital for high growth SMEs” as a weakness of the concept. About 80% of SMEs in Europe are financed by traditional bank credits. The association demands “Raising finance and retaining investors should be a top priority for industry and policy makers alike”. It recommends equity financing by the acquisition of venture capital investors,

by crowd funding and by cooperating with FinTech companies. SMEs are to use national and European support schemes, like the European Investment Fund and the German Start-up Fund (Association for Financial Markets in Europe (2018, pp. 16-19).

Weakness Due to a Fragmented Digitized Internet Infrastructure

The planned digitization of the whole chain of industrial production and logistics needs ICT-software and the access to physical transmission lines, net-works, servers etc. A functioning, efficient and secure digitized physical infrastructure is setting up the technological frame for innovative SMEs. Experts criticize the fragmented internet infrastructure in many rural regions in Europe, which is a weakness of Industrie 4.0 (Tyson J., 2018).

The infrastructure in Europe is generally state-owned and operated by large, profit oriented communication enterprises worldwide. The transmission lines and nets are set up by the Global Area Net (GAN) and the Wide Area Net (WAN). These consist of broadband networks, fiber wire lines, wireless connections, telecommunication satellites, and internet exchange points (IXP). Local servers, local connection points, routers and wireless connections at SMEs set up the Local Area Net (LAN). These enterprises in market economies demand a return on investment. To improve the internet infrastructure and the access for SMEs more public procurement programs and funds are to be launched.

Weakness Due to a Fragmented Digitized Energetic Infrastructure

Renewable energies and the digitization of energy systems are the driving forces of the digital revolution (Rifkin, J. 2015). SMEs need also access to a functioning, efficient and secure energetic infrastructure. Critics identify the fragmented energetic infrastructure and the unsolved storage problems in Europe as a weakness, too.

The ongoing digitization will increase energy demand. Billions of new devices get connected to the electricity network and thousands of new data centers and network services are getting installed over the next few years. The digitization of energy systems might enhance energy efficiency and compensate the expected increase of energy demand. Progress might also be achieved by the digitization of the power industry in Europe shifting to a balanced energy mix (Siemens, 2018). The internet platform of the German Energy Agency (2015) promotes renewable energies to cover increasing demand.

Threats by Technical Restrictions, Unskilled Labor Force and by Cyber Crime

Technical Restrictions and Unskilled Labor Force

In his thesis, Du Plessis, C. (2017) proposes to develop a standardized framework for implementing Industrie 4.0 on microeconomic level and to establish “learning factories”. His ambitious proposal is not yet approved by evidence on firm level and seems to underestimate investment costs and the technical compatibility problems. Distortions to the production process can be caused by incompatibilities between existing components and new digital components. Anderl, R. and Fleischer, J. (2017) accentuate the crucial technical challenges for the industrial digitization due to millions of small parts such as screws, nuts and rivets used for putting together equipment and machinery and for building facilities. To equip small parts with chips is technically or economically not convenient.

SMEs fear also the insufficient digital qualification of their labor force and the management. The German Government has launched the program Arbeit 4.0 to qualify employees.

Threats by Cyber Crime and Cyber War

The Industrie 4.0 technologies lead to a physically and digitally interconnection of devices, facilities and human users. The uncontrolled and unregulated use of the worldwide open broadband and the wireless telecommunication networks are making the transformed systems vulnerable against cyber crime and abuse (Balasingham, K. 2016). Cyber crime attacks by thousands of professional hackers can distort databanks and the energetic and digital infrastructure. Fundamental threats are caused by the grabbing of confidential business and administrative data, too.

Security experts of the North Atlantic Treaty Organization (NATO, 2017) have identified the crucial threats to the society of an open unsecured internet by the undeclared Cyber War. These technologies “enable disruptive behaviors,” imply a destabilization of the economy and “bring new hazards requiring an improved capacity for risk assessment and management” (NATO 2017, pp. 45-49). IT-experts have developed software for the encoding of confidential information, of data flows and data banks in such a way that only authorized users have access. Encoding cannot prevent physical interference and the hacking of codes and digital firewalls. Decentralized in-house solutions are to be given priority by the management before implementing Industrie 4.0.

SOLUTIONS AND RECOMMENDATIONS

Managers of SMEs planning to implement digital technologies are recommended to first assess their company and to conduct a SWOT- analysis. A feasibility study on the risks and benefits of an investment in digitization is to be followed by a master and action plan.

To stimulate innovative SMEs and to overcome financial strains public and private funding systems, tax reliefs, long term credits on digital business plans and the cooperation with FinTech-system are recommended. Newly founded holdings and cooperatives could build institutional bridges and enhance the collaboration between the digital world of Startups, technical universities and R&D institutes and the physical world of SMEs.

Against cyber crime software for encoding data transfer and the physical separation of local networks from the internet provide useful in-house solutions for SMEs.

For upgrading the poor official data base more data on the impact of the digital transformation on income, risks, costs of SMEs and on employment are to be officially provided.

Politicians are recommended to improve and modernize the fragmented digital and physical infrastructure by more public investment and a reallocation of public expenditures.

FUTURE RESEARCH DIRECTIONS

Future macroeconomic research is needed on the net added value of digitization in different sectors and on income and employment by applying the cost-benefit-analysis (Roland Berger, 2016 publ.).

Future microeconomic research is recommended on international comparable case studies and on the analysis of the impact of digitization on business risks and benefits for SMEs (Nilsen, S., Nyberg,

E. (2016). Research is needed to design standards and to design assessments, feasibility studies, master-plans, and action plans on digitization on firm level. R&D is to focus on pilot projects, “small steps”, and the implementation of components of Industrie 4.0.

The monitoring and analysis of ongoing larger projects is recommended, e.g. the Siemens-EU project Internet of Things at Work and the Open Integrated Factory with integrated intelligent work pieces of the software manufacturer SAP (International Fair on Industries Hanover, 2018).

R&D is needed on encrypting and on physical innovations to protect against fraud and criminal activities by professional hackers. R&D is also to be focused on the physical internet, on power lines, on local digital networks, on local grids for production, and on in-house solutions.

CONCLUSION

The digital transformation is still at its beginning. Many digital technologies have been developed and brought to the market made available to SMEs in manufacturing industries. Most SMEs still hesitate to implement the Industrie 4.0 strategy of the German Government and the EU Commission and to transform traditional industrial manufacturing into Cyber Physical Systems. The situation in each company is different. Company managers can use the methodology of the SWOT- and cost-benefit-analysis to assess the strength, weakness, opportunities, and challenges for their companies before investment. SMEs have to take care especially on financial strains, investment risks, and the discrepancies between digital innovations and business needs of traditional manufacturing.

The fragmented internet and energetic infrastructure in Europe and Cyber Crime are a crucial challenge to be overcome. Politicians are to support the transformation and to boost public investment for modernizing the infrastructure and for securing the internet against cyber crime. For measuring the impact of digitization on the economy more accurate data on costs and benefits are to be officially provided.

Startups, the academic world and SMEs need new concepts of institutional collaboration and for setting up step by step procedures for a successful digital transformation of all economic sectors taking care on labor force.

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KEY TERMS AND DEFINITIONS

3D Printer Technology: Can apply all types of pulverized solid materials, including pulverized metals, for printing physical products also of large size.

Additive Manufacturing: Describes a digitized production process and digitized products in manufacturing.

Cyber Physical Systems: Are being set up by the internet of things that are machines, employees, products, and products facilities being digitally interconnected by the internet.

Digital Infrastructure: Is set up by digital software, servers, and physical global and local networks.

Energetic Infrastructure: Is set up by power stations, long range power lines and regional and local grids for electricity.

Industrie 4.0: Is a German term used as a name of an official internet platform and as a label of digital technologies in manufacturing industries.

Robotics: Deals with the design, construction, operation, and application of robots and the computer systems for their control information processing.

Smart Factories: Are digitized intelligent factories using additive manufacturing and robotics.

ENDNOTE

¹ Due to Web site reorganizations and updates, some links need to be accessed via the main Web addresses.

IT Resources as Risk Mitigators: The Case of Spanish Bankrupt SMEs

9

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INTRODUCTION

The study of the effects of IT investments on firm's performance has been a critical issue for research since the late 1980s. Different financial models have been used to clarify the contribution of IT investments, e.g. options theory (Fichman, 2004) and Edwards - Bell - Ohlson model (Dehning et al., 2005; Muhanna & Stoel, 2010). Some researchers rely on market prices (Dos Santos et al., 1993; Kim et al., 2001; Otim et al., 2012), while others measure the effect on financial ratios (Amit & Shoemaker, 1993; Melville et al., 2004; Wade & Hulland, 2004).

This work aims to provide additional insights regarding the influence of IT resources on performance. To do that, a new measure of performance is proposed that goes beyond the well-accepted profit. Several new links between IT literature, organization theory and financial theory are elicited.

BACKGROUND

Early studies assumed that IT investments would improve productivity (Bresnahan & Tajtenberg, 1996); however, these results were inconclusive (Morrison & Berndt, 1990; Siegel & Griliches, 1991; Loveman, 1994) and new research frameworks were explored (Melville & Kraemer, 2004). Recent research generally report effects on firm value, shareholders' wealth (Dos Santos et al., 1993; Im et al., 2001), financial measures (Brynjolfsson & Hitt, 1996; Kudyba & Diwan, 2002; Piñeiro, 2006), innovation (Drucker, 1988; Osterman, 1991; Phan, 2003; Gharavi et al., 2004) and risk-mitigation (Otim et al., 2012).

However, these outcomes seem to be contingent (Dos Santos et al., 1992; Im et al., 2001; Dehning & Richardson, 2002). Several mediating factors have been identified: business processes (Dehning & Richardson, 2002; Melville et al., 2004), knowledge (Sambamurthy et al., 2003), experience and IT management skills (Damanpour & Evan, 1984; Neirotti & Paolucci, 2012), organizational capabilities (Nevo & Wade, 2010; Ravinchandran & Lertwongsatien, 2005), dynamic capabilities (Teece et al., 1997; Eisenhardt & Martin, 2000), financial capacity (Harris & Kaatz, 1989), firm's size and industry (Dos Santos et al., 1993; Im et al., 2001), R&D (Jacobson, 1990; Bharadwaj et al., 1999; Holsapple & Wu, 2011), and real options (Fichman, 2004; Sambamurthy & Bharadwaj, 2003). Time lags and accumulation effects (Kudyba & Diwan, 2002; Cron & Sobol, 1983) are also present.

These findings are consistent with the predictions of the Resource-Based View (RBV) (Barney, 1991; Amit & Shoemaker, 1993; Peteraf, 1993): some firms outperform others because they have both potentially valuable resources (infrastructure and software platforms, financial resources, etc.) and a

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suitable set of complementary capabilities (e.g. relational capital, reputation, flexibility, ability to manage complex structures, management quality, and dynamic capabilities).

The competitive potential of a resource depends on several attributes: *value* (i.e., the opportunities it offers to seize opportunities or mitigate risks), *rarity and scarceness* (cost and accessibility) and *protection* against imitation and mobility (embeddedness, network effects, complementarity, path-dependence, etc.).

For a long time, IT platforms were the focus of managers and researchers, because they are at the core of IT inside-out resources; however they are also imitable, accessible and generally cheap (Barney, 1991), and are not expected to deliver competitive advantage, unless they are leveraged by abilities (Nevo & Wade, 2010). Assets must be deployed in a suitable organizational context (Damanpour & Evan, 1984; Teece et al., 1997; Nevo & Wade, 2010) and leveraged by internal abilities, e.g. management skills (Damanpour & Evan, 1984, Mingfang & Ye, 1999; Neirotti & Paolucci, 2012), and online information capabilities (OIC) (Barua et al., 2004), to benefit from path dependence and embeddedness (Barney, 1991).

The Net-enabled business transformation (Straub & Watson, 2001) involves radical changes in the organization of the information flows (Gharavi et al., 2004). The Internet channels a large amount of multimedia (Daft & Lengel, 1986), supports internal processes (Poon & Swatman, 1995), helps the company to manage outsourced activities (Poon & Swatman, 1995; Teo & Pian, 2003; Day, 1994; Bharadwaj, 2000), allows for greater flexibility (Bhatt et al., 2010) and supports the development external intangibles, e.g. reputation and loyalty (Roberts & Grover, 2012; Barua et al., 2004).

It is useful to identify different patterns of use of the Internet resources. Passive patterns include the use of the Net to ease internal communications and/or support virtual teams; active patterns change tasks, information links, and the business model. Companies are expected to *evolve* from passive into active patterns (Nelson & Winter, 1982).

Finally, dynamic capabilities allow the company to face changes in the environment (Teece et al., 1997; Straub & Watson, 2001); flexibility is needed to embrace technical progress, to manage external partnerships and to assimilate changes in value chain (Bhatt et al., 2010; Roberts & Grover, 2012). Previous works report a positive relationship between IT decentralization, flexibility and performance (Leifer, 1988; Zeffane, 1992)

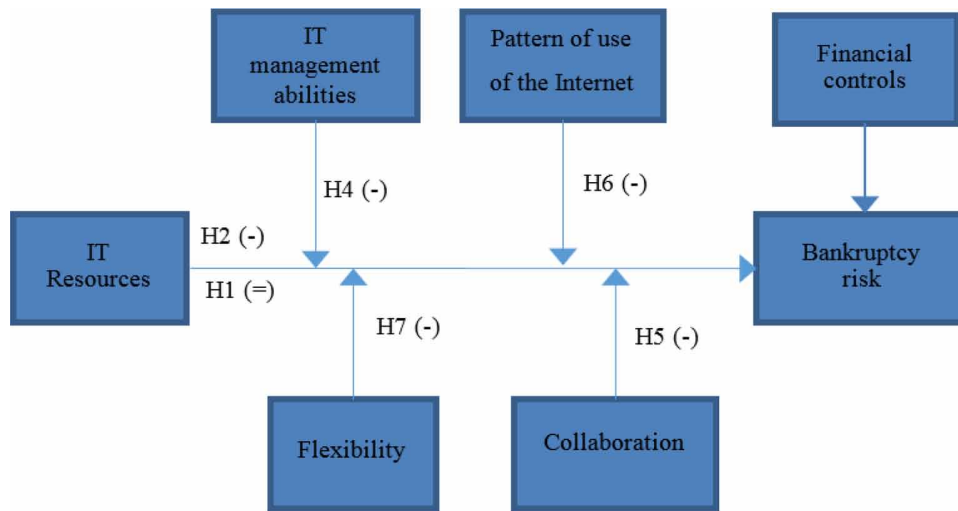
FOCUS OF THE ARTICLE

The paper explores the effects of IT on firm's performance by considering several resources and capabilities, and their respective interactions. The underlying research model connects long-term performance (as measured by the risk of bankruptcy) to several IT resources and capabilities, with some moderating factors and financial controls (Figure 1). It goes beyond traditional performance measures, to depict a complete picture of the benefits a company can expect.

The following hypothesis are suggested:

- H1. Standard IT resources have a negligible effect on the risk of bankruptcy, *ceteris paribus* capabilities
- H2: The use of proprietary software has a direct negative effect on the risk of bankruptcy
- H3: Synergies between complementary IT resources and capabilities have a direct negative effect on the risk of bankruptcy.
- H4. IT management capabilities have a direct negative effect on the risk of bankruptcy
- H5. Collaboration capabilities have a direct negative effect on the risk of bankruptcy

Figure 1. Research model



H6. Intensity of use of the Internet has a direct negative effect on the risk of bankruptcy

H7: Flexibility has a negative direct effect on risk of bankruptcy

To examine these hypothesis, a random selection of firms was sampled in 2003. Companies were observed until 2013, checking if they went bankrupt and controlling for mergers and acquisitions. A factor analysis is performed to reduce the dimension of the problem; then, a logit model is fitted to assess individual effects:

$$p = P(Y_j = 1) = \frac{1}{1 + e^{-[\beta_0 + \beta_1 \cdot X_{1j} + \beta_2 \cdot X_{2j} + \dots + \beta_n \cdot X_{nj}]}}$$

where Y_j is the status of the company (healthy vs. bankrupt) and X_{hj} ($h=1..n$) are IT resources.

DATA

This research uses a combination of public financial information and privately gathered survey information about IT resources. Financial ratios were calculated from the accounting data obtained from the Mercantile Registry; IT resources were assessed through questionnaires and personal interviews (CEO and/or CIO). Response rate was 28%, similar to that of previous studies (e.g. Teo & Pian, 2003).

Dependent Variable

Gauging corporate performance is conflictive. It has been argued that RBV might be not testable because the theory stands on an imprecise definition of *value* (Priem & Butler, 2001). Financial theory defines value as a complex notion combining the cash flows of current assets, the additional cash flows of future investments, risk and time (Makadok, 2001).

This paper suggests that *the risk of filing for bankruptcy* is a suitable and reliable measure of corporate performance. This definition provides several advantages to researchers and practitioners: while value is to greater or lesser degree subjective (depends on expectations and forecasts), bankruptcy is a fact, and it is connected to firm's performance: companies fail because they are unable to perform as well as rivals.

The dependent variable equals one if the company has filed for bankruptcy, and equals zero if not.

Independent Variables

As the paper rests on a cross-sectional sample, independent variables were designed to capture generic IT resources. They are grouped into three categories: IT resources, IT capabilities, and other capabilities

Table 1. Definition of the independent variables

Variable	Meaning	Specification	IT resources and capabilities
intes	Internal IT infrastructure	3 categories	IT resources: infrastructure, communications, proprietary technology
extes	External IT structure	2 categories	
sw	Software	4 categories	
exptic	Time from 1 st relevant IT investment	Continuous	IT capabilities: business systems thinking, ability to manage IT resources, responsiveness
imptic	Perceived importance of IT for the business	4 categories	IT capabilities: IT and business synergy, business/IT strategic thinking, IT assimilation, market responsiveness
impint	Perceived importance of the Internet for the business	4 categories	
intad	Using the internet to disseminate business information	Binary	OIC: market responsiveness, business/IT strategic thinking, efficiency, customer service, developing knowledge assets
b2c	B2C activities	Binary	
b2b	B2B (EDI / e-marketplaces)	Binary	
nsha	Number of shareholders	Continuous	Management skills, internal control
age	Age	Continuous	
auton	User autonomy, devolution	4 categories	ability to coordinate, ability to learn, flexibility, responsiveness, using knowledge assets
decen	Decentralization	4 categories	
group	Group and/or collaborative activities	Binary	
grper	Stable teams	Binary	

Table 2. Control variables

Variable	Meaning	Specification
assts	Book value of assets	Continuous
shfnd	Book value of the firm	Continuous
levg	Leverage	Continuous
liq	Liquidity	Continuous
roa	Return on Assets	Continuous
indus	Industry	5 categories

(Table 1, Table 2). Let us emphasize that the research model required data to be collected in 2003; hence, some recent advances (e.g. online social networks, e-marketplaces, m-commerce) are not considered.

Hardware and software are described by two categorical variables (INTES and SW); EXTES offers insights about external electronic linkages, e.g. Internet, e-mail, videoconference, and information services.

Two variables are used to measure flexibility (Gul & Chia, 1994; Choe, 1998): decentralization and autonomy. Decentralization (DECEN) measures physical dissemination, while Autonomy (AUTON) expresses the malleability of tasks and processes.

The use of the Internet and on-line information abilities are described by several variables. INTAD equals 1 if the company uses the Internet to spread corporate information, and zero otherwise; B2B (B2C) equals 1 if the company was conducting B2B (B2C), and zero if not.

Drawing on previous literature, developed several proxies for *human IT resources* (Melville et al., 2004) were developed. All of them assume that capabilities are an outcome of *active learning*, and emphasize collaboration (Ahuja, 2000; Blomquist & Levy, 2006).

Firm's age (AGE) may offer some insights about management skills (Nelson & Winter, 1982). However, assessing management quality is controversial because of information asymmetry and path dependence. Instead, indirect measures can be used: recent works have found that the risk of bankruptcy is inversely related to the number of *different* shareholders (NSHA) (Piñeiro et al., 2012).

Managers were asked to measure the importance of IT (IMPTIC) and the Internet (IMPINT) for their business. These variables are expected to express business/IT strategic thinking, the ability to manage IT projects, IT awareness, and IT technical skills.

As noted above, collaboration allows the company to transfer knowledge and build a shared view of the business (Gul & Chia, 1994; Brodbeck et al., 2008). GROUP equals one if there is a formal plan to facilitate collaboration throughout the company, and zero otherwise; GRPER equals one if some specific management tasks are performed by permanent teams invested with power to decide and control, and zero if not. GROUP and GRPER are expected to be closely related to flexibility.

Control Variables

Financial situation is expected to modify the availability and/or the outcomes of IT resources, therefore confounding bias must be addressed. Several magnitudes have been considered: total assets (ASSTS) and equity capital (SHFND) measure the size of the firm; return on assets (ROA) summarizes the ability of the company to generate profit, and leverage (LEVG) and current ratio (LIQ) are critical indicators of insolvency risk. Industry (INDUS) may be relevant too.

FINDINGS

27.6% of the sampled companies went bankrupt between 2003 and 2012. Healthy firms were found to be more decentralized, more likely to have high levels of user autonomy, collaboration and IT expertise, and are more prone to develop Internet-based business processes.

Given the number of variables, a factor analysis was performed. The KMO test is acceptable (KMO = 0,671), and the Bartlett's test of sphericity indicated that data is suitable for a factor analysis ($\chi^2 = 653.208$; $p = 0.000$). Six factors were extracted (eigenvalue > 1) with varimax rotation; the Chi-Square goodness-of-fit statistic is 41.611 ($p = 0.358$), so the original variables are adequately described by the factor model. Communalities are very high (> 85%) for INTES, EXTES, DECEN, B2B, and INTAD.

Factor loadings are summarized in Table 3 (values below 0.2 omitted for brevity). Factor 1 synthesizes IT infrastructure (*Internal Infrastructure*); factor 2 (*Basic Internet Resources*) summarizes the resources needed to develop business processes over the Internet; AGE, EXPTIC and NSHA are present in factor 3 (*Management abilities*); factor 4 involves e-business (*e-Business*); factor 5 (*Collaboration*) summarizes collaboration-oriented resources and software platform; finally, factor 6 (*Flexibility*) involves user

Table 3. Rotated factors matrix

	Factor					
	1	2	3	4	5	6
INTES	.864					
EXTES	.573	.650				-.377
SW			-.205		.435	.422
EXPTIC			.633			
IMPTIC	.286	.642		.276	.268	.240
IMPINT	.417			.328		
INTAD		.953				
B2C				.368		
B2B				.908		
NSHA			.362			
AGE			.882			
AUTON						.695
DECEN	.879					
GROUP					.619	
GRPER				.256	.627	

autonomy and software infrastructure. It is useful to view these factors as *bundles* of interdependent IT resources and capabilities [69].

Each firm is now described by six synthetic factors; their values are obtained by multiplying the original variables by the coefficients showed in Table 4. For example Factor 1 can be expressed as

$F1 = 0,352 \cdot \text{INTES} + 0,327 \cdot \text{EXTES} + 0,031 \cdot \text{SW} + \dots + 0,005 \cdot \text{GROUP} + (-0,077) \cdot \text{GRPER}$ —where INTES equals one if user devices are isolated, two if they are dumb terminals connected to a server, and so on (see footnote 3).

Factor analysis is intended for use with continuous variables with a multivariate normal distribution; the use of categorical values is not extraordinary, however a two-step cluster analysis was run to test the robustness and reliability of the factors. IT resources can be grouped into five clusters (Figure 2) with adequate levels of cohesion and separation (average silhouette width = 0.7); clusters and factors are qualitatively similar.

Then, for prepared data, a parsimonious logit model was fitted. Independent variables were presented into three blocks: financials, IT resources, and interactions between resources and capabilities (Table 4). Interaction terms were designed following previous research on IT and performance:

Table 4. Factor score coefficient matrix

	Factor					
	1	2	3	4	5	6
INTES	0,352	-0,019	-0,007	-0,059	-0,207	0,002
EXTES	0,327	-0,135	-0,084	-0,111	0,349	-1,187
SW	0,031	-0,023	-0,063	-0,060	0,237	0,180
EXPTIC	-0,005	-0,009	0,198	-0,010	-0,069	0,001
IMPTIC	0,062	-0,028	0,018	0,033	0,125	0,253
IMPINT	0,033	-0,014	0,025	0,043	-0,007	0,011
INTAD	-0,410	1,191	0,025	0,043	-0,355	0,552
B2C	-0,008	-0,004	-0,020	0,054	-0,001	-0,007
B2B	-0,030	-0,110	-0,047	0,921	-0,088	-0,041
NSHA	0,005	-0,013	0,076	-0,025	0,046	0,020
AGE	-0,093	-0,069	0,725	-0,046	0,034	-0,037
AUTON	0,012	0,004	-0,008	-0,005	0,003	0,120
DECEN	0,530	-0,071	0,027	-0,082	0,014	0,514
GROUP	0,005	-0,056	-0,002	-0,039	0,365	0,065
GRPER	-0,077	-0,079	0,058	0,016	0,444	-0,157

Figure 2. Summary of two - step clustering



- *Internal infrastructure* by *Management Abilities*, *Basic Internet Resources*, *e-Business*, *Collaboration*, and *Flexibility*.
- *Management Abilities* by *Basic Internet Resources*, *e-Business*, *Collaboration*, and *Flexibility*.

Basic Internet Resources by e-Business

The Hosmer and Lemeshow test (Table 5) shows that the logit model adequately fits the data ($\chi^2 = 7.870$; $p = 0.446$); omnibus tests are also significant ($\chi^2 = 61.82$; $p = 0.000$), and R^2 indicates that the model explains a large portion of firm's performance (as measured by bankruptcy risk). Hit rate is also high (86.7%).

Once controlled for leverage, four IT constructs and one interaction term are found to be significant (Figure 3):

Table 5. Results of the logit regression

BLOCK 3 (final model)	B	S.E.	Wald	Sig.	Exp(B)
LEVG	.069	.021	10.980	.001	1.072
Basic Internet resources	-1.133	.465	5.937	.015	.322
Management abilities	-.800	.521	2.356	.012	.449
Collaboration	-1.058	.437	5.858	.016	.347
Flexibility	-3.151	.994	10.046	.002	.043
Internal infrastructure by Flexibility	-1.542	.853	3.267	.071	.214
Management abilities by e-Business	-1.141	.552	4.268	.039	.320
Constant	-6.661	1.657	16.170	.000	.001
<i>Internal infrastructure by Basic Internet resources</i>	<i>2.042</i>			<i>.153</i>	
<i>Internal infrastructure by Management abilities</i>	<i>.015</i>			<i>.903</i>	
<i>Internal infrastructure by e-Business</i>	<i>.076</i>			<i>.783</i>	
<i>Internal infrastructure by Collaboration</i>	<i>.401</i>			<i>.526</i>	
<i>Basic Internet resources by Management abilities</i>	<i>.179</i>			<i>.673</i>	
<i>Management abilities by Collaboration</i>	<i>1.123</i>			<i>.289</i>	
<i>Management abilities by Flexibility</i>	<i>.009</i>			<i>.926</i>	
<i>Basic Internet resources by e-Business</i>	<i>1.912</i>			<i>.167</i>	

Table 6. Overall fit of the model

		Block 3
Hosmer & Lemeshow test	Chi-square	7.870
	d.f.	8
	sig.	0.446
Omnibus tests of coefficients	Chi-square	61.82
	d.f.	7
	sig.	0.000
Cox & Snell R ²		0.445
Nagelkerke R ²		0.643
-2LL		61.94
Hit rates (pct.)	Healthy	93.4
	Failed	69
	Overall pct.	86.7

- *Flexibility* turns out to be the most relevant IT resource ($B = -3.151$, $p < 0.01$).
- *Basic Internet resources* are significant at 5 per cent level, with the expected negative sign ($B = -1.133$, $p < 0.05$)
- *Collaboration* is also found to be significant at 5 per cent level ($B = -1.058$, $p < 0.05$)
- *Management Abilities* (management quality and IT experience) are found to be significant at 1 per cent level ($B = -0.8$, $p < 0.05$).

- Two interactions are found to be significant: the coefficient on *Management Abilities* by *e-Business* is expected to be negative and significant ($p < 0.05$); *Internal infrastructure* by *Flexibility* has the expected negative sign, although the evidence is weak ($p < 0.1$).

According to Table 6, flexibility can be viewed as the combination of an ability (user autonomy) and an IT asset (software infrastructure); the model also suggests that flexibility is enabled by decentralization. It's a dynamic capability (Teece et al., 1997) needed to carry out innovation, to manage external partnerships and to integrate outsourced activities (Bhatt et al., 2010; Roberts & Grover, 2012). This strongly supports hypothesis No. 7.

Proprietary software is tailored and embedded in business processes; hence, it offers protection against imitation. These findings suggest that the use of custom software has a measurable positive effect on firm's performance, as predicted by the RBV and hypothesis No. 2.

As noted above, *Basic Internet resources* is a compact bundle of common Internet assets (e.g. software and equipment), internal skills (IT management skills, ability to manage IT changes) and outside-in resources (e.g. market responsiveness) (Bharadwaj, 2000). The results suggest that a more intense use of *Basic Internet resources* improves performance and mitigates the risk that a company goes bankrupt (Barua et al., 2004; Teo & Pian, 2003).

Management Abilities is found to be significant, with a negative estimate: age, previous experience in the management IT-intensive projects, and the number of shareholders have substantial and positive loadings on this factor; hence, these pieces of intellectual capital reduce the average risk of bankruptcy (i.e., increase firm's performance), ceteris paribus, as hypothesis No. 4 predicted.

Collaboration is closely related to management skills, flexibility, organizational responsiveness, and knowledge transfer. The results indicate that a higher level of collaboration between individuals, groups and organizational units is expected to reduce the odds of filing for bankruptcy (i.e., is expected to increase performance): therefore, hypothesis No. 5 was supported.

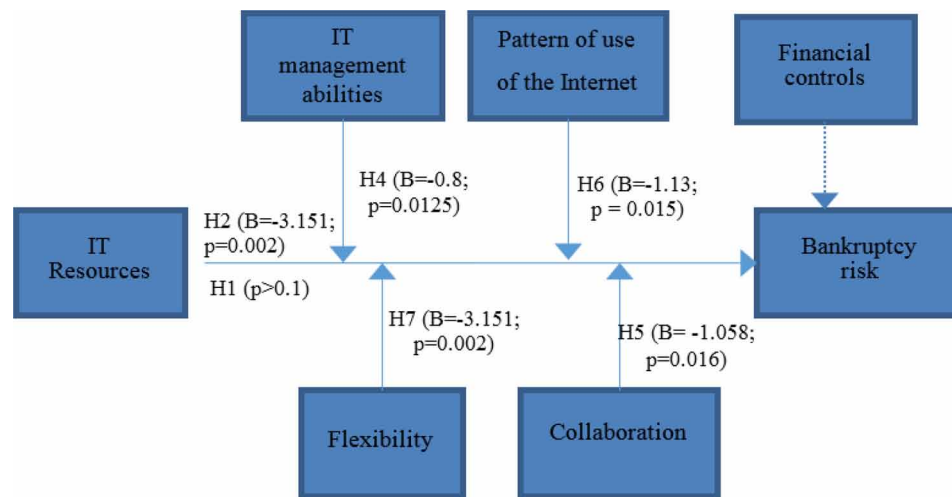
It must be noted that risk mitigation does not emerge as a consequence of *just* the adoption of IT and/or the implementation of e-commerce projects: firms need to leverage platforms with suitable internal abilities and external invisible assets. These results provide strong support for both the design of the factors (*bundles* of resources) and hypothesis No. 3: synergies between IT resources and capabilities are needed, and complementarities have a significant effect on performance (as measured by the risk of bankruptcy).

The effect of each original variable can be gauged considering both the logit estimates (Table 5) and factor scores (Table 4). Let us consider a 16.7 year old company with a single shareholder and a leverage ratio of 34.5%; a computer-based LAN and commercial software are available; managers attach high importance to IT but the firm does not perform electronic commerce; user autonomy is very low, and no collaboration plans have been developed. According to the model, the probability of the company going bankrupt is 1.79%. A similar firm that conducts e-commerce and uses some pieces of proprietary software would have an estimated risk of 14.6% - as a consequence of the volatility of Internet-based businesses.

SOLUTIONS AND RECOMMENDATIONS

From a practitioner's point of view, the critical question is whether IT investments will result in higher performance. Managers tend to evaluate investments on a standalone basis, i.e., as if they were isolated and independent projects, to clearly define the boundaries of the problem and mitigate uncertainty.

Figure 3. Summary of hypotheses and results



When supplementary resources are needed, this strategy can result in an increased likelihood of errors in capital budgeting decisions, and in an inefficient resource allocation.

The results also stress the role of intangible resources, such as management abilities or IT expertise. It has been repeatedly asserted that technology is just an enabler, and that additional skills and invisible assets are needed to benefit from IT infrastructure; this work offers evidence that coherent bundles can be identified, where IT resources are leveraged by some specific internal abilities and external intangibles.

Finally, this work proves that long-term performance can be measured reliably as the risk a company goes bankrupt. Financial failure is the consequence of a combination of reasons that causes underperformance and loss of competitiveness. Bankruptcy is a clear and accessible baseline for managers, and an objective fact for researchers.

FUTURE RESEARCH DIRECTIONS

The paper leaves several questions for future research. It might be useful to explore the effect of mature e-business projects and recent innovations (e.g. social networks, mobile commerce, and e-procurement), which were not present when primary data were collected. It also would be beneficial to apply the methodology to banking and financial services, where IT resources are strategically critical but competition is limited by regulation.

CONCLUSION

The RBV predicts that firm's performance is driven by the availability of suitable and complementary IT resources and capabilities. This work extends this view by offering i) a catalogue of relevant IT resources and capabilities; and ii) measures of their respective effect on firm's performance. To do that, a new objective and exhaustive definition of performance is suggested.

Four main conclusions can be derived from the results: i) performance (and the risk of going bankrupt) is driven by the availability of concrete IT resources and capabilities; ii) assets and abilities can

be grouped into bundles; iii) complementarities and synergies do exist, and have a measurable effect on performance; and iv) the risk of going bankrupt is a reliable measure of firm's performance.

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KEY TERMS AND DEFINITIONS

Bankruptcy: The legal status of a firm that is unable to meet payments due to massive and irreversible financial imbalances.

Capability: A skill or aptitude that confers to the company a potential capacity to carry out activities or projects with an abnormally high levels of quality and/or performance.

Performance: An assessment of how well a company is doing, often measured against financial or competitive goals.

Resource: A tangible or intangible mean to which value is attributed because it is required to perform an activity.

Risk: The inability to know in detail all the relevant factors of a problem and to forecast with certainty the outcomes of a decision, due to imperfect and incomplete information.

ENDNOTES

¹ Sampling error is 4.9%.

² Categorical variables were defined as follows:

INTES: 1 = without LAN; 2 = *dumb* terminals network; 3 = PC-based network

EXTES: 1 = not connected to the Internet ; 2 = connected to the Internet

DECEN: 1 = centralized; 2 = low; 3 = medium; 4 = very decentralized

SW: 1 = Mostly commercial; 2 = mixed, with a high proportion of commercial SW; 3 = mixed, with a high proportion of proprietary SW; 4 = mostly proprietary.

AUTON, IMPTIC and IMPINT: 1 = none; 2 = low; 3 = medium; 4 = high

³ Industry was defined as follows: 1 = Agriculture & fishing; 2 = Extractive & building; 3 = Industry; 4 = Commerce; 5 = Services.

Role of Technology Startups in Africa's Digital Ecosystem

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INTRODUCTION

The era in which we live is dominated by technology. Technology has continued to revolutionize the way people interact with one another, as well as conduct the operations of business on a regular basis (Decaux, 2018, Ogunfuwa, 2018; Osuagwu, 2019). Small and big businesses need technology to thrive. Businesses are growing and expanding across countries due to technological advancements. It is technology that gives organizations the strength to spread their wings. Oak (2018), notes that if not for technology, complex industrial processes would not have been carried out, and large-scale production of goods would have been impossible. Growing businesses create employment opportunities for people and technology plays a big role in business growth.

Apart from helping to shape the way things are done, technology has brought innovations into service delivery thus enabling human society to transform to a technology driven world where almost everything is being automated. Technology automates the most complex of processes, be it in communication, education, medicine or any other industry. With the application of technology, critical and time-consuming processes can be executed with ease and in less time. Laborious and repetitive tasks are best done by machines. People do not have to slog as much as they would have had to, if not for technology. With automation came efficiency and speed. They save human effort and time to a great extent and make life easy and comfortable.

Human life and technology cannot be separated, hence society has a cyclical co-dependence on technology (Risto, 2000). However, technology has also caused humans concerns. Its poor application has resulted in the pollution of the environment and it has also caused serious threat to lives and society. This therefore calls for proper use of technology. The biggest challenge facing mankind is to determine the type of future they need to have and then create relevant technologies that will simplify the way things are done.

In the last few years in Africa, technology startups have been developing software solutions which companies and organizations are leveraging on to improve service delivery, as well as address societal challenges. On a large scale, these efforts are geared towards closing the technological divide between Africa and Europe. Experts have noted that the growth potential for technology in the African continent is huge, judging by the remarkable breakthrough these startups are making in addressing workplace issues and getting many youths meaningfully engaged (Aliogo, 2018, p.29; Essien, 2018,p.81).

In the African context, technology innovation is seen as an option out of poverty, and most technology hubs in the continent are providing communities with infrastructures to support home-grown innovations. Startups require less infrastructures and financial risk for rapid growth than big industries. These hubs are not only providing startups with the technical support and access to fast internet, and free training but they also provide professional and social networks in which these technology entrepreneurs can thrive.

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A report by social media week shows that regardless of the growth of internet usage in Africa since 2000, only a segment of the population (about 7 percent) have access to internet. Even with the increase in access to technology globally, the divide in knowledge and skill still limits the ability of developing countries to compete in the global market. The report also stated that the digital divide is the gap in the access to information and communication technologies between developed and developing countries or among different social groups (Aliogo, 2018). The divide is not limited to internet access but also to mobile phones, computers, radio and television. Access to information and computer technology is crucial to sustainable economic and social development as well as environmental protection.

A particular report cited by Aliogo (2018) noted that Africa is at the start of technological renaissance. The report said seven out of the 10 of the world's fastest growing internet populations are in Africa. This trend is expected to re-shape the entire economies of the continent as new companies would leapfrog established technology, ideas and infrastructure to grow. It also stated that internet penetration in the continent is just 29 percent which implies that the majority of growth and network effects are still to come.

There has been a boom in tech startups and funding in the continent. The rise reflects the rapidly developing tech sector in Africa. In 2016, Africa technology startups raised in record-breaking total of \$366.8m in investment, according to San Francisco headquartered venture capital firm Partech Ventures. To put this into perspective, tech companies across the continent raised \$276.5m in the previous year (2015). Partech Ventures data only includes deals higher than \$200,000 and excludes any grant or debt deals, and "megadeals" worth \$100m and over. Only three countries accounted for annual 80 percent of Africa's total funding, with Nigeria securing \$109m or 29.8 percent; South Africa receiving \$96m or 26.4 percent; and Kenya securing \$92m or 25.3 percent.

The average size of the deals struck in Africa by startups also increased year-on-year at every stage of investment, with series A funding, for example, increasing to around \$3.7m. Series A refers to a company's first significant round of venture capital financing. At the same time, the number of tech hubs in Africa rose to 310, with 173 accelerators and incubators recorded in 2016, according to the World Bank. In the previous year (2015), there were 117. The number of tech hubs rose from 310 to 442 in 2018.

The growth in Africa's technology sector came at a time when mobile internet adoption continued to grow rapidly, with the number of mobile internet subscribers increasing threefold in the last six years to over 300m unique users, according to the mobile operator's trade body GSMA. Additional 250m subscribers are expected by 2020. Mobile internet is the platform of choice in Africa due to its relatively low cost when compared to wireless broadband. The growing uptake in mobile technology has fuelled many of the innovative digital solutions and services emerging from the continent, and, as mobile infrastructure advances and the cost of smart devices falls, technology entrepreneurs are developing uniquely African technology solutions to African problems.

The objectives of the article are:

1. To identify the role technology startups are playing in Africa's digital ecosystem.
2. To identify the challenges confronting African technology startups and how to solve them.
3. To recommend ways to promote the growth and development of technology startups in the continent.

BACKGROUND

Overview of Startups

The importance of startups to business and society cannot be over emphasized. A startup is a newly emerged business venture that aims to develop a viable business model to meet a market place need or problem. Founders design startups to effectively develop and validate a scalable business model (Robehmed, 2013; Katila et al., 2012). The concepts of startups and entrepreneurship may appear similar, but they are not the same. While entrepreneurship refers to all new businesses, including self-employment and businesses that never intend to grow big or become registered, startups are new businesses that intend to grow beyond the solo founder, have employees, and grow large.

Everywhere, startups face high uncertainty and do have high rates of failure, but the few that survive to become successful companies have the potential to become large and influential (Schmitt, 2018; Griffith, 2014). Some startups become Unicorns, that is, privately held startup companies valued at \$1billion. According to Tech Crunch, there were 279 unicorns as of March 2018, with most of the unicorns located in China, followed by the United States. The largest unicorns founded as of October 2018 included Ant Financial, ByteDance, DiDi, Uber, Xiaomi, and Airbnb.

Startups usually evolve through the effort of a founder (Solo founder) or co-founder who are determined to solve a problem. The founder(s) of a startup begin market validation with problem interview, solution interview, and then build a minimum viable product (MVP), that is, a prototype, to develop and validate the business models. The startup process can take a long period of time, by one estimate, three years or longer (Carter et al., 1996; Reynolds & Miller, 1992), and hence sustaining effort is required. However, sustaining effort over the long term is especially challenging because of the high failure rates and uncertain outcomes (Uy et al., 2015).

Startup Principles

There are many principles in creating startups. They include:

Lean Startup

Lean startup is a popular set up of principles used in creating and designing startups under a limited resources and tremendous uncertainty to build their ventures more flexibly and at lower cost. It is based on the idea that entrepreneurs can make their implicit assumptions about how their ventures works explicitly and empirically test them (Van Burg et al, 2008). The empirical test is to de-validate these assumptions and to get an engaged understanding of the business model of the new ventures, and in doing so, the new ventures are created iteratively in a build-measure-learnloop. Hence, lean startup is a set of principle for entrepreneurial learning and business model design. More specifically, it is a set of design principles aimed at repetitive experiential learning model design under uncertainty in an engaged empirical manner.

Typically, lean startup focuses on a few lean principles.

1. Find a problem worth solving, then define s solution
2. Engage early adopters for market validation
3. Continually test with smaller, faster iterations
4. Build a function, measure customer response, and verify/ refuse the idea
5. Evidence – based decisions on when to “pivot” by changing your plan’s course
6. Maximize the efforts for speed, learning and focus

Market Validation

A key principle of startup is to validate the market need before building a solution. Because startups are uncertain, you do not want to waste time or money building something that has weak demand. Validating your ideas before deciding to invest heavily in building something is a wise move no matter how confident you are. One may think a major problem has been solved, but does the market care enough to invest in it themselves? Being overconfident in an idea and failing to validate it early takes on unnecessary risk.

Design Thinking

Design thinking is used to understand the customers' need in an engaged manner. Design thinking and customer development can be biased, because they do not remove the risk of bias because the same biases will manifest themselves in the sources of information, the type of information sought, and the interpretation of that information (York & Danes, 2015). Encouraging people to “consider the opposite” of whatever decision they are about to make tends to reduce biases such as overconfidence, the hindsight bias, and anchoring (Larrick, 2004; Mussweiler, Strack, & Pfeiffer, 2000).

Decision-Making Under Uncertainty

In startups, many decisions are made under uncertainty (Schmitt, 2018), and hence a key principle for startups to be agile and flexible. Founders can embed options to design startups in flexible manners, so that the startups can change easily in future.

Uncertainty can vary within-person and between-person. A study found that when entrepreneurs feel more uncertain, they identify more opportunities (within-person difference) but entrepreneurs who perceive more uncertainties than others do not identify more opportunities than others do (no between-person difference) (Schmitt, 2018).

Partnering

Startups may form partnerships with other firms to enable their business model to operate (Teece, 2010). To become attractive to other businesses, startups need to align their internal features, such as management style and products with the market situation. In their 2013 study, Kask and Linton develop two ideal profiles, or also known as configurations or archetypes, for startups that are commercializing inventions. The inheritor profile calls for a management style that is not too entrepreneurial (more conservative) and the startup should have an incremental invention (building on a previous standard). This profile is set out to be more successful (in finding a business partner) in a market that has a dominant design (a clear standard is applied in this market). In contrast this profile is the originator which has a management style that is highly entrepreneurial and in which a radical invention or a disruptive innovation (totally new standard) is being developed. This profile is set up to be more successful (in finding a business partner) in a market that does not have a dominant design (established standard). New startups should align themselves to one of the profiles when commercializing an invention to be able to find and be attractive to a business partner. By finding a business partner, a startup has greater chances of becoming successful (Kask & Linton, 2013).

Startups usually need different partners to realize their business idea. The commercialization process is often a bumpy road with iterations and new insights during the process. Hasche & Linton (2018)

argue that startups can learn from their relationships with other firms, even if the relationship ends, the startup could have gained valuable knowledge about how it should move on. When a relationship is failing for a startup it needs to make changes. Three types of changes have been identified by Hasche and Linton (2018).

1. Change of business concept for the startup
2. Change of collaboration constellation (change several relationships)
3. Change of characteristics of business relationship (with the partner, e.g. from a transactional relationship to more of a collaborative type of relationship)

Entrepreneurial Learning

Startups need to learn at a huge speed before running out of resources. Proactive actions (experimentation, searching, etc) enhances a founder's learning to startup a company (Castrogiovanni, 1996). To learn effectively, founders often formulate falsifiable hypotheses, build a minimum viable product (MVP) and conduct A/B testing.

Business Model Design

With the key learning from market validation, design thinking and lean startup, founders can design a business model. However, it is important not to dive into business models too early before there is sufficient learning on market validation. While elucidating this, Paul Graham of Y Combinator said "what I tell founders is not to sweat the business model too much at first. The most important task at first is to build something people want. If you do not do that, it won't matter how clever your business model is"

Startup Ecosystem

The size and maturity of the startup ecosystem is where a startup is launched and where it grows to have an effect on the volume and success of the startups. The startup ecosystem consists of the individuals (entrepreneur, venture capitalists, angel investors, mentors, advisors); institutions and organizations (top research universities and institutes, business schools and entrepreneurship programs and centres operated by universities and colleges, non-profit entrepreneurship support organizations, government entrepreneurship programs and services, chambers of commerce) business incubators and business accelerators and top-performing entrepreneurial firms and startups. A region with all of these elements is considered to be a "strong" startup ecosystem. One of the most famous startup ecosystems is Silicon Valley in California, where major computer and internet firms and top universities such as Stanford University create a stimulating startup environment, Boston (where Massachusetts Institute of Technology is located) and Berlin, home of WISTA (a top research area), numerous creative industries, leading entrepreneurs and startup firms.

Although there are startups created in all types of businesses, and all over the world, some locations and business sectors are particularly associated with startup companies. The internet bubble of the late 1990s was associated with huge numbers of internet startups companies, some selling the technology to provide services. Most of this startup activity was located in the most well known startup ecosystem – Silicon Valley, an area of northern California renowned for the high level of startup company activity.

Gromov (2010) notes that:

The spark that set off the explosive boom of “Silicon startups” in Stanford Industrial Park was a personal dispute in 1957 between employees of Shockley semiconductor and the company’s namesake and founder, Nobel Laureate and co-inventor of the transistor William Shockley ... (His employees) formed Fairchild semiconductor immediately following their departure ... After several years, Fairchild gained its footing, becoming a formidable presence in this sector. Its founders began learning to start companies based on their latest ideas and were followed on this path by their own former leading employees ... The process gained momentum and what had once began in a Stanford’s research park became a veritable startup avalanche ... Thus, over the course of just 20 years, a mere eight of Shockley’s former employees gave forth 65 new enterprises, which then went on to do the same.

Startup advocates are also trying to build a community of tech startups in New York city with organizations like NY Tech Meet Up and build in NYC. In the early 2000s, the patent assets of failed startup companies are being purchased by what are derogatorily known as patent trolls, who then take the patents from the companies and assert those patents against companies that might be infringing the technology covered by the patent (McDonough, 2007)

Startup Investing

Startup investing is the action of making an investment in an early-stage company (the startup company). Beyond founder’s own contributions, some startups raise additional investment at some or several stages of their growth. Not all startups trying to raise investments are successful in their fundraising. In the United States, the solicitation of funds become easier for startups as a result of the JOBS Act (The Wall Street Journal, 2013; Financial Times, 2013; Bloomberg Businessweek, 2013; Venturebeat, 2013).

Prior to the advent of equity crowd funding, a form of online investing that has been legalized in several nations, startups did not advertise themselves to the general public as investment opportunities until they first obtained approval from regulators for an initial public offering (IPO) that typically involved a listing of the startups securities on a stock exchange. Today, there are many alternative forms of IPO commonly employed by startups and startup promoters that do not include an exchange listing, so they may avoid certain regulatory compliances obligations, including mandatory periodic disclosures of financial information and factual discussion of business conditions by management that investors and potential investors routinely receive from registered public companies.

Investors are generally most attracted to those new companies distinguished by their strong co-founding team, a balanced “risk/ reward” profile (in which risk due to the untested, disruptive innovations is balanced out by high potential returns) and “scalability” (the likelihood that a startup can expand its operations by serving more markets or more customers). Attractive startups generally have lower “bootstrapping” (self-funding of startups by the founders) costs, higher risk, and higher risk, and higher potential return on investment. Successful startups are typically more scalable than an established business, in the sense that the startup has the potential to grow rapidly with a limited investment of capital, labour or land (Ghosh, 2014). Timing has often been the single most important factor for biggest startups successes, while at the same time it is identified to be one of the hardest things to master by many serial entrepreneurs and investors.

Startups have several options for funding. Revenue-based financing lenders can help startup companies by providing non-dilutive growth capital in exchange for a percentage of monthly revenue (Goodman, 2019). Venture capital firms and angel investors may help startup companies begin operations, exchanging seed money for an equity stake in the firm. Venture capitalists and angel investors provide financing

to a range of startups (a portfolio), with the expectation that a very small number of the startups will become viable and make money. In practice though, many startups are initially funded by the founders themselves using “bootstrapping”, in which loans or monetary gifts from friends and family are combined with savings and credit card debt to finance the venture. Factoring is another option, though it is not unique to startup. Other funding opportunities include various forms of crowd funding, for example equity crowd funding (Prentice, 2010), in which the startup seeks funding from a large number of individuals, typically by pitching their idea on the internet.

Necessity of Funding

While some would-be entrepreneurs believe that they cannot start a company without funding from VC, Angel, etc., Vwekwadhwa (2018) says that is not the case.

Startup Valuations

If a company's value is based on its technology, it is often equally important for the business owners to obtain intellectual property protection for their idea. The Economist (2005) estimated that up to 75 percent of the value of US public companies is now based on their intellectual property (up to 40 percent in 1980). Often, 100 percent a small startup company's value is based on its intellectual property. As such, it is important for technology – oriented startup companies to develop a social strategy for protecting their intellectual capital as early as possible (The Wall Street Journal, n.d). Startup companies, particularly those associated with new technology, sometimes produce huge returns to their creators and investors – a recent example of such is Google, whose creators became billionaires through their stock ownership and options.

Investing Rounds

When investing in a startup, there are different types of stages in which the investor can participate. The first round is called the seed round. The seed round generally is when the startup is still in the very early phase execution, when their product is in the prototype phase. At this level angel investors will be the ones participating. The next round is called Series A. At this point the company already has traction and may be making revenue. In Series A round venture capital firms will be participating alongside angels or super angel investors. The next rounds are Series B,C and D. These three rounds are the ones leading towards the IPO. Venture capital firms and private equity firms will be participating (Nasdaq, 2013).

Africa's Technology Startups and Investment

Of late, the expansion in the technology sector has witnessed a lot of startup investments in the African continent. In 2017, \$560million technology startup investments was said to have entered Africa. Out of the said amount, South Africa and Kenya got \$167.9million and \$147million respectively, while Nigeria earned \$114.6billion. the three countries accounted for 76 percent of the total funding that came into the region two years ago (Adepetun, 2018,p.33).

The Global System for Mobile telecommunications Association (GSMA), which revealed the figures at the 2018 Mobile 360 conference in Kigali, Rwanda, noted that lately, investors' attention is tilted towards countries including Ghana, Rwanda, Senegal and Uganda. This reason, according to GSMA, is

responsible for the cut in investment from 80 percent in 2015 and 2016 to 76 percent in 2017 in South Africa, Kenya and Nigeria. While Rwanda got \$36.7million, Ghana had \$20.4million, Uganda \$16million and Senegal \$10.7million funding in 2017.

GSMA said investment in the region's technology startup ecosystem is growing, adding that in 2017, 124 tech startups across Africa raised a total of \$560million, a 53 percent increase over the previous year. Of this amount, sub-Saharan Africa accounted for about \$515million in more than 100 deals. The range of tech startups funded and the growing size of deals reflect the accelerating development of the ecosystem. It explained that Fintech (21 percent), Solar (21 percent), e-commerce (19 percent) and edtech (12 percent) accounted for the highest shares of investment. This underscores the increasing innovation and investors interest in solutions that address the region's starkest social challenges, such as limited access to financial services, education and energy by large swathes of the population.

In October 2017, Uganda solar startup, SolarNow, secured a \$6million facility to help it reach more customers and expand access to pay-as-yougo (PAYG) solar power, GSMA stated that Kenya, Nigeria and South Africa remained the most popular investment destinations, accounting for 76 percent of total funds raised by startups in the region. However, the downward trend in the combined share of investments for the three markets, from more than 80 percent in 2015 and 2016, shows growing investor appetite for other markets, notably Ghana, Rwanda, Senegal and Uganda.

GSMA also revealed that in Africa, technology hubs increased from 89 in 2016 to 133 in 2018 in SSA. South Africa currently has 59 technology hubs, Nigeria 55, Kenya 30, Ghana 24, Uganda 16, Cote d'Ivoire 13, Zimbabwe 13 and Senegal 12. The body, which represents the interest of over 800 operators across the globe, said technology hubs are a critical part of the technology startup ecosystem, and they promote ideas and collaboration locally and provide startups with business support resources and services to help them scale.

In all of these, GSMA observed that SSA has a fast – growing technology startup ecosystem, which plays an increasingly important role in the development of home grown digital content and services. It stressed that mobile has remained a key factor in the region's startup ecosystem and that many technol-

Table 1. Showing African tech startups and funding levels according to regions

Region	Startup	Funding level	Specialization
North Africa	Shezlong (Egypt)	\$350,000 in 2018	e-health innovation
	Elves (Egypt)	\$2million at the close of 2017	machine learning and AI
	Halan (Egypt)	"multi million dollar"	Transportation
East Africa	Nala (Tanzania)	Not Available	Mobile money
	Taimba (Kenya)	\$19million	Agriculture
	UTU (Kenya)	\$250,000	Artificial intelligence
Southern Africa	Finchabot (South Africa)	\$563,000	ChatBots for financial service providers
	Appy Saude (Angola)	Not Available	Health care
	Vizibiliti Insight (South Africa)	Not Available	Artificial intelligence
West Africa	Cowrywise (Nigeria)	\$120,000	Automated service that helps users save money
	CowTribe (Ghana)	\$300,000	Animal vaccines
	KudiGo (Ghana)	\$300,000	Consumer retail industry

Source: www.disrupt-africa.com

ogy startups now use the technology as the primary platform to create solutions that address various socio-economic challenges.

Disrupt Africa has identified some outstanding startups to watch in 2019 and beyond, and their funding levels. They are presented in the table below.

Mobile Technology, Research and Development, and Africa's Technology Startups

The boom in startups has been aided by the growth in mobile technology. One of the key trends having a significant impact on how people engage with the world around them is the mobile device. Mobile phone penetration is forecast to exceed the 100 percent mark as early as 2021 – indicating that the technology will be a platform that should be focused on given the ease of access (Adepetun, 2019)

The growing uptake in mobile technology has aided many of the innovative digital solutions and services emerging from the continent, and, as mobile infrastructure advances and the cost of smart devices falls, technology entrepreneurs are developing uniquely African technology solutions to African problems. There are, however, natural challenges to still overcome such as lack of capital flowing into the sector. Africa's technology future is bright, but as the technology scene continues to flourish, entrepreneurs will need to be ambitious if they hope to compete on the global technology stage. One key method to achieve meaningful progress would be for governments in the continent to boost investment in research and development (R&D).

Investment in R&D has played a crucial role in the evolution of the technology spaces in Israel and Singapore. Although R&D spend does not usually bring immediate returns to the investors, the long-term benefits far outweigh any expenditure. In Africa, budgets are often stretched, with funding being directed towards more pressing needs such as healthcare and education.

Chika Nwobi, co-founder of Lagos-based Level 5 Lab (L5Lab) says:

I think that we are being unambitious about what we can do in the technology space. When you are very far behind in a race then you have to run faster just to catch the others. And investing more of our GDP in R&D is the only way Africa can reach and surpass the other (more developed) countries. R&D is like acceleration, so the most advanced countries (in the tech sector) are also the same ones that are spending the most on R&D, even though they are further ahead than (African countries). This is money that you spend, which might not have immediate returns, but it will help you leapfrog your development (Essiet, 2019,p.35)

The African Union has set a target for member states to spend at least 1 percent of GDP on R&D. According to UNESCO data, only Kenya, Mali and South Africa are close to achieving the target, and the latter is the only country that spends a significant proportion in the business sector. In comparison, Israel and Singapore spend over 2 percent of GDP, with Israel investing over 4 percent. Both nations have reaped the rewards of their investments, especially in the ICT sector (Africa Business, 2017, p.17).

In the meantime, the focus of the sector should be on skilling up young Africans so that they will be able to participate actively in shaping the global economy of the future. Nwobi advises

We all know that we are living in the digital age and there is a huge deficit of jobs in Africa, and Nigeria has huge youth unemployment issues. .so I believe that if we are to be prepared for the coming age then we need to educate an army of coders to take us into it. (African Business, 2017,p.17).

Theoretical Underpinning

This article is predicated on the technological determinism theory and the stakeholder theory. The technological determinism theory posits that technology shapes how we as individuals in a society think, feel, act and how society operates as we move from one technological age to another.

Most interpretations of technological determinism share two general ideas namely: that the development of technology itself follows a predictable, traceable path largely beyond cultural and political influence, and that technology in turn has effects on societies that are inherent, rather than socially conditioned or that the society organizes itself in such a way to support and further develop a technology once it has been introduced.

Croteau and Hoynes (2003, pp.305-307) define technological determinism as the approach that identifies technology, or technological advances, as the central causal element in processes of social change. They further asserted that as a technology is stabilized, its design tends to dictate users' behaviours, consequently diminishing human agency.

Fischer (1992) cited in Croteau & Hoynes (2003) characterized the most prominent forms of technological determinism as “billiard ball” approaches, in which technology is seen as external force introduced into a social situation, producing a series of ricochet effects. Postman (1992, pp.3-20) notes that the uses made of technology are largely determined by the structure of the technology itself, that is, that its functions follows from its form.

The core idea of stakeholder theory is that organizations that manage their stakeholder relationship perform better than organizations that do not. Freeman (2010, 1984) suggests that organizations should develop certain stakeholder competencies. These include:

1. Making a commitment to monitor stakeholder interests.
2. Developing strategies to effectively deal with stakeholders and their concerns.
3. Dividing and categorizing interests into manageable segments.
4. Ensuring that organizational functions address the needs of stakeholders.

FOCUS OF THE ARTICLE

Issues

The funding for African technology sector seems to be soaring and technology hubs are springing up rapidly, but the figures tell only part of the story. While the number of African startups raising funding at “series A” has been on the rise, the average investment amount in Africa at seed – stage is \$200,000, according to the pan-African venture capital community VC4Africa. This compares unfavourable to an average seed investment of \$1.14m in the US. Seed funding is the initial investment used when starting a business in exchange for equity.

Thomas Van Halen, research lead at the private equity firm Venture Capital for Africa (VC4Africa) said:

We still see that there is plenty of early stage money in the market. So the deals at the lower end are still happening on a large scale, but the follow-up money that goes into Series A, for example, is where we need new vehicles to increase investment at the next level (Essiet, 2019,p.35)

The relative dearth of funding available for African startups trying to scale up has been a major challenge for those companies looking to grow beyond their local markets. One of the primary turn-offs for international investors looking at the African-tech ecosystem is the lack of significant “exits”, according to Femi Longe, co-founder of Co-creation Hub (CcHub).

The main challenge in terms of getting funding is exit and there aren't that many success stories. If you look at the UK, for example, Facebook and Google are buying startups left, right and centre. So there is a possibility for an investor to see an exit because one of those big companies could buy them out. But in Africa, we only have a few examples of this (African Business 2017).

He said to boost the number of exits large local companies and startups should collaborate more often in mutually beneficial arrangements, where the corporation offers financial support and mentoring while the startup provides a solution that the larger organization does not provide. So the natural progression will go from collaboration to acquisition.

The model outlined by Longe is currently the most viable option for startups because African stock exchange tend not to hold enough liquidity for exits via an initial public offering (IPO). Some analysts believe that one of the primary reasons huge exits do not occur on a regular basis in Africa could be that most startups have focused on solving local issues rather than setting out to tackle global ones.

The rapid growth of the African technology sector was due mainly to the expansion of mobile technology and driven entrepreneurs seeking to find answers to some of the main challenges facing the continent. In the three key technology ecosystems of Kenya, Nigeria and, to a lesser extent South Africa, innovation has been fuelled by necessity.

In Kenya, Safaricom's M-Pesa, the mobile money platform which has around 19m active users in the East African country, was launched in 2007 as a way to offer financial services to low-income under banked Kenyans. At the time of the platforms launch, only 18.9 percent of Kenyans used traditional banking services. M-pesa provided a unique solution to a common problem in Africa by utilizing already existing technology, in this case, mobile to resolve an issue.

The technology scene across the continent is filled with examples of technology companies and entrepreneurs finding a gap in the market and plugging it with simple technology solutions, according to Iyin Adogbeji, co-founder of Andela and creator of digital payment service Flutterwave.

Because we have weak institutions and poor service delivery in Africa that have millions of people on the fringes, (tech companies) actually have the ability to reinvent society around infrastructure that is built with technology. The continent is undergoing a massive digital transformation. Every industry is digitizing, from banking to telecoms, and right at the centre of that are technology developers who are building applications that fit into that mission and supporting business to digitize their processes (African Business, 2017).

In Nigeria, where Aboyeji hails from, there are numerous examples of technology companies engaging in such activities, such as the online payment service Paystack and the e-health app Lifeback. While the technology innovations in Kenya and Nigeria have an obvious value in their home nations, overseas

investors still view startups in these markets as only dealing with African issues which do not translate to the global market, according to Paul Gabriel, Africa Analyst at Control Risks.

If you look at the solutions that the startups in Africa are developing, they usually are local in nature with unclear path as to how they can properly scale up. And where there is an overlap with other regions, such as the mobility sector, then the likes of Uber move in quickly and push out the local business (African Business, 2017).

However, the technology sector in South Africa, led by startups in Johannesburg and Cape Town, remains the most advanced on the continent, with the number of exits increasing year – on – year in 2016, and startups such as WhereIs, My Transport and website builder VIGO expanding to the UK and Asian markets, respectively.

Despite the positive indicators, Overseas investors, who are key to boosting the funding available for startups, prefer to err on the side of caution when investing in Africa. This could be as result of them showing lack of imagination or an understanding of the local market. As the technology scene in Africa continues to flourish, entrepreneurs will need to be ambitious if they hope to compete on the global technology stage. One tried and tested method would be for government to boost investment in research and development (R&D).

Problems

There is no doubt that Africa's startup scene is buzzing and the future for startups in the continent is promising because the world is fast becoming technology driven. Evidence has shown that strong economies are propelled by technologies and these technologies are in turn driven by startups, who have solutions that can support economy and business.

In the last couple of years, dozens of tech hubs, “accelerators” and “incubators” have sprung up across the continent. So trendy are African startups that even Silicon Valley has taken notice of the exponential growth. In August 2016, Facebook's Mark Zuckerberg visited Nigeria and Kenya, his first time on the continent in what is seen as a watershed moment for tech in Africa. In his wake US investors have warmed to the idea of deploying capital in Africa. It has also acted as a catalyst, armed with their iPads, laptops and innovating thinking, eager to tap into this emerging opportunity.

The buzz is palpable, but amid the hype it is not obvious how much impact this is having. The space is dominated by internationally backed startups like Nigeria – based – e-commerce firm Jumia, as well as global market entrants like Uber and Airbnb. Local markets remain fragmented, awash with small-scale and largely unprofitable startups. It is also dominated by just a few cities, with the vast majority of activity concentrated in Lagos, Nairobi and Cape Town where human resource and facilities are readily available.

Funding levels in Africa are trivial when compared to other regions. Available data shows that African startups – that is across all 54 countries – raised \$129m. China alone attracted \$31bn in venture capital for the same year, with the US receiving \$69.1bn.

Would-be tech entrepreneurs also have to contend with operating in the world's least entrepreneur – friendly environment. The Global Entrepreneurship Index lists 14 “pillars” of success including education levels, governance, economic complexity and depth of capital markets. The odds of success as an entrepreneur are correlated to ones country level of development. African nations cluster towards the bottom of the 137 – country index. Nigeria and Kenya, widely considered to be the driving forces

behind tech entrepreneurship on the continent, come in at 100 and 107 respectively. The startup scene is reminiscent of the largely defunct “Africa Rising” narrative of recent years, which focused on handsome GDP growth while ignoring a lack of structural transformation taking place on the continent.

Solutions

In view of the crucial role startups play in the development of business and society, the following solutions have become necessary.

1. African governments should provide enabling environment for technology startups to thrive in the continent. This should include providing interest free loans to help young entrepreneurs develop their business, and granting them tax waivers in the first ten years of operation.
2. Software solutions that would help solve problems locally in the continent should be developed by technology entrepreneurs.
3. There is need to establish more technology hubs in cities and rural areas across countries in the continent to assist young startups with internet access and free training.
4. Technology startups developers should look beyond the African market to get support. They should link up with foreign investors that would help them gain entrance into new markets in Latin America, Central, Eastern Europe and Asia to widen the net of African technology ecosystem.
5. Foreign entrepreneurs should be encouraged to organize more programmes geared towards providing learning curve and mentorship for startups in the continent in order to boost their growth rate and raise their standards in line with global best practices.
6. in order foster a healthy innovation eco system that drives economic growth and societal development, governments across the continent should provide old and up coming start ups with the latest equipment to ease their operations.

RECOMMENDATIONS

1. African governments should either provide funding or collaborate with private entrepreneurs to sponsor old and new startups developers in the continent.
2. Governments in the continent should provide a level playing ground for the development of infrastructure in both rural and urban areas that would support the growth of technology startups.
3. Startups need bandwidth to drive innovations. Since internet and broadband penetrations are still very low in the continent, governments should come up with the enabling infrastructure to ensure that these bandwidths are accessible to startups at reduced price.
4. African startups require funds for research and development to raise their quality to global standards in order to attract foreign investors. African governments should therefore provide assistance in this direction.

FUTURE RESEARCH DIRECTIONS

In recent years and up till now, the African technology sector has witnessed tremendous growth. This remarkable progress has attracted the world's attention, but fragmented markets, lack of funding and

unfriendly business environments pose problems for the continent's new entrepreneurs. For the continent technology startups to sustain its present growth and overcome the challenges, it requires the collaborative effort of the key stakeholders in the sector.

A stakeholder is a party that has an interest in a company and can either affect or be affected by the business. The primary stakeholders in a typical corporation are its investors, employees, customers and suppliers. However, the modern theory of the idea goes beyond the original notion to include additional stakeholders such as a community, government or trade association (Carroll & Buchholtz, 2014). Stakeholders can be internal or external. Internal stakeholders are people whose interest in a company comes through a direct relationship, such as employment, ownership or environment. External stakeholders are those people who do not directly work with a company but are affected in some way by the actions and outcomes of said business. Suppliers, creditors and public groups are all considered external stakeholders (Donaldson & Preston, 1995; Investopedia, 2018; Friedman & Miles, 2002; Friedman & Miler, 2006).

Florea & Florea (2013, p.132) aver that key stakeholders are important because of participation in the organization management and secondly, during decision – making process and implementation. The key stakeholders include policy makers, officials, important professionals or community personalities who have strong position or influence.

As African governments intensify their collaboration with technology startup founders and developers, there would be need to monitor the progress made in individual countries across the continent. How far they are able to surmount the challenges and scale-up the sector to meet global standards will likely form the core of future research in this domain.

CONCLUSION

Africa's technology sector is undergoing a massive revolution. This is evident in the introduction of new and relevant startups and technology hubs across the continent, and these are making a difference in the economy of some African nations. The rise in the number of startups and technology hubs is an indication of how resilient the technology ecosystem in Africa has been. As funding for the sector soars and technology hubs spring up rapidly, African startups are attracting the world's attention.

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KEY TERMS AND DEFINITIONS

Business Environment: Is the combination of internal and external factors that influence a company's operating situation. It can include factors such as clients and suppliers; its competition and owners; improvements in technology, laws, and government activities; and market, social, and economic trends.

Digital Transformation: The process of using digital technologies to make a process to become more efficient or effective.

Entrepreneur: Is an individual who, rather than working as an employee, funds and runs a small business, assuming all the risks and rewards of the venture.

Fragmented Market: Is a marketplace where no single organization has enough influence to move the industry in a single direction. The market consists of several small to medium-sized companies that compete with each other and large enterprises.

Funding: Is the act of providing financial resources, usually in the form of money to finance a need, programme, and project by an organization or company.

Innovation: Is the process of creating value by applying novel solution to meaningful problems.

Investor: Is a person or other entity who commits capital with the expectation of receiving financial returns.

Startup: Is a newly established business venture that aims to develop viable business model to meet a marketplace need or problem. It is usually small and initially finance and operated by an individual or a handful of founders.

Scale-Up: A business that is in the process of expanding.

Tech Hub: Is a physical space—a city, a suburb, or just a suite of offices—which has developed to help technology startup companies succeed.

Knowledge in Science and Technology Parks

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INTRODUCTION

Science and technology parks (STPs) are considered as a kind of public-private partnerships designed to increase regional wealth and to foster technology start-ups growth in developed and/or in developing regions (Martínez-Cañas et al., 2011). The main aim of these institutions is to reproduce the successful factors of regional phenomena such as Silicon Valley or Boston's Route 128 (Mian et al., 2016). These institutions are focused on fostering knowledge flows, mainly among tenant institutions, as well as between tenants and nearby external institutions. Although there is no official definition of STPs, some common denominators across different existing models suggest a set of minimum standards and requirements that any knowledge cluster should have to earn this formal recognition (Link, 2009). According to the International Association of Science Parks (IASP, 2002), a science park is "*a public or private organization managed by specialized professionals, whose main aim is to increase the wealth of its community by promoting the culture of innovation and the competitiveness of its associated businesses and knowledge-based institutions*".

Among the common denominators of STPs we can highlight the agglomeration and promotion of interactions among R&D centers, Labs, entrepreneurs, Universities, specialized human capital, innovation infrastructures, venture capitalists, research consortia, research projects, technological capital, and social capital (European Commission 2008). These factors are related and favor the capacity of any firm or institution to adapt constantly to technological, economic, and social changes in markets (Albahari et al., 2016). Therefore, STPs have emerged based on new institutional and artificial arrangements that facilitate interactive relations and knowledge exchange among three main groups of agents: Universities-R&D Centers, industry and government research agencies (Etzkowitz, 2008).

To enable these goals to be met, a Science Park aims to stimulate and manage the flow of knowledge and technology amongst universities, R&D institutions, companies, and agent's markets; it also facilitates the creation and growth of innovation-based companies through incubation and spin-off processes; and it even provides other value-added services together with high-quality space and facilities (Mian et al, 2016).

The main objective of this chapter is to shed some light in the role of STPs as specialized institutions leveraging knowledge creation and diffusion. First, the origin and evolution are analyzed. Second, the evolution and typology of models of STPs are showed. Finally, conclusions and future research directions will be proposed.

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BACKGROUND

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STPs were originated in the United States as industrial concentrations that were quickly copied by other regions (Castells and Hall, 1994). The idea of concentrating companies in one single area became increasingly important in the mid-20th century, particularly during the World War II (Zhang, 2005). Shortly after that, most innovative companies were aware that science had made a vital contribution to victory (atomic energy, radar, aeronautical developments, etc.) and decided to develop an approximation to leading universities. This is how the first science parks came about around Stanford University and Menlo Park in California, both created towards 1950 (Hansson et al., 2005). In Europe, this phenomenon was retarded for almost twenty years. In the late 1960s, some universities in the UK, such as Cranfield and Cambridge, took action along these lines. In the first years, the growth and impact of parks were weak. Nevertheless, in the 1980s, the British government asked universities to be more collaborative with industry (Allen, 2007). This pressure led to the second wave of parks promoted by the main British universities. Growth continued during the 1990s and by then, more than half the universities already had some kind of agreement or collaboration with science parks. In France, the most significant example is Sofia-Antipolis, created around 1970. The first parks in Italy and Germany started in the early 1980s, concretely the Area Science Park in Trieste and the Technologic Park in Heidelberg, respectively. In Spain, the first park was not created until the second half of the 1980s. The first initiative was the Zamudio Technology Park (Bilbao), created in 1985. In summary, the creation of STPs throughout Europe and the United States has spread to other countries and continents and is currently considered a global phenomenon. Nowadays, there are hundreds of Science Parks and areas of innovation worldwide.

Studies and research on STPs are in an emerging stage of development, and during recent years researchers have stimulated an important academic debate concerning whether such property-based initiatives really enhance the performance of firms and economic growth of regions (Martinez-Cañás et al. 2011). To this respect, there are differences of results in previous empirical research with findings that show positive or no-significant effects of STPs on the firms' performance (Link 2009). This divergence implies that previous studies do not analyze STPs from the point of view of their active role in the knowledge-based economy where intangible and relational aspects are critical in the market (Hansson 2007).

The research in STPs can be divided into two distinct, but complementary, aspects of STPs and areas of innovation: First, on the one hand, there is research concerning the effective role that STPs have as infrastructure. That is, they play an important role as a highly specialized institutions (with a mix of public-private policies, quality space, incubation facilities, spin-off mechanisms, the ability to accelerating the growth of small-medium firms and high value-added services) that are artificially created to help develop their environment economically. On the other hand, they also play an important role through favoring a dynamic and innovative stimulation and management of the flow of knowledge and technology between universities and companies. That is, STPS facilitate the communication between companies, entrepreneurs, and technicians, providing environments that enhance a culture of innovation, creativity, and quality, for companies, research institutions and on people: the entrepreneurs and 'knowledge workers'. The prominence of this second aspect is being powered by the work of the IASP with a global network that gathers many thousands of innovative companies and research institutions across the globe, facilitating the internationalization of their resident companies.

ISSUES, CONTROVERSIES AND PROBLEMS

Research in Science and Technology Parks show several issues, controversies and problems. Here are highlighted the most important issues:

Firstly, Science and Technology Parks as platforms that enable tenant firms to innovate thanks to their networking nature across universities, research labs, start-ups, SMEs, and large firms. However and according to Simsek and Yildirim (2016) their innovative context have several factors that obstruct innovation. Their research found important constraints concerning “confidentiality and conservativeness of the firm” (not all firms want to share their knowledge and patents), “human resources, brand and image” (people flow from firm to firm forgetting loyalty and spreading firm best keep secrets), “resources and costs” (being located inside a science park is not cheap and some resources are outside their limits), “management and organization” (some parks don’t promote networking activities and only are offering administrative help), “market, partnership, and technology sources” (in order to gain benefits from innovation is needed to create partnerships with competitors) and “administration” (to create value administration has to offer high quality services and overall promote networking). Therefore, located firms should face some issues in order to obtain benefits for their location and activities inside the infrastructure.

A second issue is related to the effectiveness of Science and Technology Parks as instrument of innovation policy. Accordingly, there is a gap in the existing literature on STPs because mainstream research mostly does not consider STPs’ heterogeneity. In a recent paper by Albahari et al. (2016) they study the influence of different STP characteristics on their tenants’ performance founding that firms located in very new or longer established STPs show better innovative performance. Also Albahari et al. (2016) found that the size of the STP and its management company positively affects the innovative performance of tenants while services provision has no effect on firms’ achieving better results. Furthermore, they found that firms in less technologically developed regions benefit more from location in an STP.

And finally in third position, another important issue is related with process effectiveness. Seems clear that located firms need an important acquisition capacity to acquire and assimilate the knowledge provided by universities, mainly due to being academic spin-offs or having long-term relationships with them. A recent study made by Díaz-Vial and Montoro-Sánchez (2016) argue that firms located in central positions of the firms network inside the STP have access to a complementary source of technical knowledge. Also they found that having long-term relationships with universities, based on both formal and informal interactions, is the most important means of obtaining technical knowledge from them. Díaz-Vial and Montoro-Sánchez (2016) also observed a positive relationship between the technological knowledge obtained from universities and the innovation carried out by firms. Consequently, it is showed the significant role of go-betweens in order to gain a high level of innovation.

SOLUTIONS AND RECOMENDATIONS

Solutions and recommendations for issues analyzed in the previous section of this chapter are mainly related with economic regions policies for developing Science and Technology Parks. However, and despite of decades of progress and experience, politicians have realice that Science and Technology Parks are a complex and multi-faceted phenomeno because many gaps and unanswered questions regarding the incubation process remain. Mian et al. (2016) in a recent article published where they made a state of art proposing some solutions and recommendations in order to advance in the knowledge about STPs:

- Still is needed an integrated definition of STP, because there are a lot of elements that need to be included in, such as: physical space, professional management, entry and exit policy, a mix of business support and professional services, networking, access to capital, and university resources among others.
- It lacks of a unified theory about what really incubation is and which value-added processes are included. Consequently, a contingency approach to incubation should be proposed to address varying objectives, organizational form, and context.
- The role of public support must be defined by emphasizing how societal objectives and social returns of innovation exceed the private returns of these activities. Therefore it needs to be studied how providing indemnification of the entrepreneur's risk by supporting an embryonic technology that may not emerge otherwise.
- Despite the general acknowledgement that STP phenomenon is related with integration of activities and value-added infrastructure, a nested a dynamic and multidimensional view of STPs is needed. Mainly because there are a lot of bridging mechanisms embedded within a dynamic innovation ecosystem that need to be explored with different levels of analyses-national, regional/state, park/incubator, and entrepreneur/team level (Etzkowitz, 2008).
- Another important issue to be solved is mechanism's governance because of relationships between management, client firms, and other key stakeholders. For example, university incubation programs need to address the STP role in bridging entrepreneurial firm-university relations (Díez-Vial and Montoro-Sánchez, 2016. Also and at a more micro level an in-depth exploration of the incubation process is still needed (Ahmad, 2014).
- The last recommendation is related with the analysis of accelerators and firm assistance over a limited period to help young TBFs achieve sustained growth. Incubators powered by accelerator can be an essential tool for successful STPs.

FUTURE RESEARCH DIRECTIONS: EVOLUTION OF STPs MODELS

STPs models are as diverse as individual initiatives have been carried out (European Commission, 2008). In any case, they all are characterized by the fact of being public-private organizations “managed by specialized professionals”. Their main aim is to increase the wealth of its region/community by promoting the culture of innovation and the competitiveness of its associated businesses and knowledge-based institutions. The difference among one type of STP and another is the nature of stimulation of the flow of knowledge and technology amongst universities, R&D institutions, companies, and markets. Furthermore, there are notable differences among the intentions of the promoters and the selected place for a physical location, which can influence on the creation and growth of innovation-based companies through incubation and spin-off processes; and can provide other value-added services together with high-quality space and facilities (IASP, 2002).

In practice, there are different models of Science Parks and Research Parks. While the former denomination is the most common in Europe, the latter is widely used in the United States and Canada (Sanz, 2003). Furthermore, Science parks in Europe coexist with technology parks.; there are not great differences between both concepts. The main differences probably refer to the size or the possible admission of productive activity. While a science park is of reduced size, with strong links to university and little emphasis on manufacturing activities, a technology park is medium-sized or big and allows for productive activities (IASP, 2002).

From a geographical point of view, science parks are mainly located in the United Kingdom (British model), while technology parks refer to the «Mediterranean model», which is typical of countries like France, Spain, Italy, and Portugal. Apart from these two best-known models, there are other similar concepts like Technopole, Business Park, Innovation Center, Science City and living lab (please see complete definitions in the last part of the chapter).

Despite the wide typology of Science Parks and areas of innovation, a holistic point of view about their nature, promoters, governance systems, and innovation policies is really needed. According to Annerstedt (2006) and Haselmayer (2004), we can find up to three generations or models of STPs and areas of innovation (see Table 1):

Table 1. Models of STPs development

	1 st generation STPs	2 nd generation STPs	3 rd generation STPs
Nature	Science push	Market pull	Interactive
Main promoter	Government/Region /Universities	Business located in High-Tech zone or Tecnopoles	Government, University & Industry in an urban location
Governance	A foundation or a limited company created by a University	A privately-owned company that manages the park	Strategic decisions (owners) and day-to-day decisions (a highly specialized company)
Innovation	Linear system (from science to business)	The first phase of innovation (Raw innovation)	Interactive innovation (push and pull) oriented to the last phase of the innovation process

Source: Adapted from Martinez-Cañas and Ruiz-Palomino (2011)

- First Generation STPs, are an extension of a university into a dedicated neighborhood area that includes incubating facilities for start-up firms, related business services and, as importantly, includes pathways into new, research-based technology (and know-how) for potential investors and other business entities. The typical mode of governance of a First Generation Science park is that of university-control through a foundation or limited company, created by the university or a related association. The innovation philosophy of a First Generation Science park is a “linear approach” to innovation, which sees scientific results as raw material for innovative activities. That is, in these types or generation of STPs, knowledge flows from universities and research centers to firms.
- Second Generation STPs are mainly science-economy interaction institutions. They are also considered as an extension of a university (or other major R&D facilities) into a dedicated high-tech zone. Managers respond to the businesses needs included in the STP by favouring a mix of high-quality facilities into the Park. The typical mode of governance of a Second Generation Science park is that of a privately-owned company which manages the Park. Academic or other research representatives must be involved with local or regional policymakers. The innovation philosophy of a Second Generation Science Park is “demand pull” where research results and techno-scientific findings are regarded as “raw materials” for the Park’s innovating firms. In this model, tenant firms establish in the park and create agreements with research institutions in order to obtain applied knowledge that can be exploited as innovations in the market.
- Third Generation STPs are the new model among the current evolution of STPs. Generally, these STPs are located within a vibrant urban community and are perceived as the quintessence of

science-industry-government relations, increasingly functional and specialized along with its participation in local, regional and even global innovation activities. The objective in these STPs is to increase the wealth of the whole community that the Park serves by promoting science-industry-government relations in a number of ways. The typical mode of governance is through long-term public-private partnerships, where strategic decisions regarding the Park's operations are agreed through joint decisions, while the day-to-day operations can be carried out by a highly-specialized limited company. The innovation philosophy is cluster-oriented "interactive innovation". It is both "science push" and "market-pull". In this model, knowledge is created through an interactive process where value co-creation is the rule. Customers, research institutions and firms are together co-creating knowledge and innovating.

Therefore, the evolution of these infrastructures has created a new emerging model of STP that operates through interactive models of innovation, and that is embedded in diverse urban environments. In such areas, networks and systems of trust, the development of respective public, private or scientific partners, cultures of interpretation, and degrees of public or institutional participation, as well as the availability of financial/legal instruments all, form an integral part of the innovation environment's global function (Annerstedt, 2006). Location embeddings is no longer just a feature, but a key success factor (Haselmeyer 2004).

Other key success factors and best practices that this third generation STPs must take care are also considered by John Allen report at Manchester Business School (2007):

- Born as a global project to overcome a limited regional or local scope.
- Being part of a sustainable community and being a sustainable business.
- Having a long-term strategy with clear objectives.
- Being a gateway to innovation and not a destination.
- Being managed to optimize serendipity.
- Being developed to aid creativity, interaction, and innovation.
- Growing a strong two-way relationship with the associated university.
- Building active networks of all kinds and at all levels.
- Establishing an understanding of each tenant's needs.
- Offering incubation facilities either directly or indirectly.

Research on STPs was primarily concerned with comparing the benefits of tenant and no-tenant firms (Hansson, 2007). However, located firms base their competitive advantage largely on their technological resources and innovation capabilities in order to create and leverage knowledge. Therefore, knowledge helps in the process of developing the innovation capacity directed to the launch of new products and/or services. This innovation capacity could be internally developed by relying on internal R&D; however, it can also be externally acquired by buying it in the market or, more importantly, by establishing technological collaborations with other R&D partners located inside or outside of the park. Consequently, this technological collaboration provides participating firms with opportunities to acquire technological resources and capabilities such as capital, knowledge, innovation, and consultancy in the field of high technology (Löfsten and Lindelöf, 2005), and enable them to share complementary resources with other firms.

Science Parks act as a catalyst fostering agreements and improving the innovation performance derived from technological collaboration between firms and research and technology organizations (Martinez-

Cañas et al. 2011). The geographical proximity of these agglomerations provides opportunities for formal and informal contacts as well as strong links which allow knowledge exchange (Bakouros et al. 2002) and may lead to joint projects developments among their tenants (Fukugawa 2006) through which to gain access to mutual exchanges of resources, information and knowledge (Siegel et al, 2003). Accordingly, the success of technological collaboration and knowledge exchange depends on the creation of a favorable innovation environment. Science Parks provide located firms with a more appropriate technological environment than is available to firms in off-park locations, encouraging them to establish their technological collaborations and stimulating research productivity among on-park firms (Siegel et al. 2003).

Moreover, technological knowledge flows more easily locally than over great distances, favoring the generation of more knowledge spillovers which on-park firms can transform into valuable new products, services or processes (Löfsten and Lindelöf, 2005). Additionally, Science Parks offer firms several general and specialized services such as financial and marketing support to help them succeed in the commercialization of their new products (Martinez-Cañas et al. 2011). In summary, because of the important role of STPs in helping firms develop and improve their competitiveness, further research on Science Parks is needed. In particular, more studies are needed that investigate and advance our understanding concerning intangible aspects such as knowledge creation, knowledge acquisition, knowledge implementation, technology diffusion, social capital, trust, reputation, talent retention, projected image, employer branding and people management in knowledge institutions among others lines of research.

CONCLUSION

Science and technology parks are catalytic institutions designed for creating and fostering new environments favorable to innovation. Thus, the main contribution of this chapter has been to focus on analyzing the knowledge and innovations generated through relations fostered with effective networking activities to encourage the transfer of knowledge, resources, and innovations from universities and research institutions located inside.

The world has seen an increasing number of science parks since the 1960s, but still lacks systematized accumulated knowledge about science parks. The current chapter has briefly tried to analyze and evaluate the science park phenomena.

STPs are the result of a deliberate action amidst many taken within a given environment to compete in the knowledge economy. This concept is closely related to concepts such as science cities and knowledge regions and their goal is to consolidate areas competing based on paradigms related to the new economy. All agents in this geographical area should act in a coordinated way and with a wide range of simultaneous actions.

In conclusion, the knowledge environment of STPs must be oriented towards interactivity of agents:

- In the global economy, STPs should move towards a wider environment than their own borders, a very appropriate strategy for regions wishing to change their competitiveness in order to be a worldwide reference region.
- Parks should differentiate and specialize in their activities searching for better identification of its personality, brand and projected image.
- Parks needs to define its main priority, related to the creation of a scientific climate or a market climate for creating new knowledge-based companies. Also, a STP can combine both concepts and follow them simultaneously, but the focus needs to be fully justified.

- Facilities and buildings are not the key elements. Although they represent a necessary variable, STPs should give even less importance to the physical space and give more importance to synergies, the diversity of centers and value-added services instead.
- The role of universities and other research centers should focus on creation and spillover of intangible resources.
- Capturing and involving non technology-related sectors such as the real estate sector that should be attracted by future profits.
- STPs management is critical in its initial stages, and it should be professional driven.

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KEY TERMS AND DEFINITIONS

Area of Innovation: They are places created and designed to attract entrepreneurial-minded people, skilled talent, knowledge-intensive businesses, and investments, by developing and combining a set of infrastructural, institutional, scientific, technological, educational and social assets, together with value-added services, thus enhancing sustainable economic development and prosperity with and for the community (IASP, 2002).

Business Park: It is an area that is specially designed to have business offices, small factories, etc. Sometimes it is just a for renting spaces, with no other value-added services.

Industrial Cluster: Clusters are groups and networks of interdependent firms, knowledge-producing institutions (universities, research institutes, technology-providing firms), bridging institutions (e.g. providers of technical or consultancy services) and customers, linked in a production chain which creates added value together. The concept of the cluster goes beyond that of firm networking, as it captures all forms of knowledge sharing and exchange. Clusters have a more industrial or productive orientation than science and technology parks.

Innovation Center: It is a space where organizations of any kind establish labs or spaces for makers (makerspaces) on their own campuses. Oftentimes, corporations use an innovation center to showcase their own innovations or new products to employees, investors or even customers. And, as spaces for innovation, innovation centers typically include the latest technologies and tools for employees to use to experiment or iterate on their ideas or see how else they might apply the technologies in their businesses. An innovation center also serves as a space where people can gather and where design thinking for innovation can directly happen, meaning it is designed to host brainstorming sessions, design sprints, or innovation workshops.

Living Lab: A living lab is a research concept. A living lab is a user-centered, open-innovation ecosystem, often operating in a territorial context (e.g. city, agglomeration, region), that integrates concurrent research and innovation processes within a public-private-people partnership.

Research Park: It is an area where companies have offices and laboratories and where they do work involving science and technology. This is the most common denomination in the US. Mainly, Research Parks are promoted by private corporations.

Science City: A science city is an urban settlement endowed with developed (independent or shared with nearby cities) infrastructure, manufacturing and service sectors, and industrial facilities. Also is considered as a major scientific and technological complex, which is put in place primarily to address priorities of national defense. This factor underpins the creation of these infrastructures in countries such as Russia.

Science Park: A science park is a public or private organization managed by specialized professionals, whose main aim is to increase the wealth of its community by promoting the culture of innovation and the competitiveness of its associated businesses and knowledge-based institutions. This is the most

common denomination in Europe. Science Parks are mainly promoted by public institutions such as Universities and their size is smaller than areas of innovation and industrial clusters.

Technology Park: A landscaped development usually comprising of high specification office space as well as residential and retail developments, designed to encourage localization of high technology companies operating in related sectors such as information technology, software development, etc., thereby giving each the benefit of economies of scale and location.

Technopole: Technopole describes regions worldwide dedicated to technological innovation. Technopoles may be developed by the private sector or by the co-operation or partnership between the public and private sectors. Governments of all levels promote them as a panacea for economies hurt by economic restructuring. Large corporations and small business operate within these high technology areas. Networking between companies is important and made possible by technological advances. Technopoles are combined technological and business centers specifically established around recognized educational and research institutes.

Section 10

Hospitality, Travel, and Tourism Management

Internationalization in the Hotel Industry and Modes of Entry

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INTRODUCTION

The globalization of markets and production has been sparked by pervasive technological change and led to the internationalization of many companies whether large, medium or small. As such, internationalization is ever present in basically all contemporary business activities as it is a dynamic process that is the result of the exploitation of competitive advantages (Stanisauskaite & Kock, 2016).

Business internationalization has evolved over time involving different theories and understandings (Ribau, Moreira, & Raposo, 2015). However, not only there is no single definition of internationalization but also there is a myriad of topics involved in the analysis of internationalization (Ribau, Moreira, & Raposo, 2018).

Internationalization refers to the process of increasing involvement in international activities and is related to how firms explore international markets (Moreira, 2009). Many studies analyze the internationalization process based on four main strands: the Uppsala model, that advocates an evolutionary, sequential and linear model of international involvement (Ribau, Moreira, & Raposo, 2015); the network-based view of the firm (Hakansson & Snehota, 2006), based on a relational-based perspective among market players; the eclectic paradigm that explains the main drivers of internationalization among firms based on three main specific advantages – *Ownership, Location and Internalization* (OLI) advantages (Dunning, 2000); and the theory of international entrepreneurship that advocates that firms seek to exploit their specific advantages in international markets based on the exploitation of their internal capabilities (McDougall & Oviatt, 2000).

The globalization of business and investment has led to the growth of the internationalization of tourism related activities, namely of hotel chains, as a means of diversifying their services, which began to

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invest in new locations across the world. This is also the result of the exponential growth that tourism has been experiencing.

The theories of internationalization have dealt with an evolutionary perspective covering the macro/nation perspective and the industrial perspective, but have not fully disclosed the internationalization of service firms, especially from the hotel industry perspective (Ribau, Moreira, & Raposo, 2018).

There are different internationalization strategies between the business and tourism industries, since not only they have different activities but also different objectives, the tourism industry being more focused on service activities, which may influence the internationalization process (Berbel-Pineda & Ramírez-Hurtado, 2012; Marco-Lajara, Zaragoza-Sáez, Claver-Cortés, Úbeda-García, & García-Lillo, 2017). The internationalization of the hotel industry necessarily implies the presence and provision of services in foreign markets, which is quite unique in globalized industries (Berbel-Pineda & Ramírez-Hurtado, 2012; Marco-Lajara et al., 2017).

The mode of entry into foreign markets is considered to be one of the most critical strategic decisions that firms have to make, given the repercussions on business success (Young, Hamill, Wheeler, & Davis, 1989; Berbel-Pineda, Palacios-Florencio, & Ramírez-Hurtado, 2017).

In general, there are three main ways of serving foreign markets (Rothaermel, Kotha, & Steensma, 2006): exports, licenses and / or direct investment. Each option has different implications for the firm in terms of the level of control the parent company has over the foreign operations, the resources it must commit, and the potential benefits it can obtain (Buckley, 1995; Root, 1987). Considering the importance of the hotel industry as a result of the growing internationalization process, the objective of this chapter is to analyze the ways in which hotel chains internationalize and relate them to the main underlying theories of international business.

The chapter is structured in six sections. After the first section that presents the chapter the second section addresses literature on motivations for internationalization and modes of entry in international markets, namely in the hotel industry. The third section explores the main results found. The fourth section discusses the main results. Section five presents the main conclusions of the chapter. Finally, section six explores future research directions.

BACKGROUND

Internationalization Theories

There is no single definition regarding firms' internationalization, mainly due to the different theories and approaches used to explain internationalization (Ribau et al., 2015). The phenomenon of globalization of investment has led to the internationalization of tourist activities, including hotel chains which, as a way of diversifying their services, have begun to invest in new locations throughout the world. On the other hand, globalization has led to the exponential growth of tourism, which in turn has led tourist companies to invest in internationalization to take advantage of their intrinsic skills.

Although there are several theories that explain firms' internationalization, there are four main theories that have been widely used (Ribau et al., 2015), as referred to above: the Uppsala model, the Eclectic Paradigm, the network-based perspective and the theory of international entrepreneurship. However, they tend to ignore the internationalization of service-based firms, in general, and the internationalization of the hotel industry, in particular.

The Uppsala model defines internationalization as a gradual process with several sequential steps. It is a theory based on an evolutionary perspective in which the behavior of the firm is based on a knowledge-commitment binomial relationship in which firms increase their international reach and enter new markets as they know these markets (Ribau et al., 2015). According to Child, Rodrigues, and Frynas (2009), firms choose markets sequentially according to the perceived proximity to those markets, based on the low psychic distance, since as they manage to control the inherent risks of internationalization they incorporate basic knowledge to enter other foreign markets (Etemad, 2009).

The Eclectic Paradigm explains the causes of firms' internationalization through the specific advantages firms must master in order to be successful in the internationalization process. That is, to have their own skills or intangible assets and be able to provide these services internally and seize opportunities abroad in order to take advantage of their specific advantages.

According to Dunning (2000), this theory is predominant when talking about international business as it integrates economic theories, foreign direct investment (FDI) and international activities of multinational companies (MNCs). When using the eclectic paradigm it is necessary to follow a holistic perspective since the variables under consideration are interdependent (Dunning, 2000).

The theory of internationalization networks assumes that firms are interdependent and that their expansion abroad results from established relationships among previously interacting business units (Håkansson & Ford, 2002). Networks established in relationships with different stakeholders and shared resources support firms' internationalization process (Johanson & Mattsson, 2015). This is because firms are dependent on resources controlled by other parties, leading to the creation of relationships that represent the process of consumption of those goods (Ribau et al., 2015). As such, entering new countries gives companies the opportunity to create relationships that can help them reach new markets abroad. Moreover, these relationships are a potential competitive advantage for the internationalization of SMEs through the sharing of both information and knowledge (Ribau et al., 2015).

Internationalization of Service Companies

Regarding the classification of services, there are some important contributions that seek to explain how the different types of services are internationalized (Lovelock, 1996; Erramilli, 1990; Clark, Rajaratnam, & Smith, 1996). It is important to note that each typology has its direct influence on entry modes and integration strategies in international markets.

Lovelock and Yip (1996) classified services into three main types: people-processing services; possession-processing services; and information-based services.

People-processing services involve tangible actions in which the consumer becomes an integral part of the service production process, where production and consumption take place simultaneously. These types of services require that the consumer is present in the establishment of the service provider, or that the supplier directly provides the service to the consumer. In these cases the modes of entry in international markets should involve a local geographic presence. Possession-processing services involve tangible actions on physical objects, that is, objects are involved in the service production process. Geographic local presence makes sense when it is assumed that the service will be provided on a continuous basis. Finally, information-based services are related to the manipulation, collection, interpretation and transmission of data and knowledge (Lovelock & Yip, 1996).

Regarding the way services are internationalized, Clark, Rajaratnam, and Smith (1996) classified services into four different types: international contact-based services; international vehicle-based services; international asset-based services; and international object-based services.

International contact-based services are services in which the supplier maintains direct contact with the consumer, involving for example legal services, consulting services, or professional services. According to Javalgi, Griffith, and White (2003), this type of service has all the classic characteristics of services (intangibility, inseparability, perishability, and heterogeneity).

International vehicle-based services are those in which the supplier does not need to physically establish itself in other markets.

International asset-based services involve physical presence in other markets – such as banks or hotels – that represent the capabilities of the companies (countries) that export these services.

International object-based services are contact-based services that are embedded in physical objects.

Erramilli (1990) classified the services taking into account the required interaction between the service provider and the consumer, dividing it into hard services and soft services. The former are services in which the production and consumption process are separated, and that the need to be present during the provision of the service is limited or non-existent. On the other hand soft services require that the production and consumption occur simultaneously, as for example, catering services and health services.

When comparing Lovelock and Yip's (1996), Clark et al.'s (1996) and Erramilli's (1990) typologies, one can claim that people-processing services and soft services fit into the types of services that involve great interaction between the service provider and the consumer, whose production and consumption processes are inseparable.

Theoretical Challenges

It is important to note that hotels and hotel chains can expand through acquisitions, cooperation or partnerships, or even integrating certain brands into their own core brand, creating large international hotel chains that increase industry competition. Uppsala's model is not fully adapted to the different forms of investment that exist in the hotel industry as hotels and hotel chains seek to exploit international opportunities through modes of entry such as franchising or FDI at any given point in time without necessarily holding deep knowledge of market behavior or without following an evolutionary perspective. Moreover, over time, there is not necessarily a gradual growth or expansion in the destination market given the volatility of tourism markets, where some tourist destinations may experience uncontrollable swings due to variations of the external context.

In the case of the hotel industry, it involves other support services that are not directly related to the provision of accommodation. Thus, in the case of the eclectic paradigm, there are services that can be internalized by the company, although there are others that can be easily outsourced without jeopardizing the company. The locational advantages can be crucial for the internationalization of the hotel company or hotel chain, as long as it has an international image, reputation and brand. Nowadays, internalization can take place as a result of both high competitiveness among firms and the need to keep abreast of information so that companies can retain full proprietary advantages in order to exploit them more easily as a result of an ownership advantage. Taking these aspects into account, the eclectic paradigm could be clearly useful in explaining firms' internationalization in the tourism industry. Despite this, there are authors who consider that it is a theory that does not fully explain the internationalization of the hotel industry by not considering all the agents involved, such as other services, local authorities, financial companies, among others (Niewiadomski, 2014).

Some authors link the internationalization of the hotel industry to the Eclectic Paradigm (Chen & Dimou, 2005; Dunning & Kundu, 1995; Williams & Shaw, 2011). However, Chen and Dimou (2005) argue that large MNCs do not have a country of origin, especially when it refers to the hotel industry, since

some hotel chains change ownership/proprietorship several times leading to a change in the company's headquarters, culture and portfolio of activities, which ultimately influences the company's investment strategy and sites. In addition, in the hotel industry SMEs tend to adopt different internationalization strategies than those used by large multinationals, although over time, when smaller groups grow, these differences tend to disappear.

Internationalization in the Hotel Industry

The internationalization strategy varies according to the different activities companies carry out (Berbel-Pineda & Ramírez-Hurtado, 2012; Narula, 2012). Moreover, the vision and mission of each company also differs. The internationalization of the hotel industry necessarily implies a presence in foreign markets and the provision of local services, being one of the most globalized industries (Berbel-Pineda & Ramírez-Hurtado, 2012; Marco-Lajara et al., 2017).

The mode of entry into the foreign markets is considered one of the most critical strategic decisions that companies have to take, since it has repercussions on the success of the business (Young et al., 1989). In general, there are three ways to serve foreign markets: exports, licenses and / or direct investment (Rothaermel et al., 2006). Each of these options has different implications for the company in terms of the level of control the parent companies have over foreign operations, resources that they must provide, and potential benefits that they can obtain (Buckley, 1995; Root, 1987). However, entry modes need to be differentiated according to the level of control companies desire (Aliouche & Schlentrich, 2011; Haro, Gândara, Rastrollo, & Mondo, 2014; Pla-Barber, León-Darder, & Villar, 2011).

The main modes of entry in foreign markets implemented by hotel companies can be clustered in three main groups (Pla-Barber & León-Darder, 2004; Rodríguez, 2002):

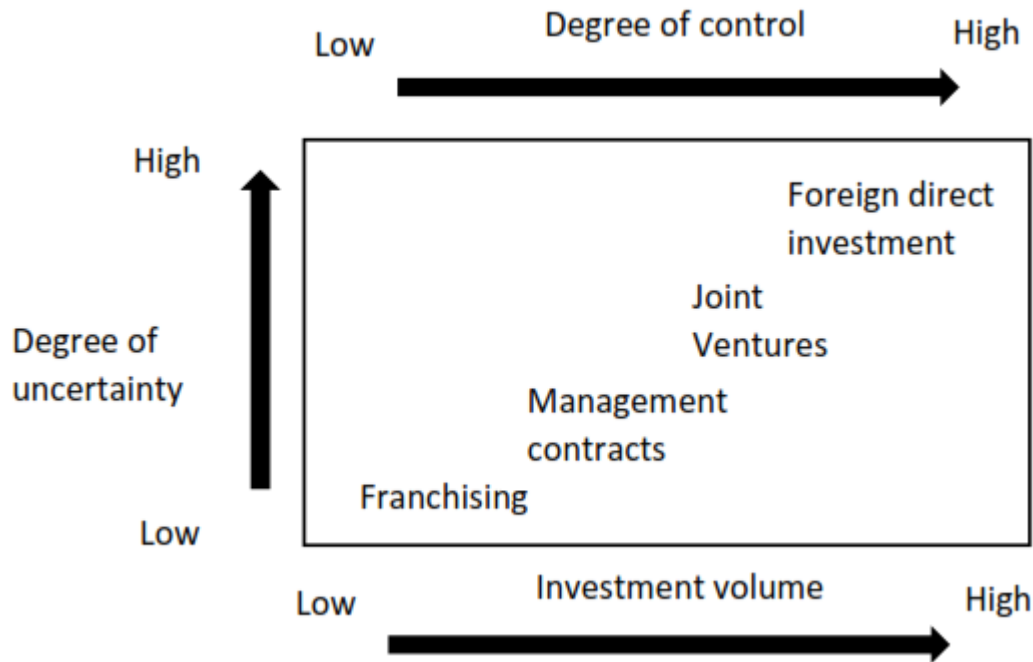
- Direct investment modes with full control, which can include Greenfield investments or mergers with existing companies. A merger is an economic operation that brings together two or more companies giving rise to a new one, while an acquisition consists of the purchase of one company by another.
- Cooperative contracts that may involve Joint ventures (JVs) and/or international strategic alliances. These contracts allow companies to penetrate foreign markets, always maintaining some control over its administration. These processes involve direct investment with shared control over activities. These cooperative contracts allow companies to share resources, split risks and dissolve cooperation after project completion (Silva & Sousa, 2009).
- Franchising agreements and management contracts can also take place when companies wish to expand into the new market transferring certain advantages to a company located abroad.

These three modes of entry can be divided into two groups (Berbel-Pineda et al., 2017):

- Equity-based entry modes (FDI and JVs): with these modes, hotel chains commit more resources in their internationalization process, but also enjoy greater control over their foreign business operations.
- Non-equity entry modes (franchises and management contracts). Through this type of entry mode, the hotel chains commit themselves with fewer resources and consequently less control over their foreign business operations.

It can be argued that the greater the degree of control, the volume of investment and the degree of uncertainty, the more companies choose to make FDI in order to guarantee total control, as shown in Figure 1.

Figure 1. Modes of Entry and degree of control



Contrary to this situation, i.e. the lower the degree of uncertainty, the lower the volume of investment and the lower the degree of control, the more the companies resort to franchising.

Direct investment (notably mergers and acquisitions) has been extensively used by companies wishing to expand abroad, changing the characteristics of the industry in recent years (Hill, 2011).

Companies that opt for these modes of entry have the following qualities (Hill, 2011):

- Strong capabilities to deploy their competitive advantages;
- High adaptability to local markets;
- High degree of knowledge of the targeted market;
- High degree of control of product costs and service quality;
- High degree of control of marketing activities;
- High market/sales potential.

There are several reasons why firms choose particular countries to internationalize, which may vary according to regional, geographic, fiscal and political actors (Hitt, Ireland, & Hoskisson, 2011). Within this context, there may also be a number of reasons that help explain why acquisitions is an important entry mode in the hotel industry: access to a more efficient global market, exploitation of technological advances, protection and consolidation of market position, diversification of assets, financial assets that

facilitate investment, a way to eliminate customs barriers, obtaining tax profits, diversification of profit and reduction of risks (Rodríguez, 2002; Valdés, 2003).

The management and franchising contracts have been among the most widely used modes of entry by the large hotel companies because they involve low costs (Garcia, 2013). The American hotel chains are the main protagonists and leaders of the world rankings. These strategies allow companies to be present in several countries. Although hotel chains have targeted mainly developed countries, with the globalization of markets there has been an increase in the number of hotel chains investing in emerging economies.

RESULTS

In the hotel industry, modes of entry are analyzed considering the level of management control and the identification of factors that may influence the choice of these entry modes. The main factors influencing the corporate development of decision making of international hotels and their strategic expansion involve the degree of ownership and the idiosyncratic knowledge embedded in the hotel service (Chen & Dimou, 2005).

The brand image plays an important role in determining the internationalization strategies. In addition, embracing the franchising option of hotel companies that are internationalized is inversely related to size. In turn, the franchising experience and its percentage of franchises granted are positively related to the franchisees' decision to internationalize (Alon, Ni, & Wang, 2012).

The decision to opt for franchising or management contracts differs among companies. For example, from the perspective of cost minimization, luxury hotels may opt for management contracts or acquisitions as an expansion strategy. However, lower-tier hotels may opt for franchising (Chen & Dimou, 2005).

The internationalization process varies from country to country, especially in terms of critical success factors, depending on both the origin and destination country, as a result of market behavior and management decision making processes.

In the case of the Portuguese hotel industry, the critical success factors underlying this internationalization process are the growth capacity of emerging markets and natural resources. In the Portuguese-speaking African countries, Portuguese hotels have looked for low competition of large players of the world hotel industry, allowing very high investments by Portuguese companies, which have also benefited from the proximity of the linguistic and cultural base (Garcia, 2013). Those investments are focused on emerging markets as well as bottom of the pyramid markets, in which products and/or services are customized for each region/country. Among the various entry modes, the most adopted ones have been management and franchising contracts because they involve low costs.

Generally, the internationalization of US multinational hotel companies increases their value (Lee, 2008). Expansion to Asian countries is normally more beneficial than to European countries as it brings more business opportunities.

The internationalization of the Spanish hotel industry does not behave in the same way as that of the world hotel industry. In the Spanish case, companies tend to prefer more flexible modes of operation, acquiring more knowledge and reducing internal uncertainty (Berbel-Pineda et al., 2017). When Spanish hotel companies are located in high-risk environments considered, they prefer to share control with local agents. When they invest in high-income countries, they place greater importance to entry modes such as franchising or management contracts. International hotel companies that settle in urban areas tend to adopt indirect modes of entry in environments with higher risk indices but with higher levels of

development measured by Gross domestic product (GDP) per capita. It is more frequent to find direct investments in highly competitive markets, with a strong local industry, characterized by higher GDP per capita and high rates of FDI (Berbel-Pineda et al., 2017).

The cultural distance, the attractiveness of the market, the international experience of the company, the intangibility of the assets, the size of the enterprises and the number of Chinese tourists who visit each country are determining factors in the choice of the mode of entry of the Chinese hotel chains. The modes involving capital investments prevail over contractual arrangements among Chinese hotel chains (Andreu, Claver, & Quer, 2017).

Besides analyzing the critical success factors that determine the choice of a mode of entry from the perspective of the country of origin, it is also important to analyze the difference between small and large hotel companies. Small hotels with limited multinational experience tend to prefer to enter high potential perceived markets through joint ventures. Moreover, companies that are more capable of developing products are worried about the possible loss of their advantage in countries that are perceived to have greater contractual risks. Although entering high potential perceived markets is more interesting, the existence of investment risks leads small hotels to flee from those investments (Agarwal & Ramaswami, 1992).

The analysis of the modes of entry can also take the perspective of the specific factors of the hotel chains. This can be seen in the case of Chinese hotel chains that prefer input modes involving capital investment, to the detriment of contractual modes. Chinese hotel chains prefer destinations near China, where the entry mode chosen is FDI. Risk aversion as well as cultural distance may have influenced Chinese hotel chains in their decisions to enter foreign markets. In the future, Chinese hotel chains may choose contractual agreements (management or franchising contracts) to avoid higher costs when entering countries with higher cultural distances. However, the chains that serve the middle and lower segments of the market opt for franchising for in order to increase their global reach. In what pertains the company's specific factors, the size of the company, the international experience and the level of intangibility of the assets are important in the decision making process regarding the mode of entry abroad (Andreu et al., 2017).

In the case of Spanish hotel chains, it is clear that the greater the cultural distance, the more Spanish hotel companies tend to opt for FDI and avoid contract agreements. Entering a culturally similar market not only helps avoid the uncertainty of evaluating unfamiliar environments, but also facilitates the establishment and control of integrated operations. In addition, the mode of entry into external markets should be understood as a gradual process that results from the interaction, cultivation and maintenance of relationships over time (Rodríguez, 2002).

DISCUSSION

In a global context, internationalization increases the firms' value, although this depends on where firms decide to internationalize and the opportunities / risks they embrace. Companies with greater ownership advantages can gain pioneering benefits by being the first to enter these countries (Lee, 2008; Agarwal & Ramaswami, 1992).

Companies that have greater capabilities to develop new products/services are normally concerned about the possible loss of their advantage in countries that are perceived to have greater contractual risks. That is, although they are interested in entering in international high perceived potential markets, the existence of investment risks leads them to avoid those investments. It was also possible to realize that the capacity for differentiation mitigates the effect of contractual risks (Agarwal & Ramaswami, 1992).

There are other variables – such as policy variables – that can have a positive impact on investment and technology transfer.

Investments are focused on emerging markets, which is why the products / services are customized to each region / country. The main key success factors of these investments are the growth capacity of emerging markets and natural resources (Garcia, 2013).

It can also be said that there is a positive relationship between international experience and the mode of entry, with the desire to control the value chain. This ratio is measured by both time involved since the hotel firms began to operate abroad, in terms of the number of years, and the degree of internationalization, which reflects their state of international development. The mode of entry into external markets should be understood as a gradual process that results from the interaction, cultivation and maintenance of relationships over time (Rodríguez, 2002; Berbel-Pineda et al., 2017).

The decision of the hotel companies to internationalize is negatively related to the size of the company (Alon et al., 2012). A very important factor in the strategic expansion decision is the degree of ownership and the idiosyncratic knowledge embedded in the hotel service (Chen & Dimou, 2005).

As opposed to the previously referred, the internationalization of the Spanish hotel industry does not behave in the same way as the internationalization of the world hotel industry. In the Spanish case, companies tend to prefer more flexible modes of operation, acquiring more knowledge and reducing internal uncertainty (Berbel-Pineda et al., 2017). When located in risky environments, they prefer to share control with local agents. However, it should be noted that the greater the cultural distance, the more Spanish hotel companies tend to opt for foreign direct investments and avoid contractual agreements (Rodríguez, 2002). In the case of Chinese hotel chains, entry modes involving capital investments prevail over contractual arrangements, since risk aversion may have influenced their entry decisions, as the level of internalization is low in that market (Andreu et al. al., 2017).

In the case of US hotel chains, the decision to expand is based on how this can bring value to the company or reduce risk if they wish to be prudent (Lee, 2008).

The size of the company, the international experience and the level of intangibility of the assets stand out in the decision making in choosing the mode of entry of the Chinese multinational hotel chains in the luxury market segment. In the future, Chinese hotel chains will be able to choose contractual agreements that help avoid higher costs of entering countries with more distant cultures (Andreu et al., 2017).

The success of the expansion of the Portuguese hotel chains may be due in part to the fact that they choose to invest in countries based on the proximity to the linguistic and cultural base, rather than geographical proximity, mainly through management and franchising contracts, as they involve low costs (Garcia, 2013).

The choice between the different modes of entry differs according to the different variables used, so this analysis requires caution. It is also important to analyze from the point of view of the type of market exploited, where it is possible to conclude that franchising is adopted more in small and medium-sized markets, whereas in large luxury markets management contracts are more popular. When quality is not important to the achievement of competitive advantage, management contracts are not widely used and franchising is more likely to be used when hotel size increases (Cunill & Forteza, 2010).

High-income countries attach relatively greater importance to entry modes such as franchising or management contracts. International hotel companies that are established mainly in urban areas tend to adopt indirect entry modes. This occurs in environments not only with higher risk levels, but also with higher levels of development measured by GDP per capita. Besides, it is more frequent to find FDI in highly competitive markets, with a strong local industry, characterized by a higher per capita GDP and high rates of FDI (Berbel-Pineda et al., 2017).

The analysis carried out refers to the different theories evidenced previously, revealing that it is not possible to be restricted when looking at internationalization, given the number of factors that can be considered. However, the hotel industry is part of the tertiary sector in which services play a major role, which is not particularly well covered by traditional internationalization theories as they are more prone to explain the internationalization of industrial firms.

CONCLUSION

The theories of internationalization most emphasized in the literature analyzed in the hotel industry are the Uppsala model and the Eclectic Paradigm. The former is in the sense that there are cases in which the intention was to enter into foreign markets linearly and gradually, especially with low psychic and geographical distances, usually where hotel chains seek to take advantage of new opportunities by exploiting their core competencies through equity and non-equity investment modes.

As regards the Eclectic Paradigm, its interpretation and adequacy to the hotel industry becomes more accessible than the Uppsala model, since the main modes of entry in international markets are in some way related to the ownership, location and internalization specific advantages. Although this theory is predominant when it comes to international business, it has to be adapted to the current internationalization of the hotel industry, in particular the internalization specific advantages.

It is clear that hotel chains exploit international market opportunities by choosing specific locations according to the conditions of these international markets. It is possible to conclude that the main modes of entry have been the FDI, the joint ventures and the contractual agreements (management contracts and franchising). If the internalization advantages can be easily explained through the FDI, the use of joint ventures and contractual agreements make the majority of hotel chains enter international markets without the provision of their services internalization, which can be explained by nature of asset-based services and people-processing services. It is important to refer to that in most situations the agreements signed – management contracts, franchises or joint ventures – among all parties involves a clear definition of the services provided, which helps circumventing the internalization advantages.

In conclusion, within the four main theories indicated in the literature review, of which only three were analyzed, there may not be a single theory that adequately explains the internationalization of the hotel industry, although the eclectic paradigm can easily be adapted to most situations.

Due to changes in global economies and increased competitiveness, it becomes more important to opt for an opportunity with more associated risk than entering the market in a sequential manner that would eventually take longer and may jeopardize opportunities. Furthermore, small and medium-sized companies in the hotel industry tend to adopt different internationalization strategies *vis-à-vis* large multinationals in this industry.

One can conclude that franchising and management contracts are the most common modes of entry in the global hotel industry, because they allow for economies of scale to be more easily achieved and to increase the scope of the hotel chain itself. The same is true of Spanish and Portuguese hotel chains operating abroad, since they prefer these same more flexible modes of entry, while Chinese chains opt for modes of entry that involve greater capital investment and control (FDI). In addition, it should be noted that Chinese and Spanish hotel chains are in an initial state of internationalization.

The analyzed literature also showed that in the hotel industry franchising is more adopted in small and medium markets, while management contracts are more popular in large markets or among luxury brands.

It was important to analyze different markets in the state of evolution of internationalization, namely, Chinese, Portuguese, Spanish and American markets as this helped to understand modes of entry in mature markets as well as the justification of the modes of entry.

Large hotel chains benefit from economies of scale in two complementary ways: they raise important entry barriers: firstly, through the advantages gained by the input mode that exploits these economies of scale, and secondly, because the government of the destination country applies rates that reduce FDI, which reduces international competition.

It is also noticed that the literature on the internationalization of hotel chains focuses on the understanding of the modes of entry and considering three main perspectives: the company / hotel chain and its internal factors; the country of origin; and the market, or country of destination, for which firms intend to internationalize. For each of these perspectives, there are critical factors that, although they may be independent, end up intertwined with the critical factors of other perspectives, and it is therefore relevant to analyze these processes from several points of view. Moreover, there is also a focus on markets where the main chains are concentrated, denoting a lack of analysis of other markets.

FUTURE RESEARCH DIRECTION

Internationalization is very important for firms, in general, and for firms of the hotel industry in particular. Although contractual agreements are important means of entering international markets, and national brands and chains seem to play a vital role in diversifying to foreign markets, it would be of added value to keep abreast of the new perspectives so far not investigated as:

- The role knowledge management plays in generating and adapting valuable resources within the hotel groups;
- The role horizontal knowledge management plays in the generation of competitive advantages within the hotel groups;
- The role competitive dynamics in the hotel industry;
- How competitive rivalry underpins internationalization in the hotel industry.

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KEY TERMS AND DEFINITIONS

Consortium: Consists of the association of several companies: which give rise to the creation of a new entity. Consortium allows companies to share resources, divide risks and dissolve cooperation after project completion.

Franchising: Is another organizational form used by companies to compete in highly decentralized industries. In the hotel industry, franchising was launched in the 1960s as an expansion strategy for the Holiday Inn group and since the 1980s it has become a form of international business, especially in the service industry.

Globalization: IT is a worldwide movement toward economic, financial, trade, and communications integration. It is normally envisaged as a lack of trade barriers between nations, which are removed through free trade agreements throughout the world and between nation states. It implies the opening of local and nationalistic perspectives to a broader outlook of an interconnected and interdependent world with free transfer of capital, goods, and services across national frontiers, in which investment opportunities soar.

Internationalization: It is the process of increasing involvement of enterprises in international markets. It involves a strategy carried out by firms that decide to compete in foreign markets. It involves cross border transactions of goods, services, or resources between two or more firms or organizations that belong to two different countries.

Internationalization Process: It involves the emphasis of a trajectory of a company in its transition from a national market to a particular foreign market. It normally involves several entry modes (exports, FDI, franchising, etc.) that exert a critical influence on the subsequent trajectory, as well as on cost related to the internationalization process. The two most important theories that explain the internationalization process are the Uppsala model and the network-based approach.

Joint Venture: Is another growth vehicle available to hotel/business companies. These types of agreements are considered as legal contracts whose ownership and management of the organization are shared by more than one organization and are normally used when the benefits outweigh the additional costs.

Management Contract: Is a long-term agreement in which the owner of the property contacts an international hotel company in order to manage the hotel. Through management contracts, hotel chains are responsible for all hotel operations, namely by implementing systems and procedures, selecting the hotel manager, and enforcing their human resources and quality policies.

Network-Based Approach: It based on the industrial networks theory, which states that firms evolve on the basis of established relationships. It considers the companies' internationalization process through their integration into networks and relationships. Following this perspective, the internationalization process occurs in interactive environments where companies of a well-established network of companies have an opportunity to develop new relationships that give them access to broader markets in other countries.

Strategic Alliances: Are designated as intermediate modes of entry in international markets. They are normally carried out by companies that have experience and knowledge in certain specific areas, but need to complement forces in other areas. Strategic alliances aim to share and/or exchange products, services, knowledge, and profits.

Uppsala Model: It has been one of the most discussed dynamic theories in Nordic School and International Business Studies. It explains the process of internationalization of companies. It explains how organizations learn and the impact of learning on the companies' international expansion. This theory defends that the companies' internationalization process is carried out in stages, from non-regular exports to the establishment of companies abroad.

Similarities and Differences Between Word-of-Mouth and Electronic Word-of-Mouth

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INTRODUCTION

One of the most common behaviours after enjoying a product, especially if it is a tourist service (Woodside & Moore, 1987), is comment the experience. Habitually, this behaviour is called Word-Of-Mouth (WOM). With the appearance of Internet, this behaviour began to occur through the new media (Gruen, Osmonbekov & Czaplewski, 2006, Hennig-Thurau, Gwinner, Walsh & Gremler, 2004) and is called electronic Word-Of-Mouth (eWOM). Both concepts have been considered the same but it is necessary to perform analyses and comparisons to verify this fact. To compare both concepts, the causative variables of recommendations generation will be analysed in one of the most important economic activities, the tourism sector. Tourism literature recognizes the importance of emotions, satisfaction and post-purchase behaviour (Bigné, Andreu, & Gnoth, 2005), and diverse studies show emotions as antecedent of satisfaction and behavioural intentions (e.g., Grappi & Montanari, 2011; Han & Jeong, 2013; Yuksel & Yuksel, 2007). Some studies have found a positive relationship between satisfaction and the intention to recommend (Lii & Lee, 2012; Prayag, Hosany, Muskat, & Del Chiappa, 2017), but other authors raise doubts about the existence of this relationship (Dolnicar, Coltman, & Sharma, 2015; Yang, 2017).

At present, consumers are looking for a lot of information on Internet before making any decision. Among the multiple information available, the comments and opinions of other consumers are the most valued. Consumer-to-consumer (C2C) communication in social media has become a critical element for companies, especially for service companies. The importance of C2C communication has made fundamental to analyse the causes of eWOM generation and the effects that eWOM has on the potential consumers (Serra & Salvi, 2014). eWOM has overshadowed the traditional WOM and created a new line of research. As noted in previous studies (e.g., Filieri & McLeay, 2013; Litvin, Goldsmith, & Pan, 2008) there is a need for more research that explores eWOM and tourist behaviour.

Although some authors have identified emotions as precursors of positive word-of-mouth, but eWOM in comparison to traditional WOM (recommendations to relatives and friends) requires a plus to be generated. WOM are made through an 'unplanned' process when there is a chance to do it in casual meetings or somebody ask. However, eWOM requires a conscious, planned action with slightly more effort involved in uploading comments to Internet. The purpose of this chapter is to examine the

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differences and similarities between traditional WOM and electronic WOM, based on empirical data, to see if they are the same thing in different supports or different things. To achieve this objective, it will be examined the role of six variables (Service Quality, Perceived Value, Customer Satisfaction, Brand Reputation, Customer Loyalty and Emotional Experience) in WOM and eWOM generation, in the context of lodging services. Moreover, it will be analysed the relationship between the two types of recommendations. A statistical analysis is performed based on the use of Structural Equation Models (SEM), specifically by Partial Least Squares (PLS) technique. The main conclusion is that the two types of recommendation are not exactly the same. In both cases, Emotional Experience is very important but Customer Satisfaction is a differential element.

BACKGROUND

First, must briefly comment on a set of concepts that intervene in the behaviour of the customer and that may have an effect on the client's intention to comment on their experience. Due to the nature of the services (intangibility, simultaneity and heterogeneity), the quality assessment carried out by clients has a global focus, taking into account what happens before, during and after provision of the service. This implies that everything from the request for information, prior to the purchase decision, to the buyer-seller relations, very subsequent to the provision of the service, is important for the client. Clients perceive the Service Quality as a set of attributes that are taken into account to perform the overall evaluation of the service (Choi & Chu, 2001).

The concept of value can be applied to various fields of knowledge (Nasution & Mavondo, 2008). Normally, definitions of value include aspects related to price, quality and customer perception (Slater & Narver, 2000). In addition, customers' expectations regarding the product should be considered (Fornell, Johnson, Anderson, Cha, & Bryant, 1996). Value is a process of interpretation of the consumer in relation to the product (good or service) consumed, measuring the benefits and sacrifices including both monetary and non-monetary (Nasution & Mavondo, 2008). Mittal & Sheth (2001) emphasize that providing positive value (more benefits than sacrifices) to customers is an important factor for the success of companies. Nasution & Mavondo (2008) indicate that the value provided to the client is associated with the generation of positive WOM.

Customer Satisfaction is a comparison between the service expectation and the perceived service (Parasuraman, 1997; Raval & Grönroos, 1996). There is a logical and important positive relationship between Service Quality and Customer Satisfaction and it is widely contrasted in the literature (Da Silva & Alwi, 2008). In fact, the Service Quality is usually considered as the satisfaction of the client, that is to say, meet the requirements that the consumer expects to find before the provision of the service.

Keller (1993) defines brand image as the perception in consumer memory and adds that brands are an intangible asset of companies that are difficult to imitate. It is considered that brands are a sum of elements that represent an organization (Da Silva & Alwi, 2008), and is the company vision from customer perspective (Grönroos, 1990). In this sense, it is considered that the brand image or reputation is generated through an accumulation of consumer reactions to the experiences lived (Davies & Chun, 2002). In this chapter, reputation (Loureiro & Kastenholz, 2011) and image (Da Silva & Alwi, 2008) will be considered as synonyms. A strong and positive corporate Brand Reputation not only helps a company achieve a competitive advantage, it also stimulates repeat purchases (Da Silva & Alwi, 2008).

Customer Loyalty has been defined in many different ways. Although the customer's intention to repeat purchase selection is central to all definitions, as Kabiraj and Shanmugan (2011) points out, loyalty

is a very complex multidimensional concept, influenced by a large set of variables. Attitudinal approach depicts loyalty as a psychological state that the customer may attain as a result of the relationship with the firm. Customer may voluntarily maintain that relationship based on the benefits that receives during the relationship (Caruana, 2002). This approach advocates the idea that the foundation of true loyalty is a positive attitude toward the firm and this positive attitude is necessary for a repeat purchasing behaviour. The importance of customer's loyalty to long-term company's sustainability is widely acknowledged (Callarisa, Sánchez, Cardiff, & Roshchina, 2012).

In recent years, there has been more talk about the tourist experience than about service quality. Tourist experiences include satisfying and pleasurable emotions (Coghlan, Buckley & Weaver, 2012) and positive emotions are associated with memorable experiences (Tung & Ritchie, 2011). As Xiang, Schwartzb, Gerdes Jr and Uysal, (2015) state, the guest experience is an extremely complex construct. Depending on the research design and methods, researchers could get very different pictures of what constitutes experience. Customer experience can be defined as the entirety of the interactions a customer has with a company and its products. Positive emotional experiences in the hotel context could be defined as: service encounters that exceed customer's expectations and flawlessly executed; design and delivering of customized, innovative and unique products; surprising and unexpected levels of service; a touch of additional differentiation.

The six variables exposed are potential causes of recommendations generation, regardless of the communication channel chosen. Therefore, it is possible to propose a causal model with a dependent variable (generation of recommendations) that is affected by the independent variables indicated.

WOM and eWOM

The WOM analysis goes back to the eighties, with studies like that of Woodside and Moore (1987). The eWOM analysis is much later and appeared with studies such as Hennig-Thurau et al. (2004) and Gruen et al. (2006). The eWOM, also often referred to as online reviews, online recommendations or online opinions, has gained importance with the emergence of new technology tools, especially with the emergence of Internet 2.0 and social media. Litvin et al. (2008) define eWOM as all informal communications directed at consumers through Internet-based technology related to the usage or characteristics of particular goods and services, or their sellers. Traditional WOM has evolved into eWOM in the new digital era and the main differences can be identified in the reach of the reviews' impact (number of people who can be influenced) and the speed of interaction: "compared to traditional WOM, online WOM is more influential due to its speed, convenience, one-to-many reach, and its absence of face-to-face human pressure" (Sun, Youn, Wu, & Kuntaraporn, 2006).

Companies are increasingly seeking to understand the factors that influence eWOM generation, as well as the impacts resulting. The tourism industry is strongly affected by eWOM and hotels are probably the most affected (Serra & Salvi, 2014). Many of the studies carried out have analysed the WOM, that is, the comments made person to person in a traditional way, but the analysis of eWOM is very recent. In many cases, it is considered that eWOM is essentially the same as WOM but by electronic means. The situations in which it occurs suggest that this equivalence should not be assumed without having a statistical comparison. The WOM is usually the result of search for a topic of conversation in family or friends' meetings or the answer to a question or a doubt from someone. The eWOM implies a dissemination of information without a specific addressee and with the sole purpose of making known something that has surprised positively or negatively.

The main objective of this chapter is to make a comparison between both types of recommendation (WOM and eWOM) by means of a statistical analysis on a sample of hotel customers. This is to provide empirical analysis to indicate if there is any difference between the two concepts, beyond the speed of dissemination of comments. To do this, two causal models will be analysed, one for each type of recommendation, to compare causal effects, and finally the two will be integrated in a single model in which one type of recommendation is the cause of the other type. Although they are different concepts, it is possible that there will be a positive relationship between WOM and eWOM.

COMPARISON BETWEEN WOM AND eWOM

Methodology

To test the hypotheses, a questionnaire has been designed containing some items already used in previous studies (e.g. Han & Jeong, 2013; Loureiro & Kastenholz, 2011; Sun et al., 2006) and others from own elaboration. To measure items, a five-point Likert scale has been used, and questionnaire was completed with questions dealing with demographic aspects and trip information. The fieldwork was done in the second part of 2017. A total sample of 240 valid questionnaires was obtained in the personal survey conducted in the Maldonado-Punta del Este conurbation (Uruguay) between people who had lodged in a hotel during the previous six months. In all cases, they were asked about their last stay in a hotel. The socio-demographic profile of the resulting sample is fairly balanced, and questions related to the trip show type of trip and accommodation chosen (Table 1).

The research model has been tested using Partial Least Squares (PLS) technique, a variance-based Structural Equation Modelling (SEM). More precisely, this study uses SmartPLS 2.0 software (Ringle, Wende, & Will, 2005). While the results differ little for the alternative weighting schemes, path weighting is the recommended approach (Henseler, Ringle & Sinkovics, 2009).

Results

Before proceeding to analyse proposed models, it is necessary to analyse the measurement model. Individual item reliability is considered adequate when an item has a factor loading (Table 2) that is greater than 0.707 on its respective construct (Carmines & Zeller, 1979). Construct reliability is usually assessed using Cronbach's Alpha (Cronbach, 1970) and composite reliability (Anderson & Gerbing, 1988; Bagozzi & Yi, 1988). When both values are greater than 0.7 it is considered as a valid reliability criterion (Nunnally, 1987), as in this case (Table 2).

To assess convergent validity was examined the Average Variance Extracted (Fornell & Larcker, 1981). AVE values should be greater than 0.50 (Bagozzi & Yi, 1998; Fornell & Larcker, 1981), and are greater than 0.63 (Table 2). Discriminant validity indicates the extent to which a given construct differs from other constructs (Anderson & Gerbing, 1988). There are two approaches to assess discriminant validity (Chin, 1998) and these conditions are satisfied for all latent variables.

After testing the measurement model, it proceeded to analyse proposed causal relationships. PLS-SEM relies on a nonparametric bootstrap procedure (Davison & Hinkley, 1997) to test the significance of estimated path coefficients and with this information t-values are calculated (Hair, Hult, Ringle, & Sarstedt, 2014). At this stage, values for path coefficients and Student's t are obtained (Table 3).

Table 1. Characteristics of the trip (own elaboration)

	Frequency	Percentage
Reason for the trip:		
Leisure.	171	71.25%
Job.	30	12.50%
Visit relatives.	29	12.08%
Others.	10	4.17%
Length of stay:		
Between 1 and 3 days	85	35.42%
Between 4 and 7 days.	94	39.17%
Between 8 and 15 days.	53	22.08%
More than 15 days	8	3.33%
Type of Hotel:		0.00%
Urban hotel	156	65.00%
All-inclusive hotel.	65	27.08%
Rural hotel.	14	5.83%
Others.	5	2.08%
Hotel category:		
1 star or 2 stars.	10	4.17%
3 stars.	53	22.08%
4 stars.	79	32.92%
5 stars.	44	18.33%
5 stars Great Luxury.	16	6.67%
Not have / Not know.	34	14.17%
Others.	4	1.67%
Source of information:		
Web pages of opinion.	78	32.50%
Web pages of the destination.	37	15.42%
Website of the hotel.	43	17.92%
Friends and family.	55	22.92%
Travel agency.	47	19.58%
Magazines.	8	3.33%
Others.	9	3.75%
Reservation Method:		
Website of the hotel.	72	30.00%
Travel agency.	57	23.75%
Other web pages.	43	17.92%
By phone to the hotel.	50	20.83%
Others.	18	7.50%

Table 2. Measurement Model (own elaboration)

	Loadings	Cronbach's Alpha	Composite Reliability	AVE	Communality
Service Quality:		0.905	0.925	0.639	0.639
Qual01	0.885				
Qual02	0.778				
Qual03	0.798				
Qual04	0.798				
Qual05	0.765				
Qual06	0.830				
Qual07	0.733				
Perceived Value:		0.879	0.943	0.892	0.892
Valu01	0.949				
Valu02	0.939				
Brand Reputation:		0.865	0.908	0.712	0.712
Repu01	0.844				
Repu02	0.796				
Repu03	0.856				
Repu04	0.875				
Customer Satisfaction:		0.895	0.950	0.905	0.905
Sati01	0.954				
Sati02	0.949				
Customer Loyalty:		0.917	0.960	0.923	0.923
Loya01	0.964				
Loya02	0.958				
Emotional Experience:		0.862	0.906	0.706	0.706
Expe01	0.850				
Expe02	0.803				
Expe03	0.840				
Expe04	0.867				
WOM generation:		0.859	0.914	0.779	0.779
WOM01	0.848				
WOM02	0.896				
WOM03	0.904				
eWOM generation:		0.898	0.924	0.709	0.709
eWOM01	0.895				
eWOM02	0.892				
eWOM03	0.805				
eWOM04	0.786				
eWOM05	0.828				

Table 3. Structural Model (own elaboration)

	WOM generation ($R^2 = 0.511$)				eWOM generation ($R^2 = 0.302$)			
	Path Coefficients	Standard Error	T Statistics	P value	Path Coefficients	Standard Error	T Statistics	P value
Service Quality:	0.026 ^{ns}	0.149	0.177	0.430	-0.151 ^{ns}	0.177	0.852	0.197
Perceived Value:	-0.073 ^{ns}	0.125	0.584	0.280	0.094 ^{ns}	0.131	0.718	0.236
Customer Satisfaction:	-0.010 ^{ns}	0.173	0.058	0.477	-0.490**	0.173	2.831	0.002
Brand Reputation:	0.154 ^{ns}	0.142	1.084	0.139	0.212*	0.155	1.373	0.085
Customer Loyalty:	0.149 ^{ns}	0.139	1.067	0.143	0.211*	0.162	1.305	0.096
Emotional Experience:	0.511***	0.123	4.162	0.000	0.507***	0.140	3.619	0.000

* $p < 0.1$; ** $p < 0.01$; *** $p < 0.001$; ^{ns} not significant.

In the first causal model, only Emotional Experience has a significant effect on WOM generation (Table 3), but it allows explaining a very important part of the variance ($R^2 = 0.511$). In the second causal model, Emotional Experience has a significant positive effect and Customer Satisfaction has a significant negative effect on eWOM generation (Table 3). In addition, Customer Loyalty and Brand Reputation have slightly significant positive effects (at 0.1 level). With all, second model explains less variance than first ($R^2 = 0.302$). This indicates that there are differences in the causes, especially in the importance of Customer Satisfaction.

When focusing on WOM and eWOM, there is a correlation between the two variables of 0.390 and if a simple regression is considered, in which one of the two types is the cause of the other, the effect is important ($\beta = 0.418$) and significant (p value = 0.000), regardless of which is dependent or independent. But if the two causal models analysed in Table 3 are linked by a causal relationship between the two types of recommendation, this causal relationship has a low level of significance (p value = 0.07). This suggests that WOM and eWOM have similarities but cannot be considered to be the same concept in different support (the correlation is too low) or one is causing the other (there is little significance in the causal relationship when other variables are introduced). The differences between both types of actions

Table 4. WOM and eWOM generation (own elaboration)

	Sample Average	Standard Deviation
WOM generation:		
WOM01	3.664	1.114
WOM02	3.299	1.155
WOM03	3.175	1.126
eWOM generation:		
eWOM01	2.325	1.099
eWOM02	2.227	1.168
eWOM03	2.186	1.176
eWOM04	2.466	1.276
eWOM05	2.288	1.254

can be seen even in the purely descriptive data, and the same sample has clearly different intentions in terms of WOM generation and eWOM generation (Table 4).

SOLUTIONS AND RECOMMENDATIONS

The provision of emotional experiences to hotel guests may constitute a powerful review-generating factor in hospitality services, and the data in this study corroborate this assumption. Several professionals consider that the relationship between tourist experience and eWOM generation is so strong that, in reality, commenting on the experience would be part of the experience. This level of integration is only an assumption of some people, but the causal relationship is more than plausible (Jang & Namkung, 2009). The discussion regarding emotional experiences and eWOM generation is complex to clarify because statistical tools hardly allow the high level of precision that would require:

- The simplest interpretation is to consider that the online content that a person generates is the result of an emotionally shocking experience. The person seeks to communicate their experience to make known something positive or negative that has happened. Generally, greater the surprise, greater the intention of commenting. Essentially an action subsequent to the enjoyment of service and that allows an emotional satisfaction based on the remembrance of the experience.
- It can be considered the possibility that uploading content online is not an action subsequent to the experience but the final phase of the experience. The vision of eWOM generation as part of the experience would be reaffirmed by the trend, now possible thanks to mobile technology, to generate eWOM during the experience. It is common for some people to perform a “live broadcast”, or almost, of what they live during an event or a trip.

Regardless of which explanation is considered correct to understand the relationship between emotional experiences and generation of recommendations, what this study indicates is that experience is fundamental for both types of recommendation (traditional and electronic). This implies that entrepreneurs from all sectors, but especially those that offer services linked to leisure, should contribute something more to the client, an affective and emotional component that goes beyond expectations. This will generate recommendations and positive comments, both person to person and on Internet, which will be the best possible promotion, as the opinions of other clients are the most valued information source. The rest of factors need more analysis to know their importance, but positively surprise the customer is a fundamental element for success.

FUTURE RESEARCH DIRECTIONS

The relationship between customer satisfaction and the positive eWOM has been analysed but there are still no conclusive results (Lii & Lee, 2012; Prayag et al., 2017). Swanson and Hsu (2009) reach the conclusion that customers who experienced satisfactory incidents are not necessarily more likely to recommend the service provider or to convince others to use the service provider than their dissatisfied counterparts. In the context of restaurant-services, Yang (2017) did not find support for the link between satisfaction and positive eWOM intentions. Dolnicar et al. (2015), in their meta-analysis of methodologi-

cal aspects of guest surveys in the context of tourism destinations, also raise some concerns regarding the link between satisfaction and intention to recommend.

In the present work, Customer Satisfaction does not have any causal effect on WOM generation, but has it on eWOM generation. It is striking that the sense of the causal relationship between Customer Satisfaction and eWOM generation is negative, that is, the more dissatisfied customer the higher is the probability of commenting in the online environment. This would indicate that the eWOM, for the sample studied, is a form of protest for a bad service that seeks a great impact among the potential customers. Therefore, the relationship between Customer Satisfaction and eWOM generation deserves additional research effort and, particularly, in the hospitality context. In addition, the rest of variables cannot be discarded in future studies, especially Brand Reputation and Customer Loyalty. These two variables have a moderately significant effect on eWOM generation. In future studies should be deepened in the comparison between both types of recommendations and the causal variables, both through qualitative and quantitative studies.

CONCLUSION

The eWOM is not identical to the WOM and this fact must be taken into account by both researchers and managers. They have similarities, such as the importance of emotions and the client's experience in their generation, but also differences. Based on the results of this study, it is possible to affirm that eWOM is more complex, since more significant variables have been found but with less explanatory power. This implies that they must be considered as distinct concepts with different causes and consequences, which should be analysed in future studies that complement the current work and overcome its limitations (study with a small sample in a specific region and sector). In a more generic way it could be affirmed that human behaviour is not equal offline and online and cannot be considered equivalent.

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KEY TERMS AND DEFINITIONS

Brand Reputation: Opinion of the clients about a company or product.

Customer Loyalty: Affective and behavioral fidelity to a product, brand, or company.

Customer Satisfaction: Comparison between the client expectations and the valuation subsequent to the enjoyment of the product.

Electronic Word-of-Mouth (eWOM): All informal communications directed at consumers through Internet-based technology related to the usage or characteristics of particular goods and services, or their sellers.

Emotional Experience: Affective effect generated by the enjoyment of the product.

Perceived Value: Comparison between the costs and benefits of a product.

Service Quality: Consumer perception of the technical and objective characteristics of a service received.

Structural Equation Model (SEM): A statistical method studying causal relationships amongst data. It uses a confirmatory approach of multivalent analysis that applies a structural theory related to a given phenomenon.

Word-of-Mouth (WOM): All informal communications person to person related to the usage or characteristics of particular goods and services, or their sellers.

Mobile Culture for Tourism Communication

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INTRODUCTION: WHY MOBILE CULTURE FOR TOURISM COMMUNICATION?

Mobile culture is emerging as a new paradigm of social action and discourse. It works as a sort of template for practicing, learning and applying information and knowledge, within multiple economic, political and cultural activities within the urban fabric. This phenomenon involves capitals, persons and objects, which are profoundly on the move across global and local arenas. According to John Urry (2007) and Mimi Sheller (2006), *social mobilities* even constitute the leading process shaping contemporary societies and urban cultures. Likewise, interpretation methods of all social realms are being shaken by quick and deep discursive movements, for instance in what concerns the analysis of cultural heritage (Cessari, 2011; Andrade, 2013) or mobilities (Giannotti, 2008).

However, such mobilities of cultural goods, services and interpretation are not desirable or even possible, without adequate *communication* among the main stakeholders involved in this novel reality. In other words, contemporary societies face a critical *intercultural* process (Piller, 2011; Paulston, 2012), that is, the encounter or clash between national citizens and foreigners, be them tourists (Andrade, 2014) or immigrants (Benson, 2012; King, (2013). And the correspondent communication of local, national or international information and knowledge are being activated, more and more, through *digital mobilities* and the underlying discourses. Among the central instruments which facilitate this communication, *mobile devices* such as cell phones are becoming prominent (Ling, 2009). For instance, according to André Caron (2007), when exchanging text messages, young people don't just share information, but develop verbal performances that create knowledge and culture. And, beyond culture, mobile devices are becoming a cult (Goggin, 2006), a posture that, occasionally, may bring pleasure but also some risks, within the present *risk society* (Beck, 1992, 2008).

In sum, mobile devices are transforming the way we understand and sense urban and intercultural processes. Recently, mobile devices users are dealing with sophisticated new information and knowledge technologies, via *Virtual and Augmented Reality* apps, which may help them to get more and deeper experiences and understanding of their everyday life in urban places, contexts and territories. Following this trend, city planners are developing intelligent strategies for experiencing and interpreting practices, knowledge, culture and arts related with urban mobilities. Such initiatives aim to redefine not just local life and national citizenship, but also, at an international level, intercultural exchanges between the citizen and the Other, that is, visiting foreigners such as tourists or immigrants (Arvastson, 2006).

Within this perspective, the purpose of the following text is twofold: firstly, to define the main ideas and concepts which clarify the process of mobile culture, activated through the use of mobile devices (cell phones, etc.). Secondly, inquiry why and how mobile culture and its devices facilitate or difficult one of the most relevant processes in the contemporary city, that is, *urban mobilities* and its *modes and means of communication*. This text considers just one of such mobilities, the tourism travel, and focus on

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the most relevant social and cultural exchanges of competences and performances among, on one side, native citizens of a destination place and, on the other side, tourists visiting this locality (Andrade, 2017).

BACKGROUND: STATE OF THE ART ON MOBILITY CULTURES AND TOURISM

Mediatization can be briefly defined as a social process which translates, shapes and frames all other processes and discourses within contemporary society. It was studied, among other authors, by André Jansson (2017), in connection with the ideas of individualization and globalization, and mainly in what regards mobile middle-class lives and *post-tourism*. In particular, it is important to know how media-tization is culturally legitimized, in a moment when connectivity and mobility are central elements of self-realization.

Within such media hegemony, *digital media* acquired an even more protagonism. Some practical applications of these ubiquitous digital media include tourism, banking and health. In fact, digital devices are profoundly transforming human experience and knowledge. This is visible at a global geographic dimension, within processes of deconstructing and reconstructing urban environments, local life worlds, infrastructures, networked practices and even global geopolitics. Identities are also changing along subjective, perceptive, and affective levels, in terms of digital users' engagement with the spatial world (Felgenhauer, 2017).

This *digital daily world* is a context based on *mobilities*, which are circumscribed as social processes of displacement among diverse areas of cities, regions, countries or other social spaces, at a local and global levels. Mobilities are simultaneously shaped and feeding economy, politics, culture and all other realms of society. Within this context, everyday life is an arena where examples and applications of such phenomena can be easily found. Sara Paiva (2018) inquires how recent technological innovative platforms may develop daily mobility of visually impaired people. The ultimate aim for these social actors as users of such appliances, is their societal inclusion. In this sense, some practical applications are obstacle detection systems, indoor and outdoor navigation and transportation sustainability systems. At a macroeconomic and policies level, such improvements may be undertaken by companies as well as by municipalities, in order to enhance *global and urban mobility* (Kolke, 2014).

Likewise, tourism is an activity where mobilities are to be found in the most unexpected ways, within the intersections of globalized mobility and everyday *mobile tourist* practices. Kaya Barry (2017) points out the apparently irrelevant action of packing a bag for a travel. The author shows how idealized tourists destinations influence their daily actions, and specially their everyday experiences of movement such as this minimal action of preparing a bag for a voyage. To prove such thesis, Barry uses multiples photographic documentation and interviews collected with tourists in hosteling accommodations.

Many of these mobility phenomena are more systematized within one of the seminal books written by John Urry and Jonas Larsen, with the title *Mobilities, Networks, Geographies*, and published in 2016. The authors defend that, as for social mobilities, physical meetings aren't less fundamental to human life than virtual travels. In effect, both are interconnected and equally necessary. Moreover, the book establishes an interesting typology of modes of mobility, in our world where there is a substantial increase in long-distance travels and in communicating through mobile phones, text messaging, emailing and videoconferencing. These geographies of social networks include the following five *interdependent mobilities*: physical travel of people; physical movement of objects; imaginative travel through mass media; virtual travel inside cyberspace; and communicative travel via other more primitive means e.g.

letters, telegrams and telephone. These interconnections between different mobilities require efficient systems of coordination among them.

Another synthetic essay, conducted by Adriana de Souza Silva and Mimi Sheller (2014), criticize the way previous studies cope with mobility, by focusing on virtual mobility and personalized communication. On the contrary, it is necessary to concentrate on mobile media in context, such as people using transportation networks, navigating urban spaces, and sharing content and messages within social networks or inside mobility events such as tourism travels. In sum, it is crucial to emphasize the relations among location, mobile technologies and mobility, in order to redefine *mobile communication* and *mobile sociality*, operated through *locative media*. In this way, concrete applications of mobility in the social fabric (such as mobile art, mobile gaming, architecture, design and urban planning) may better connect citizens and tourists to their urban contexts.

In fact, mobilities are defining a new lifestyle, predominant and maybe dominant in the present world. Scott Cohen and collaborators (2014a) argue that, among other phenomena on the move, *mobile lifestyles* include the reshaping of information, knowledge and cultural values. This process unfolds through everyday repetitions and routines, such as daily bodily performances, that produce new meanings to our lives. Even social sciences are being transformed, via *mobile methods* and through a reconceptualization that articulates the ideas of mobility, immobility, belonging and mobile identities (Urry, 2000).

It is crucial to note that our mobile world includes *gendered mobilities*. Tim Cresswell (2016) interconnects gender with mobility and social justice, underlying that women can reach more agency and freedom through mobile activities inside health, education and political participation. Ultimately, women's wellbeing is associated with mobile actions conducted both socially and geographically.

Several practical applications of mobilities are developed by urban designers. The METPEX research project, conducted by Coventry University, aims to resolve transport and traffic problems that European cities are experiencing, which cause environment damages. For such purpose, the project members developed a *mobilities design* approach, where they consider needs of transport users in balance with urban sustainability targets. This aim was pursued through a specific instrument developed for measuring passenger experience, which reports and analyses the passenger journey. The practical results indicate how to attract travelers to use more public transportation, in order to reduce traffic congestion (Tovey, 2016).

Such concern for the organization of urban mobilities is so urgent that several *practical guides* are being published along last years. One of the most complete was written by Sachin Date (2015). It covers a plethora of application fields pertaining to *wireless communication*: digital cellular networks definitions of "digital" and "cellular", mobile apps ecosystems, how to evaluate consumer mobile apps, etc. For decision makers, and especially in the case of corporate professionals, the author explains how to develop *mobile marketing*, in order to increase sales, obtain customer satisfaction and operational efficiency, and how to reach a true enterprise *mobility*. In particular, in the areas of Hospitality, Travel and Tourism, multiple advices are suggested on brand projection and about mobile enabled websites, augmented reality or GPS based selling techniques. More advanced strategies include *mobile enabled ecosystems*, e.g. 'wearables' for automotive mobility and activities inside the Internet of Things (Fortino, 2014).

For its part, the *Routledge Handbook of Mobilities* (Adey, 2014) has a more *encyclopedic* purpose. In particular, the authors highlight the relevance of mobilities as a central concept and keyword within the *social sciences*. Multiple approaches and debates, as well as methodologies and techniques innovation, case studies and reconceptualizations, are described and evaluated. A *typology of mobilities* include infrastructure, services and events mobilities. This research can be applied to multiple fields and activities, e.g. transport, migration, tourist and feminist studies.

In some way, the book by Vogl's team (2013) takes a step further: mobilities are rehearsed here within the *mobile discourse* that presided at the very realization of this collective work that, in occurrence, analyzes mobilities. In fact, the book allows the sharing and *mobility of meanings*, among the analyses produced by researchers from different origins, such as social sciences, artists and art theorists. Concretely, such cross-disciplinary mobility, while adopting a mixed media and visual representations approach, uses texts and images to debate regulation and structure of mobility, mobility policies of global corporations, bicycle policies on public space and migration flows, among other issues.

Therefore, it seems that, within contemporary societies, social and cultural mobilities, and in particular *mass tourism* (Bramwell, 2004; Blackman, 2005; Buhalis, 2011; Conrady, 2012), happens to be some the most important activities that mobilizes mobilities. Pau Pons (2012) shows that Mediterranean region, the largest tourist destination in the world, owes its economic success to parallel cultural and aesthetic phenomena. There, tourists' experiences are articulated with (and remade by) mobilities and performances conducted by local actors and cultures inherent to destination places.

Such mobilities' social processes induce important consequences and teachings. In what concern *Tourism Studies*, another essay (Molz, 2012) intends to shake research routines on mobilities within this field. The author argues that classical concepts on tourism no more translate the present situation, such as landscape, the tourist gaze, hospitality, authenticity and escape. These notions can profitably be replaced by the following terms: smart tourism, the mediated gaze, mobile conviviality, re-enchantment and embrace. In particular, togetherness may be reached through interactive travel. This last idea can be defined as a voyage where the traveler aims to be in touch simultaneously with friends, family members and strangers, via new practices such as location-aware navigating, travel blogging, etc.

Likewise, travel writers are rebuilding their practice (i.e. the writing that involves voyage, migration, mobility and displacement), by creatively using experimental techniques. The confessed target is to overcome colonial or Eurocentric tradition in *travel writing* (Edwards, 2012).

Ultimately, the concept of tourism itself and the connected leisure patterns were put into question by Peter Burns (2008). New articulations must be made among mobility, media and citizenship, in order to take in account the new realities of post-modern youth, independent mobility and hypermobility within global space.

Last but not the least, for applications of mobile cultures in the economic world, in order to develop and practice a sustainable *mobile business*, see: Bhuvan, 2008.

FOCUSING ON MOBILE TOURIST COMMUNICATIONS

Departing from previous considerations on cultural mobilities, it is important now to focus on one of its more profoundly related ideas, i.e. *tourism communication*. In fact, mobile culture, although revealing to be an end in itself, often works as a means to achieve a deeper communication between citizens and tourists across a destination place.

One *tourism communication* issue, somehow unsuspected, is climate change. Indeed, at the macro-social level, tourist industry and global mass tourism, and at the microsocial level, daily tourist behaviors while communicating with locals, influence the climate of the places of destination, in the long term (for instance, via the increase of traffic pollution). It is therefore necessary to change tourism policies in conjunction with sustainable climate policies (Cohen, 2014b).

This and other real problems lead to questions pertaining to the *morality of tourism* (Mostafanezhad, 2014). Any tourism encounter presupposes a moral encounter. And during touristic voyages, exchange experiences hide power relations, that often dictate moral reconfigurations within visited societies.

Language is other powerful instruments of human communication, especially in what regards tourism communication. An emerging field, Sociolinguistics of tourism, debates how language constitutes identity, power and social difference in the context of tourism mobilities. Some sources are used by Jaworski (2007) to demonstrate this argument: on one hand, classical sources such as interviews with tourists, service encounters, analysis of postcard messages and guided tours; on the other hand, sources involving recent methodology, e.g. TV holiday programs or digital interactional data.

More specifically, *tourism discourse* has been analyzed and interpreted for several years, as one central part of tourism communication's teaching and research. Corpus including spoken, written and visual texts, were used to clarify the ideas and practices of space and representation within the tourist experiences or performance, as well as to reflect on the pursue of tourist identity via the authenticity of destination places (Jaworski, 2005).

The following example corroborates this power of tourism discourse: reflexions on several case studies demonstrated that *tourism marketing* often promotes insignificant places as desirable tourist destinations. Such propaganda uses language from diverse cultures in relation with the concept 'tourism gaze', among other ideas (Held, 2018).

In sum, the whole *tourism industry* has been profoundly transformed with the advent and dissemination of electronic technologies and the correspondent communication phenomena (Reilly, 1990). The effects of digital communicative processes and methodologies cover economic, social, regional, social, marketing and cultural branches of tourism activities (Pease, 2007).

Moreover, for other specific reflections and empiric analysis on tourism communication, e.g. on accessible tourism for disabled people, see Westcott (2004).

SOLUTIONS AND RECOMMENDATIONS

On Technologies and New Media for Tourism

This section intends to clarify some more intense articulations between mobile cultures and tourism communication, the two subjects treated in the precedent pages. In this confluence, the reported issues, controversies and problems require the definition of means and methods that could substitute complexities, biases and abuses perpetrated with such appliances, with more practical and democratic uses.

Debates on tourism technologies

Previous discussions: states and European policies stakeholders, city planners, scientific communities, corporations, among others, have been debating for several years the impact of information and communication technologies in tourism, related with contextual variables, within periodic conferences and other regular events. For example, in what regards sustainable local development, environmental and climate change, cybercities, second homes (Graham, 2004; Hall, 2004, 2005; European Communities, 2005; Gössling, 2006; Girard, 2009; Hannam, 2010; Cunha, 2011; Francesconi, 2014; Hanna, 2015).

Following anterior editions, in 2006 a major event took place in this subject at Bilbao, the *conference ENTER - International Conference on Information and Communication Technologies in Tourism* (Klein,

1996). The scope was to rethink the whole process of touristic goods and services, from a technological point of view. For instance, connect, on one side, telecommunication and information systems in tourism, to, on the other side, the dissemination of information for eventual users. In particular, the redesign of touristic products and the redefinition of standardization norms, could help to restructure tourism values. The target public was composed by researchers, system developers, principals, tour operators, travel agents, customers, among other users.

Another conference in a connected direction tried to report the recent impressive technological metamorphoses related to mobilities, occurred in the last years of the 21th century first decade, and the respective impacts on society (Cunha, 2011).

In 2013, the series of conferences more focused on Information and Communication Technologies in Tourism was retaken (Cantoni, 2013). The subjects discussed testify advances in two interconnected fields: (a) on one hand, digital media in general: for instance, web site and search engine optimization, eLearning, recommender systems, technology adoption and diffusion, online communities, social media and Web 2.0, user generated content; (b) on the other hand, digital media applications on tourism activities: for example, electronic tourism marketing, tourism management and decision support, mobile technologies and applications in tourism, e-intermediaries and networks in tourism, customer research in e-tourism.

Such particular themes were developed in 2014. Other themes were added, e.g. electronic distribution for hospitality and travel products, virtual travel communities, to name just a few (Xiang, 2014).

In 2015, new debates considered big data and analytics, mobile sensors and geosocial services, augmented reality, wearable computing, smart tourism, responsive web design and management, and eTourism for development (Tussyadiah, 2015).

Two years later, more recent controversies were debated, such as semantic technologies, electronic distribution and online travel reviews, eGovernment, sharing economy, digital strategies within digital economy. Research advances and innovative ideas were reported, as well as industrial case studies (Schegg, 2017).

In 2018, besides some recurrent themes, the latest research was publicized (Pesonen, 2018), e.g. about online travel reviews, gamification (Flanagan, 2009; Burke, 2014; Jin, 2016), electronic distribution, online education and learning

Finally, in 2019, the focus was directed to virtual reality, peer-to-peer accommodation, hotel technology, robotics, and recommendation systems (Pesonen, 2019).

Solution / recommendation: these and other conferences, as well as seminars and other scientific events, testify the dynamic debate that is being conducted on these urgent issues. Therefore, such effort must go on and be supported by states, municipalities, intercultural scientific and technological communities, corporations and, ultimately, diverse segments of users. Furthermore, articulations between the multiple subjects of cutting-edge research and its inclusion within education and learning institutions must be encouraged, e.g. at public and private universities, polytechnic courses and grammar schools.

Tourism communication via mobile devices

A recent controversy: tourism communication is more and more conducted using *digital mobile devices*, through the so-called electronic and internet-based *e-tourism* and the more mobile oriented *m-tourism* (Egger, 2010, 2011). After all, mobile devices contribute not just to change culture, as stated here in the section on mobile cultures, but also to transform communication itself. New types of social relations emerge from the use of cell phones in all realms of everyday life. For example. a new literacy results

from the combination of textual features of mobile phones to the use of, say, its ringtones. Moreover, a clear dialectic emerges between two articulated processes, that aren't always consensual: on one direction, outstanding technologies become suddenly ordinary and even necessary, as the use of cell phones by all social classes, which is often judged as an aberration of everyday communication. Inversely, ordinary technology often seems mysterious or discussable, e.g. the belief that mobile phones can communicate with the dead, in some regions of Africa and Asia (Katz, 2008).

Solution / recommendation: more studies must be pursued on the utilization of different or opposite opinions, about mobile devices by tourists, within diverse contexts across various destination places, and inside specific situations where communication happens among tourists and local citizens (Lew, 2004; Meng, 2005; McWatters, 2009; Nyerges, 2011; Perkins, 2011; Paganoni, 2015). For instance, case studies and theoretical research on mobile cultures influencing physical or digital interactions during multiples types of tourism: mass tourism, beach tourism, mountain tourism, eco-tourism, cultural heritage tourism, creative tourism, etc.

Broader solutions

It is not feasible to enunciate here all the possible applications of mobile culture into tourism communication. Thus, just some broader considerations including possible trends and respective solutions will be stated below.

We noticed that mobile digital information, knowledge and culture are more and more produced and consumed within multiple and diverse locations of cyberspace, e.g. at sites, wikis, virtual museums etc. And nowadays this is done, extensively and intensively, through mobile devices. These appliances disseminate different configurations of digital information, knowledge, culture and arts, according to the subjects and means of expression implemented in its apps, among other factors.

Cyberspace and cybertime

In order to understand this new social and cultural conjuncture, it is necessary to note the following. Cyberspace, circumscribed by William Gibson (1984), does not exist without cybertime (Andrade, 1996). *Cybertime* is a social process and concept defined as a set of temporalities browsed by Internet users, such as the synchronous rhythm of a chat, an almost synchronous beat of a social network, or the asynchronous rate of a web page. The societal and conceptual constellation cyberspace / cybertime hosts a number of new institutions, organizations, associations and groups, e.g. virtual museums and galleries, which constitute new places of production, exhibition, sharing and criticism of digital culture, knowledge and arts (Parry, 2009).

Web 2.0 and Web 3.0

Among other virtual localities, the user travels across *Web 2.0* (or Social Web) dispositives such as the social network Facebook, or along *Web 3.0* (Semantic Web) instruments e.g. Wikipedia. *Web 2.0* means the so-called second age of the internet, which had a notable development after 2001, and where users became apparently more active than in the precedent decade. In other words, in addition to reading information, they also write content, e.g. posts and comments in blogs, or messages to other users within social networks. That's why *Web 2.0* is also named '*reading/writing Internet*'. *Web 3.0* consists of a network mode, which is censed to foster a new style of reception and production of information,

knowledge and meaning. It is often nominated *Semantic Web*, because its main aim is to construct social semantic sites and networks where their own underlying model of meaning and knowledge is manifest and described (Andrade, 2011).

FUTURE RESEARCH DIRECTIONS

Finally, in this section, some emerging directions and opportunities of research are reported, in order to progressively test the viability of the corresponding paradigms.

Virtual, Augmented, Mixed and Hybrid Realities

In these last years, mobile phones have been enabling applications including some articulation among different reality modes, configurations or constellations. For instance, virtual reality allows immersion of a user into virtual worlds, while augmented reality blends some virtual objects or scenes with physical or social reality. Mixed reality means a fusion of virtual and augmented realities. Beyond this, *Hybrid Reality* transforms the very nature of media involved in a given process. In other words, originating or originary (initial) media will be mutated into original (new, innovative) media.

In this perspective and paradigm of multiples realities, apps may target consumer profiles such as youngsters and tourists: i.e. they can show real locations in images, video, or 3D, and real-time information or knowledge about them. This trend inaugurates an *augmented / hybrid urban culture* and an *augmented / hybrid tourism*, where the reality of leisure (free time from working hours) is enhanced or blended by the combination between (a) spectacular entertainment and (b) relevant information or knowledge on places visited and on cultural events.

Worldwide cities have been supporting such intelligent development strategies for mobile societies and cultures, e.g. through programs UNESCO Creative Cities and Smart Cities. And research will find here proficient opportunities to develop innovative reflections and novel applications to multiple economic, social and cultural uses.

BRIEF CONCLUSION: MOBILE TOURISM COMMUNICATION, A NEW FORM OF ACTION AND KNOWLEDGE?

The preceding sections circumscribed the main issues and debates on the subjects in question. Some concluding remarks are the following:

Firstly, mobilities, mobile cultures and tourism communication, not just constitute recent and somehow unexplored networks of *mobile social practices*. They also emerge as webs of subjects in constant *reflexive mobility*, convoking multiple areas of information and knowledge, such as economy, management and social sciences.

Secondly, such perennial movement of practices and discourses circumscribes a specific *style of tourism communication*, which is becoming not just *intercultural* in the confluence of citizen and tourist cultures, but more and more a somehow *hybrid communication*. This means that communication in the area of tourism is using different instruments and methods, that are blended in order to organize and do the management of diversified and complex contacts, decisions and messages shared and exchanged among the stakeholders involved in tourism activities.

Thirdly, this hybrid nature of mobile tourism communication, may constitute pertinent reflections within new *savoirs*, such as *Hybridology* (Andrade, 2015). This term means the interpretation of all kinds of hybrid entities, within our interconnected world, which shares, mix and fusion all local and global processes, structures, contexts, events, actions, subjects and objects.

In sum, all conclusions proposed inside this mobilities realm are, so far, inconclusive. Therefore, the present text just intended to furnish some clues to the possibilities, but also to the limitations, of this mobile debate on contemporary social processes such as mobile culture for tourism communication, that are irreversibly mobilizing and transforming our contemporary mobile world.

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KEY TERMS AND DEFINITIONS

Citizen: A social actor who inhabits within a democratic society. (S)he may establish pacific or conflictual relations with other city inhabitants or visitors, such as tourists or immigrants.

Cybertime: The rhythms that an internet user activates when s(he) explores digital network's territories within cyberspace.

Hybrid Reality: A fusion of various configurations or constellations of reality, e.g. Mixed Reality and the so-called "Real Reality".

Mixed Reality: This concept signifies a fusion of Virtual and Augmented Realities.

Mobile Culture: A recent mode of production and consumption of information, knowledge and culture, articulated to social mobilities and discourses on the urban, and mainly activated through digital mobile devices, such as cell phones.

Mobilities: In our contemporary world and societies, all processes, capitals, actors, and things, and even spaces and places, are permanently on the move and being transformed.

Tourism Communication: This concept is based on three main modes of communication: (a) *interpersonal face-to-face interactions* among tourists and inhabitants, citizens and immigrants within a physical and social destination place; (b) *classical mediated communication*, undertaken by tourists through tourism institutions (tourism central or local offices), tourism organizations (tourism agencies) and via mass media e.g. newspapers, television; (c) *digital media*, for instance tourism sites and social networks and, recently, digital mobile media. Mobile devices are the main tool that contribute to the emergence of both the so-called electronic and internet-based *e-tourism* and the more mobile oriented *m-tourism*.

Tourist: A social actor, originating in a departure society and culture, that visits destination societies and cultures, within (her)his leisure time.

Web 2.0: The so-called second age of the internet, that had a notable development after 2001, and where users became apparently more active than in the precedent decade. That is, besides reading information, they write content, e.g. posts and comments in blogs or messages to other users in social networks (Facebook, etc.). That's why Web 2.0 is also named '*reading/writing internet*'.

Web 3.0: This network mode is censured to foster a new style of reception and production of information, knowledge and meaning. It is often nominated *Semantic Web*, in that its main purpose is to construct, deconstruct and reconstruct social semantic sites and networks, where their own underlying model of meaning and knowledge is manifest, described, narrated, and interpreted.

The Integrated Tourism Analysis Platform (ITAP) for Tourism Destination Management

10

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INTRODUCTION

Tourism in the European Union (EU) is the third largest socio-economic activity and the world leader in tourism destinations, making an important contribution to the EU's gross national product and employment. Tourism is an important sector for sustainable local development, by preserving and enhancing cultural and natural heritage. The European Commission estimated that European tourism industries are almost 2 million, most of them small and medium-sized (SMEs), providing work for 5% of the total EU workforce (Juul, 2015).

In the tourism sector, data analytics using information on online platforms are the order of the day, offering results and value conclusions. Even so, according to the literature review (Wong, Law & Li, 2017), the work done so far, has focused on technical aspects of the analytical, and few of them in the tourist management. Of these, a part has focused on understanding the mobility of tourists based on different criteria, such as space, time, and the profile of visitors (Vu, Leung, Rong & Miao, 2016; García-Palomares, Gutiérrez & Mínguez, 2015; Kádár & Gede, 2013; Leung, Vu, Rong & Miao, 2016). And so, understand the relationship between types of attractions and types of tourists or the difference between visitors and residents. Other works have also used the digital track, to make tourist recommendations (Xu, Chen & Chen, 2015; Okuyama & Yanai, 2013; Jiang, Yin, Wang & Yu, 2013; Kurashima, Iwata, Irie & Fujimura, 2013). But only one work (Zhao et al., 2017) has been found that analyzes the images to predict the interests of visitors and another recent work (Cai, Lee & Lee, 2018), which takes into account the factors of space and time sequentially.

Online social networks have features common to several user profiles, such as demographics (location, age, gender, education) and interests (religion, sports, politics, music, literature). Such a profile can act as an integration element with other elements (Boyd, 2008). Features such as updates and comments allow the users to evaluate the content and to serve as recommendations to other users. The metadata gives the possibility to create references such as the Twitter hashtags (#) with titles, descriptions, category and keywords, from which, it's possible to filter or extract information.

The existing opinion extraction systems nowadays are created to analyze the English language and for specific text topics, such as movies or other type of product reviews. More than just evaluating the positive or negative feelings of the sentences, the data of social networks can provide more information regarding particular aspects, for example, tourism. Opinions in social networks have been generally classified according to its polarity (positive or negative) and intensity (number of opinions). Sentiment

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analysis is a huge step concerning machine learning and the latest trends include the development of routines allowing clarifying the lexical subjectivity of options. The analysis of information from social networks comprehends two main areas: Social Network Analysis and Sentiment Analysis. The first concerns pattern detection for descriptive or predictive relations between the elements of social networks (Curran, O’Kane, McGinley & Kelly, 2010), assuming that these patterns are important parts of the users’ interaction with the real world. It’s known as link mining since not only identifies categories, but also relationships and attributes of the analyzed nodes, from which it’s theoretically possible to predict the node and link connection to other nodes, via neighboring algorithms and even clustering of nodes with common structure. Sentiment Analysis is the text treatment according to the development of algorithms and lists to represent statements as positive, negative or neutral regarding a given topic (Pang & Lee, 2008). The World Wide Web allowed developing more studies in this field, since the production of information led to Big Data. The answer to Big Data was the development of techniques to extract relevant information through the interpretation and classification of contents from websites, blogs, forums, open data portals and social networks, among others. Liu (2010) presented the steps that comprise the sentiment analysis process: extraction of relevant information; identification of objects and features of the referring opinions; classification of sentiments; and visualization.

We intend to combine opinion mining with the geospatial location of a touristic review to enable a context-aware analysis of the ITAP data. Instead of overwhelming the user by showing the details first, we visually group similar patterns together and aggregate them by applying Self-Organizing Maps in an interactive analysis application. Thus, ITAP will be able to cope with unstructured touristic user feedback data and shows location dependencies of significant terms and sentiments. The capabilities of our approach are shown in a case-study regarding “Intelligent Analysis of tourists’ behavior” in Barcelona using real-world user feedback data exploring and describing interesting research questions.

BACKGROUND

Tourism is a phenomenon that reaches social, cultural and economic spheres focused on the movement of people from their usual locations to other places, motivated by personal or professional purposes, such a broad field of study is also a great opportunity to improve the services of Startups (e.g. Travel & tourism Barcelona Startups such as Grandtourgo (2018) or Authenticitys (2018) and of companies specializing in internet-related services and products in the hotel, lodging and meta search fields (e.g. Trivago); and also develop new business opportunities as well as technological evolution. And despite being an unpredictable branch of the economy due to factors such as political instability and natural disasters, Tourism continues to be a growing sector in Global economy with a GDP growth of 4.6%, surpassing the growth of global economy (3.0%), while generating over 8.2 trillion dollars and 313 million jobs in 2017 (Statista, 2018a). Tourism in the European Union (EU) is the third largest socio-economic activity and the world leader in tourism destinations, making an important contribution to the EU’s gross national product and employment (Statista, 2018b).

These figures point out the need to have better information systems for stakeholders or common users. Buhalis (2003) pointed out the necessity of better integrated systems of information and communication to develop the tourism sector and evolving it within businesses and organizations, 15 years later with the advent of big data and real time data, information in the tourism sector is no longer just a necessity, it’s the driving force behind its strong growth.

The role of technology in tourism transformed common travelling into “smart tourism” with the internet becoming the main distribution channel and evolving it to e-tourism (Buhalis, 2003) in a similar framework to e-commerce, where users would access online tools to acquire services and products, increasing the touristic network and thus, increasing the need of specialization of tourism companies. The technological response evolved from the searches via personal computer and the need of time for travel preparation to the current touristic patterns where providing experiences can be made almost in real time with the use of mobile technology, such as tablets and GPS technology.

Smart tourism is the evolution from e-tourism in a sense that data can be collected, shared, stored and analyzed with algorithms to maximize future users’ experiences using the users’ own perception regarding the visiting sites. This new paradigm changes the users’ experiences while creating new business models with new touristic flows, better services, more advertising models and innovation with the association of tourism with other business segments. The application of smart tourism nowadays is more applied to cities in a sense that there’s still a high need of infrastructures, resources and business density to access the required data to achieve efficiency, sustainability and quality of life while developing new ways to create value.

The Integrated Tourism Analysis Platform (ITAP)

The ITAP solution must be presentable for the tourism stakeholders and easy to use for the end users. The end-users will range from specialized researchers studying the tourism fluxes, Public bodies (NSI), tourism agencies or ICT working under the Tourism Directives.

In June 2010, the European Commission adopted the Communication, “Europe, the world’s No. 1 tourist destination – a new political framework for tourism in Europe”. This framework consisted in four major points of action:

1. To stimulate competitiveness in the European tourism sector.
2. To promote the development of sustainable, responsible, and high-quality tourism.
3. To consolidate Europe’s image as a collection of sustainable, high-quality destinations.
4. To maximize the potential of EU financial policies for developing tourism.

Our vision embodies these four points, while providing a contribution in terms of technological solutions, while following the Open Source Vision.

Tourism is an important sector for sustainable local development, by preserving and enhancing cultural and natural heritage. According to the latest data from the Organization for Economic Co-operation and Development (OECD), in OECD Member States, tourism directly contributes, on average, around 4.7% of GDP. The European Commission estimated that European tourism industries are almost 2 million, most of them small and medium-sized (SMEs), providing work for 5% of the total EU workforce (Juul, 2015).

Following the Lisbon Treaty, the European Commission prepared a strategy for Tourism via projects and initiatives to provide mainly financial support for tourism in the EU. The aim is to maintain Europe as a leading destination while contributing for the industry’s contribution to growth and employment with the promotion of cooperation between EU countries (Juul, 2015). The main technological challenges for tourism will consist in “keeping up to date with IT developments caused by the globalization of information and advances in technology (IT tools for booking holidays, social media providing advice on tourism services, etc.)”. ITAP intends also to provide an answer for tourism services using social media.

The Commission promoted several projects and initiatives, such as grants and events (e.g. the annual European Tourism Forum), competitions and webinars (web seminars on e.g. marketing tourism businesses online), websites providing networking opportunities (e.g. www.tourismmlink.eu), studies and surveys (e.g. Eurobarometer reports on the preferences of Europeans towards tourism). There was also promotion to the involvement of SMEs and various tourism stakeholders, such as local and regional authorities. In 2009-11, the EU allocated €1-1.5 million per year for Calypso projects and for 2012, €450 000 (Juul, 2015). The funding for these projects came from the Entrepreneurship and Innovation Programme (EIP), and since 2014, from the Programme for the Competitiveness of Enterprises and SMEs (COSME). In order to develop sustainable tourism, the Commission has co-founded the development of cultural routes that help European as well as non-European tourists to discover how Europeans have lived since ancient times. It has co-funded, for example, the development of a route of astronomical sites in Europe (in Greece, Spain, Italy, Portugal and Bulgaria); such as a long distance EuroVelo route (e.g. the Iron Curtain Trail which invites tourists to discover the former division of Europe on a 6 800 km cycle track along the former border), combining European culture, history and sustainable tourism.

The EU provides support to the tourism business sector in three ways: 1) Digital Tourism, 2) Professional Skills, 3) Enterprise Europe Network. The ITAP solution intends to be transversal to these three aspects, since it's a different technological solution, from which it will be also possible to extract information to have means to improve the professional skills from the users (e.g. locating agencies related to the tourism sector) and to promote brands and businesses related to this activity.

ITAP's Objectives

The main goal is to take advantage of the ENERGIC OD Virtual Hubs and Open Data portals, Mobile, Geotagged city information, Open data, Social media data containing information about touristic events; from ITAP crowdsourcing platform; from sensor conception and existent experimentations, namely the data from the Internet of Things native experimentation (wireless sensor network experiments) and service provision experiments (applications using real-time real-world generated sensor data). In this sense, it was intended to implement an interactive dashboard to integrate and explore different data sources related with tourist management.

ITAP's Architecture

The ITAP solution will be built on the existing scientific and commercial achievements to test the applicability of using Mobile, Geotagged city information, Social media, Crowdsourced and Open data for tourism analysis. Web-based application will be deployed to analyze crowd gatherings, based on an application to detect crowd gatherings from mobile location data automatically. Geotagged city information, Social media, and Open data will be used to add contextual information to tourist movements. The existing sensor networks and experiments will be used to test the effects of various environmental factors on tourism, such as: Internet of Things native experimentation (wireless sensor network experiments) and service provision experiments (applications using real-time real-world generated sensor data).

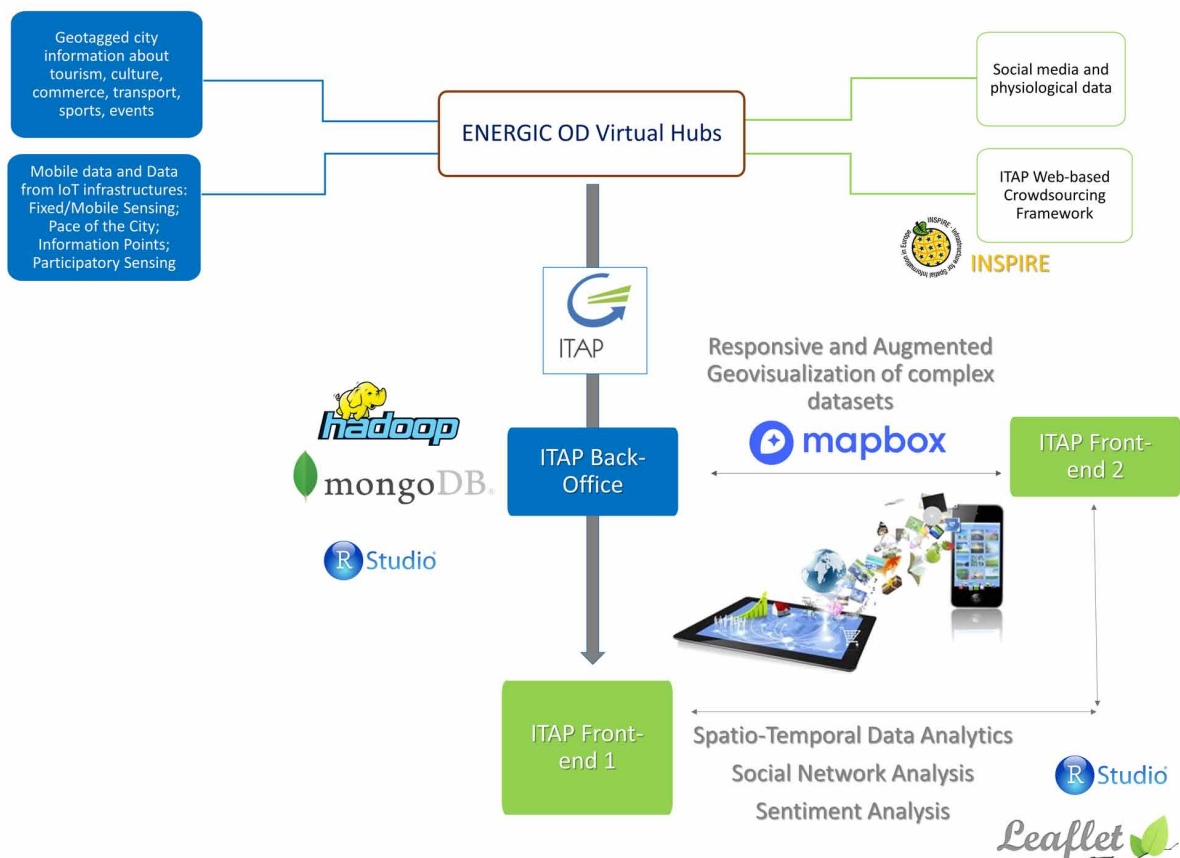
The ITAP solutions will rely on Big Data Technologies, namely the MongoDB, SparkR and Shiny - RStudio. The use of several large datasets and their integration will push the capabilities in terms of customizability and data processing. In a context of tourism-related big data, we face a challenge of integrating several data sources in different categories: data generated by users including online textual data and online photo data; device data (by devices), including GPS data, mobile roaming data,

Bluetooth data, etc.; transaction data (by operations), including web search data, webpage visiting data, online booking data, etc. Therefore, carrying different information, different data types address different tourism issues in ITAP.

Datasets to be used in the interactive dashboards:

- Data sources integrated in the ENERGIC OD Virtual Hubs.
- Mobile data (e.g. Orange, Vodafone).
- Data from IoT infrastructures: Fixed/Mobile Sensing; Pace of the City; Information Points; Participatory Sensing.
- Geotagged city information about tourism, culture, commerce, transport, sports, events.
- Open Data such as Open Street Maps (OSM) and Open Data portals.
- Social media data for contextual information, such as, Twitter, Facebook, Flickr, Instagram and TripAdvisor.
- ITAP Web-based Crowdsourcing Framework. Includes INSPIRE data together with the crowdsourced data. The crowdsourced data will be structured according the INSPIRE Data Specification on Population Distribution.

Figure 1. Proposed flow diagram of ITAP



The system architecture of the ITAP will include two main components (Figure 1): ITAP Back office and ITAP Front-end modules 1 and 2. The ITAP back office corresponds to a Processing layer / Low-level processing, based on MongoDB and SparkR, where will be performed data curation, pre-processing of the raw data (structured, semi-structured and unstructured) and implementation of machine learning models for opinion mining. All datasets, according to geospatial according to the Open Geospatial Consortium (OGC), will be collected with data collectors in order to be harmonized and stored in a standard format (GeoJSON). Concerning the Opinion mining, we intend to implement a novel method in the RSpark framework. The algorithms will exploit the hashtags and emoticons as sentiment labels, and proceeds to a classification procedure of diverse sentiment types in a parallel and distributed manner.

The ITAP front-end module 1 and 2, based on Shiny - RStudio, will allow the users to explore data analytics and interactive visualizations of the distinct data sources. The ITAP front end module 1 will allow the Spatio-Temporal Data Analytics, Social Network Analysis and Sentiment Analysis with the geospatial location. The second module of the ITAP interactive dashboard will be used to display the relationship between the local attractions (events, cultural venues) and the foreign visitors in a visual immersive way. We expect to achieve unusual results with strong visual representations accessible on location.

Discussion

Knowing the tourists' behavior is very useful for tourism destination management when planning territorial and marketing strategies, however, it is also of interest, for those tourist information platforms, when making suggestions in person. The ITAP tool could be valuable for projects related with "Intelligent Analysis of tourists' behavior".

In this kind of case study, it is intended to analyze and know intelligently, what is the visitors' behavior and the criteria for decision making regarding their trip. In order to achieve these objectives, visitors' information can be analyzed, such as knowing their destination, the typology of visited sites and the emotions expressed during the travel. The sources of information will be TripAdvisor, Instagram and data of mobile phones.

In order to strengthen the information, it will be used Artificial Vision technologies to detect the typology of activities carried out by the tourists, as well as the location. Machine Learning, Deep Learning and Natural Language Processing algorithms will be applied to extract emotions from the social networks publications.

It is expected that the combination of these sources and with the use of the ITAP tool, the extraction of information can solve questions, such as:

- What is the interest of a certain area and how much time is it spent on it?
- What are the areas with the lowest satisfaction levels? And the ones with greater satisfaction?
- What are the routes that generate the most satisfaction?
- What are the most visited areas, that generate fewer publications?
- What is the relationship between the types of activities carried out during the morning and those made during the afternoon? And the activities that are done during the year with those that are made during the holiday period?
- Which tourists will repeat the visits? What are you interested in? What other tourist destinations will you visit?
- Where do the visitors generate a positive satisfaction?

FUTURE RESEARCH DIRECTIONS

Interactive decision-support tools, such as ITAP, have become an essential tool in outcomes improvement for integrated tourism analyzes. They can provide important insights and near real-time data, helping touristic destination managers and citizens make better decisions about tourism events and patterns. Today, decision-support tools are evolving beyond traditional dashboards into true real-time reporting and customizable self-service tools that meet the ever-growing demands of tourism data.

In the next steps, we plan to extend the data source catalog with more private data, and implement a new module integrated in the ITAP Dashboard in which citizens and policy makers can share and co-create personalized visualizations. Therefore, with the ITAP integrated dashboard, we intend to present a new and comprehensive way of enabling citizens to define and adapt tourism-related real-time data visualizations by themselves. Instead of relying on pre-packaged solutions that can only address restricted and communal needs, we enable and touristic destination managers and citizens with little or no expertise to create their custom visualizations taking advantage of the provided functionalities in ITAP Front-end modules 1 and 2.

CONCLUSION

With ITAP will be easy to use and provide near real-time data about tourism events and venues linked to social media data, Open and Crowdsourced data, geotagged and sensor city information related to environmental aspects, and users and touristic destination managers can have access to the deep insights in their data and can use the knowledge to drive improvement initiatives.

In this sense, ITAP leads to the definition of many key aspects to building a good decision-support tool. The following five features are essential to implement this interactive decision-support tool:

- Be easily accessible: A decision-support tool should be easily accessible to each user who will need to tap into its insights.
- Display reliable data: Users need reliable, trustworthy data.
- Contain relevant data: A good decision-support tool should only contain the factors users need.
- Use timely data: A decision-support tool needs to contain near real-time data, so users can address challenges promptly.
- Include trends and/or benchmarks: Trends and benchmarks show users where they've been and where they are going. This retains them involved and motivated.

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KEY TERMS AND DEFINITIONS

Big Data: Mainly was used as a term to define a large or complex volume of structured, semi-structured and unstructured data that can be mined for information and used in machine learning projects and other advanced analytics applications.

Crowdsourcing: Obtaining information's or inputs by enlisting the paid, or normally unpaid services of a large number of people, typically via internet.

Data Analytics: Discovery, interpretation, and communication of meaningful patterns in data; and the process of applying those patterns towards effective decision making.

ITAP: Integrated Tourism Analysis Platform.

Natural Language Processing: Sub-field of Artificial Intelligence that is focused on enabling computers to understand and process human languages, to get computers closer to a human-level understanding of language.

Sentiment Analysis: The process of computationally identifying and categorizing opinions expressed in a text, especially in order to determine whether the writer's attitude towards a particular topic is positive, negative, or neutral.

Smart Data: Formatted digital information so it can be acted upon at the collection point before being sent to a downstream analytics platform for further data consolidation and analytics.

Social Network Analysis: Process of investigating social structures through the use of networks and graph theory.

Exploring Terroir Zone and Tourism Cluster Based on GIS Mapping

10

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INTRODUCTION

Terroir in term of agro-viticulture at the plot scale demonstrates significant differences of grape varieties, rootstocks and soil management practices in which different degrees of variability of environmental factors. Terroir related to agro-viticulture primarily focuses on the relationships between environmental factors related to vines, the quality of grapes and wines in order to assess the potential of vineyard quality and the indigenous knowledge in the defined area (Goulet & Morlat, 2011). Terroir is a spatial, ecological and cultural concept that links the cultivators with the special agricultural practices (traditional knowledge and cultivating technology), and it focuses on environment factors such as terrain, soil and climate conditions. Terroir conveys geographical distinctiveness, culture identity of a collective memory and a framed place name against globalization food production (Bowen & Zapata, 2009).

Even the agricultural products are not cultivated on a terroir zone, the linkage between agriculture and tourism is still evident. The nature of agricultural products, availability of other supporting cultural and tourism products, and proximity to markets vary from place to place. These factors influence the form and strength of links that can be fostered between agriculture and tourism. Stratford and Muskoka, both at a similar distance from metropolitan Toronto with strongly seasonality in their agricultural products and tourism, demonstrate different extent of agriculture linkages with tourism. Stratford with possessing more productive farmlands has a much stronger agricultural resource base than Muskoka, while Muskoka has longer history for tourism development based on the forested-lakes complex. Although neither of Stratford and Muskoka has the reputation to claim status as a “terroir” in the absence of a specific place branding strategy, both have successfully developed culinary tourism by the linkage of agriculture and tourism (Lee, Wall & Kovacs, 2015).

The Niagara Region has become home to an emerging New World Wine Route by the competitive advantages of winery clusters on the increasing in scale for marketing is the horizontal cluster advantage of the wineries surrounding the heritage-shopping town of Niagara-on-the-Lake. The complementary to the wineries of close to 60 tourist shops, numerous accommodation establishments, a historic fort and a festival theater reveals the advantage of tourism cluster. At the Regional level, the entire Niagara Wine Route with over 50 wineries, which are connected to the major tourist attractions of Niagara Region. Label of origin is particularly useful for the embeddedness and convention for marketing terroir specialties. By insisting upon a strong link in production to the ecology and culture of terroir, a local brand in the natural process labeled by terroir is essential. Several destinations and festivals promote their terroir specialties to serve as major tourist foods (Telfer, 2001).

A viticultural terroir is related to a particular area with a distinct quality of grapes and their wines in France. Although the conception of terroir is used as an analysis unit for comparing chemical composition of vintage products in different viticultural zones (Schlosser, Reynolds, King & Cliff, 2005; Bonfante, Basile, Langella, Manna & Terribile, 2011; Bowen & Zapata, 2009). Terroir means a small

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area of land reveals characteristics of a cultivation zone, an environmental complex including conditions of terrain, climate, and soil. Terroir related researches have mostly focused on the relationships between the quality of grapes or wines and a few environmental factors for the past 30 years. Until 1990s, GIS mapping was used on the concept of terroir by focusing on spatial analysis of diversity of viticultural environments in different areas (Vaudour, 2002). Thus, there is a need for empirical research on a better meaning of linkage between terroir and tourism by using GIS mapping to define terroir zone and its impacts on tourism cluster. This chapter aims to define different agricultural terroir zones, analyze the influencing factors on the spatial distribution of terroir zones by processing GIS mapping to examine the role of terroir specialty on how to shape a tourism cluster.

Although the linkage between agricultural products and tourism was weak on the food supply chains of hotel service sectors, the development of tourism itself does not trigger decline of agricultural sector, and the demise of agriculture can be attributed largely to the emergence of tourism as a viable alternative to a chronically unstable agricultural sector. Actually, the linkage between agriculture and tourism plays an importance role on the dimension of tourism development. When tourists are seeking authentic and unique experiences, agricultural products bring tourists in close proximity to the host culture, which can be as an input to tourist attractiveness. Foods and beverages have long been regarded as important components of tourist experiences, often can promote destination image and as contributors on festivals. Regarding to travel motivation, foods and beverages range from high interest to a destination as the primary motive to visit a specific restaurant or winery by accidental discovery (Plummer, Telfer, Hashimoto & Summers, 2005).

Terroir specialty, in relation to tourist food, sustains cultural heritage, promotes destination's visibility, especially for a significantly larger proportion of peak season, and offers a destination a longer, more sustainable to sell local produces (Everett & Aitchison, 2008). Local specialty referring to visitation of food festivals, restaurants or specific locations for food tasting, experiencing the attributes of cultivation region may be as a primary or secondary tourism motivating factor. Accordingly, terroir specialty can be transformed as a manifestation of tourist food by tasting local food or visiting local food consumption spaces such as restaurants and coffee shops, which become the places of culture performance, rather than simply physical consumption.

BACKGROUND

A number of researches use GIS mapping to define meaningful areas according to different given indexes. Hsueh (2013) defines a clustering area of locations of mushroom huts based on GIS mapping according to the indexes of environment complex of slope, elevation, ventilation and water supply. Hsueh & Chen (2015) use GIS mapping to distinguish a clustering area of locations of tea processing firms distributed on a tea specialized cultivation area to confirm the co-location concept of industry cluster according to the indexes of environmental complex associated with accessibility, climate conditions and terrain conditions. Hsueh & Hsieh (2017) use GIS mapping to clarify a clustering area of pineapple dining industry including pineapple bakeries, creative restaurants and pineapple vendors based on point density analysis, buffer analysis and overlay analysis according to the indexes of terroir zone, tourism cluster, climate conditions, terrain conditions and local practices. Hsueh & Chang (2017) use GIS mapping to define a tourism potential area with ranked scores according to the site criteria of elevation variation, slope diversity, proximity to water, accessibility and service facilities. Hsueh, Chuang & Hsieh (2018), based on GIS mapping, explore a clustering area of tourist spots in a peripheral mountain area to develop

niche tourism in consideration of the linkage between organic agriculture and tourism, creative knowledge and religious attractiveness. Obviously, GIS mapping performs well for defining the clustering area of tourism development, especially on the linkage between agriculture and tourism by overlaying the locations of agricultural farms and tourist spots.

DEFINING TERROIR ZONE BASED ON GIS MAPPING

Taiping District, in the eastern part of Taichung City, is famous for a number of agricultural products, especially as the birthplace of loquats of Taiwan for a long cultivation history. Loquat, cultivated in Taiping District about for 257 hectares, is a kind of high-value cash crops, and the production season ranges from February to April. The climate condition of Taiping is foggy frequently and the temperature varies greatly between day and night, suitable for planting loquats. To promote loquats and other agricultural products, Taiping government holds a series of festivals and events in each year, especially featuring the Bamboo Festival, Lychee Festival and Loquat Festival to market the year's best loquats, bamboos and lychees. Figure 1 illustrates Taiping's terrain condition of elevation altitudes including several hill areas including Shan-Ding-Hill, Jiu-Tong-Hill, Tou-Bie-Hill, Jin-Zi-Dong-Hill, Che-Long-Hill, Da-Jian-Jiao-Hill, and Da-Hen-Ping-Hill. Figure 2 shows the spatial distribution of the three main agricultural products of Taiping District by using GPS positioning the sets of points of locations of 80 loquat farms, 300 bamboo farms and 1650 lychee farms to specify on the GIS raster surface.

Figure 1. Terrain condition of Taiping District

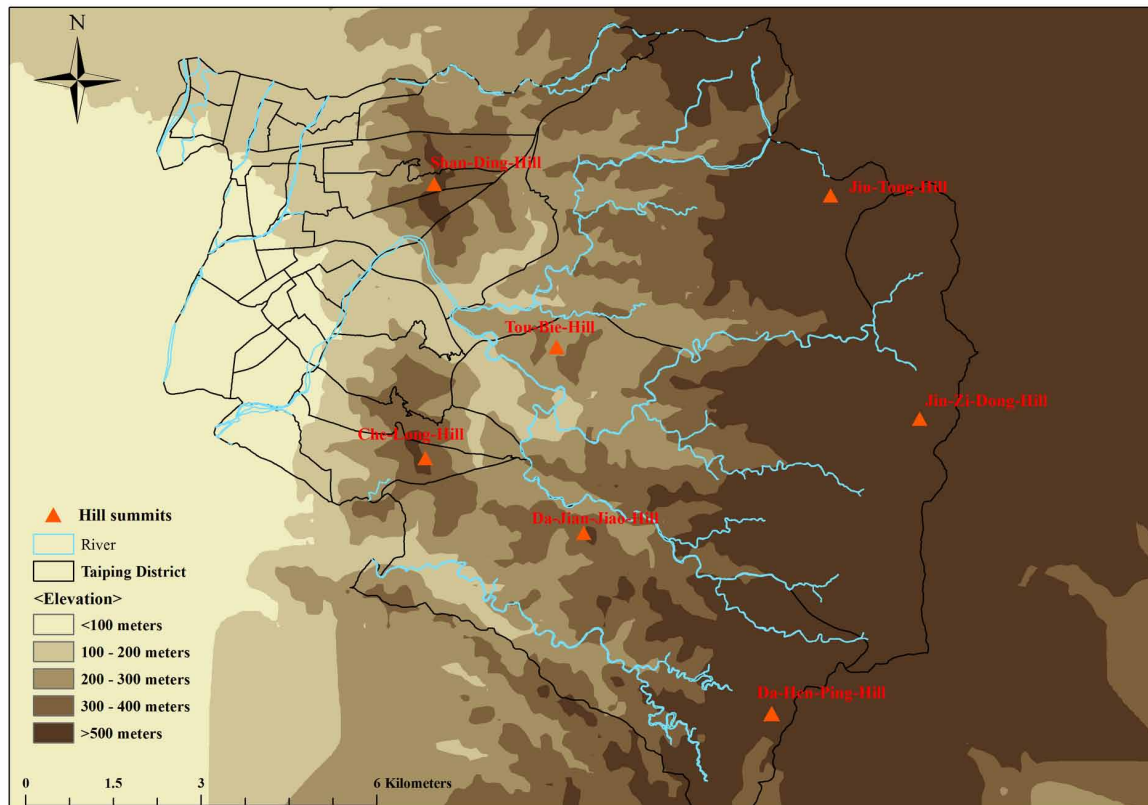
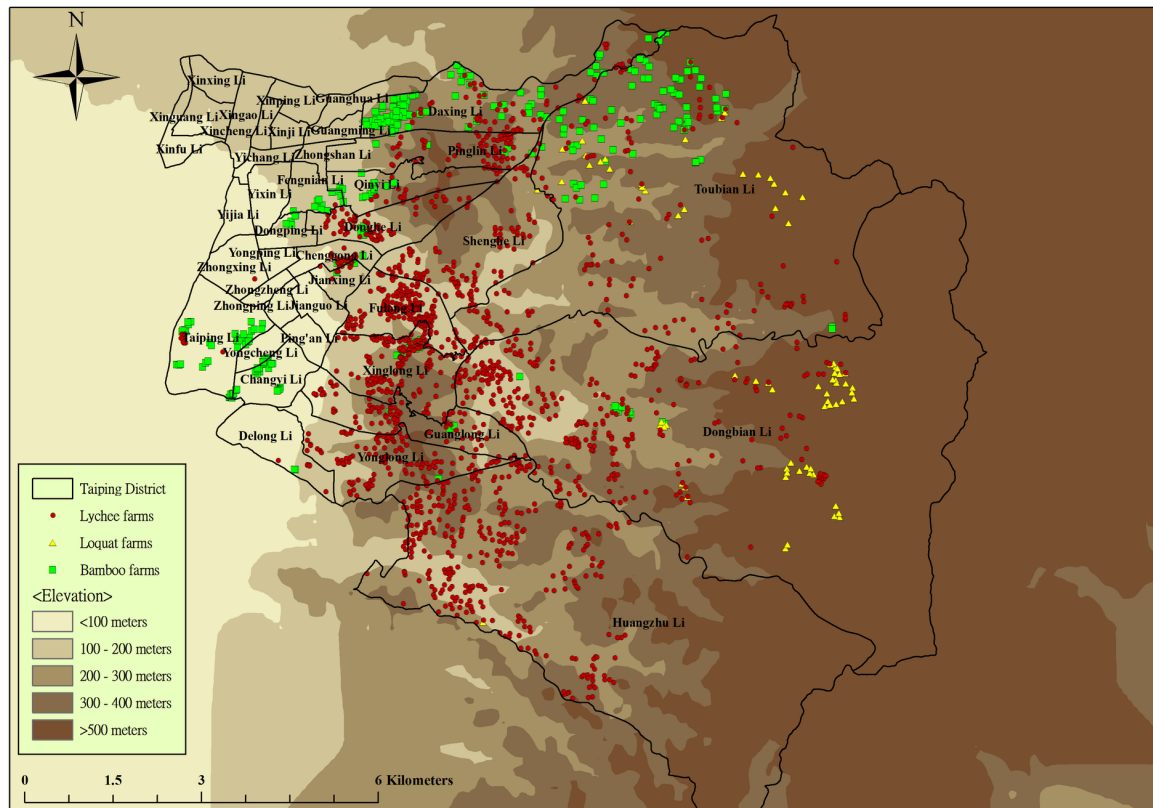


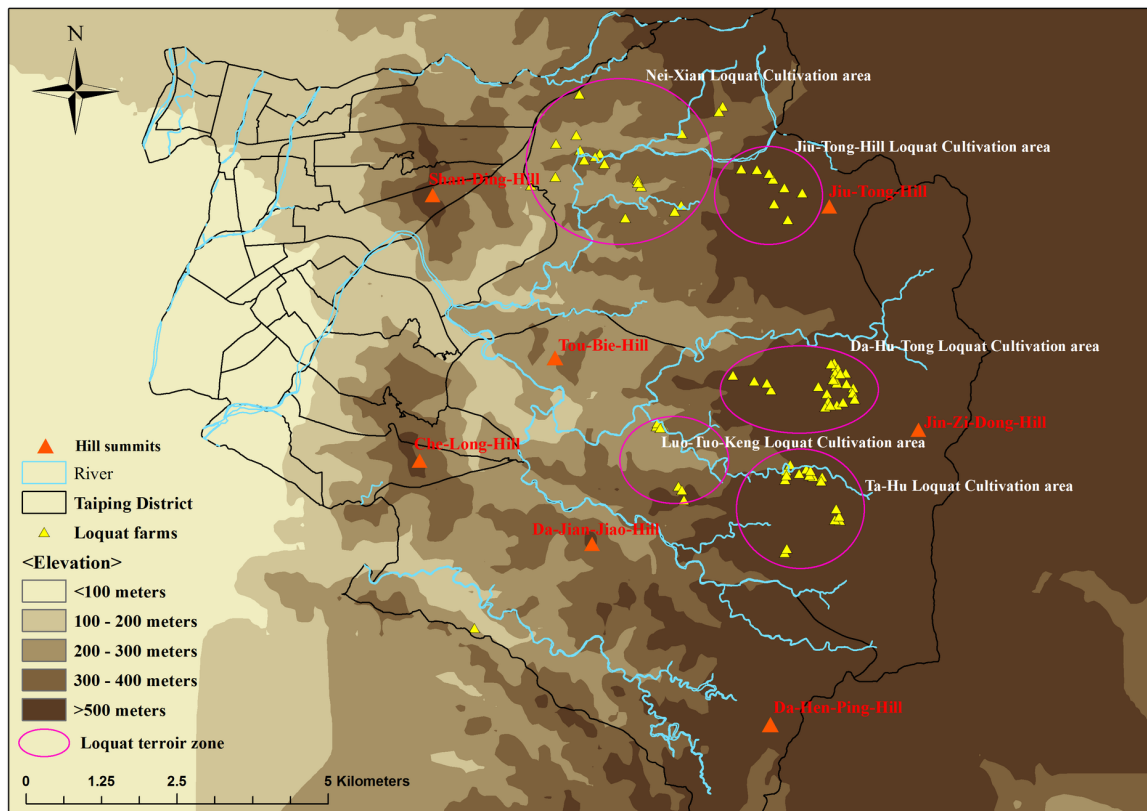
Figure 2. Spatial distribution of loquat farms, bamboo farms and lychee farms in the District



GIS point density analysis can be used to examine spatial clustering of creative industries by locating the sites of creative industry parks and visualize the core area of creative industries clustering (He & Gebhardt, 2012). To define the terroir zone in the District, this chapter also uses GIS point density analysis to sum up as the clustering area of cultivation of different terroir specialties including lychee, loquat and bamboo (cell value 300x300 meters, searching radius 500 meter). Point density analysis is suitable for defining a clustering core or concentration zone of several layers on which each layer is with a set of points. Point density analysis is based on estimating the quantity of points per cell on each neighborhood of a defined searching radius. The harvest season of loquats in the District is in March and April. Loquat tree is wind and drought tolerant, but sensitive to temperature condition, adapted to a subtropical to mild temperature, tolerate temperature as low as 15°C without damage. The killing temperature for the flower bud is too cold below 10°C, and for the mature flower is above 35°C of high heat. The climate condition of high heat above 35°C and sunlight during the winter often results in sun-burned fruit. Loquats grow well on a variety of soils from sandy soil to heavy clay and even limestone soil. Slightly acidic soil with pH range of 5.6 to 6.8 is considered optimum for loquat cultivation. The soil in Taiping is sand shale soil well to be drained and light in texture.

Based on GIS mapping, the loquat terroir zone as illustrated in Figure 3 is consist of 5 loquat specialized cultivation areas including Da-Hu-Tong cultivation area, Luo-Tuo-Keng cultivation area, Nei-Xian cultivation area, Jiu-Tong-Hill cultivation area and Ta-Hu cultivation area. Most of the loquat cultivation areas in the District are located on high elevation hills, and it also reveals that the suitable elevation for

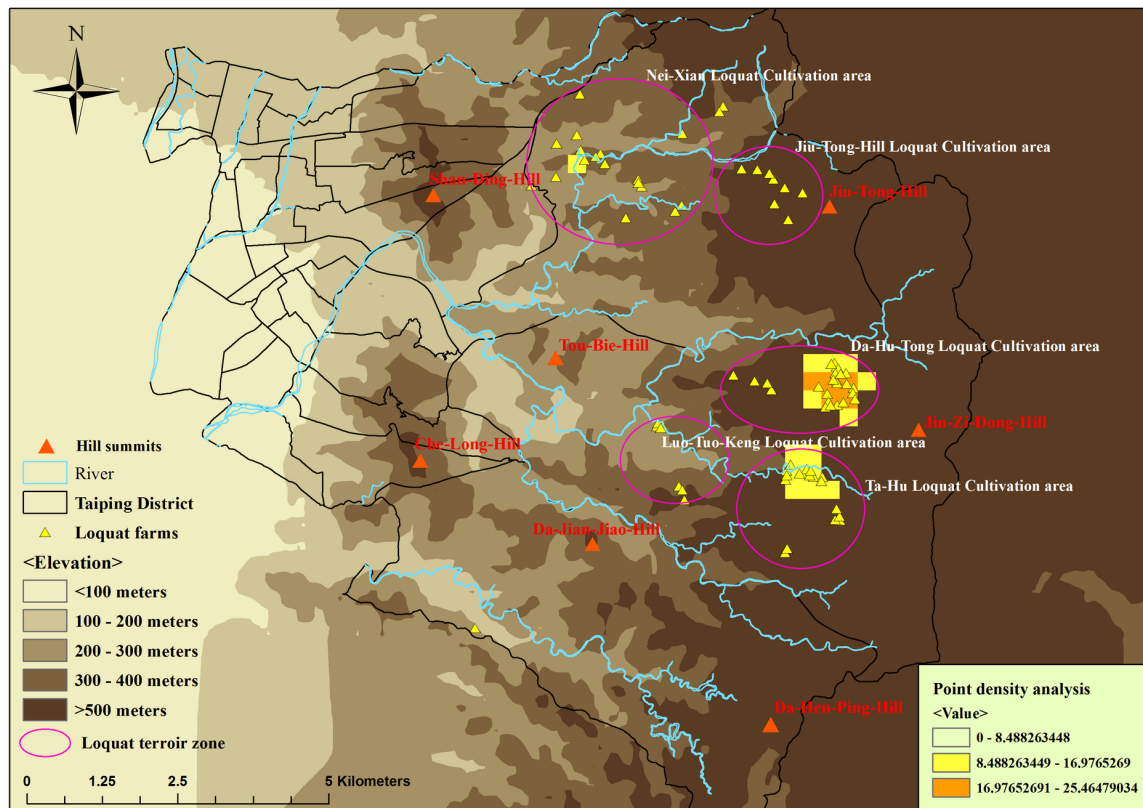
Figure 3. Loquat terroir zone in the District



loquat cultivation is over 500 meters, cold temperature for loquat growth. Figure 4 indicates that the area with the highest point density value between 16.97652691~25.46479034 is located on Da-Hu-Tong cultivation area, the next are Ta-Hu cultivation area and Nei-Xian cultivation area with point density values between 8.488263449~16.9765269, so Da-Hu-Tong cultivation area, Ta-Hu cultivation area and Nei-Xian cultivation area are the 3 significant loquat cultivation areas in the District. Actually, the original loquat cultivation area was located on the Tou-Bie-Hill area in the District in the early stages, but the elevation of this area is below 500 meters not suitable for cultivating loquats due to its heat condition, so the loquat farmers move to high elevation hills of over 500 meters to cultivate loquats. Although Tou-Bie-Hill area was well known for loquat cultivation and there is no loquat farm now, the loquat origin of place brand of “Tou-Bie Loquat” is still the favorite in Taiwan.

The harvest season of bamboo shoots for eating in the District is from March to November. Bamboo is suitable to grow in the climate conditions of high temperature and high humidity, adapted to the terrain of elevation below 500 meters. Bamboo shoots grow well on a sandy soil with slightly acidic soil of pH 7, and the soil in Taiping is sand shale soil well to be drained and light in texture. Based on GIS mapping, the bamboo terroir zone in the District is illustrated in Figure 5, which is consist of Shan-Ding-Hill cultivation area, Che-Long-Pu cultivation area and Nei-Xian cultivation area. Most of the bamboo cultivation areas in the District are located at the elevations below 500 meters, and it also reveals the suitable climate condition for bamboo cultivation is high temperature. Figure 6 indicates the areas with the highest point density value between 39.04601289~58.56901932 are located on Shan-Ding-Hill cul-

Figure 4. Point density analysis of locations of the loquat farms in the District



tivation area and Che-Long-Pu cultivation area, 2 significant bamboo cultivation areas in the District. Actually, the most famous bamboo in the District-King bamboo is cultivated in the Che-Long-Hill area, but this kind of bamboo is rare, not easily available to pick and grows on steep slope, so this bamboo also called “beheaded bamboo” to describe the risk to bamboo farmers. Beheaded bamboo has been described as “King of bamboos” because of its flavor difficult to find. Due to the delicious and the fresh, Taiping bamboo is popular for cooking a variety of creative cuisine. Annually, Taichung City holds Taichung Bamboo Competition for marketing bamboo, and Taiping bamboo often wins the championship in the competition, thus Taiping bamboo is branded with the origin of “Golden Bamboo”.

The harvest season of lychee in the District is in June and July. Lychee, similar to bamboo, is also suitable to grow in the climate conditions of high temperature and high humidity, adapted to the terrain of elevation below 500 meters. Lychee grows well on a sandy soil with slightly acidic soil of pH 5.0 ~ 5.5, and the soil in Taiping is sand shale soil well to be drained and light in texture. Based on GIS mapping, the lychee terroir zone in the District is illustrated in Figure 7, which is mainly including Shan-Ding-Hill cultivation area and Che-Long-Hill cultivation area. The 2 significant lychee cultivation areas both are located at the elevations below 500 meters, and it also reveals the suitable climate condition for lychee cultivation is high temperature. Figure 8 indicates the area with the highest point density value between 117.9868674~176.9803009 is located on the Che-Long-Hill cultivation area. Actually, the most famous lychee in the District is nuomici lychee cultivated in the Tou-Bie-Hill area, also called “Queen of lychees” to describe the special flavor of juicy and delicious. Due to the fragrant and the sweet, Taiping lychee is

Figure 5. Bamboo terroir zone in the District

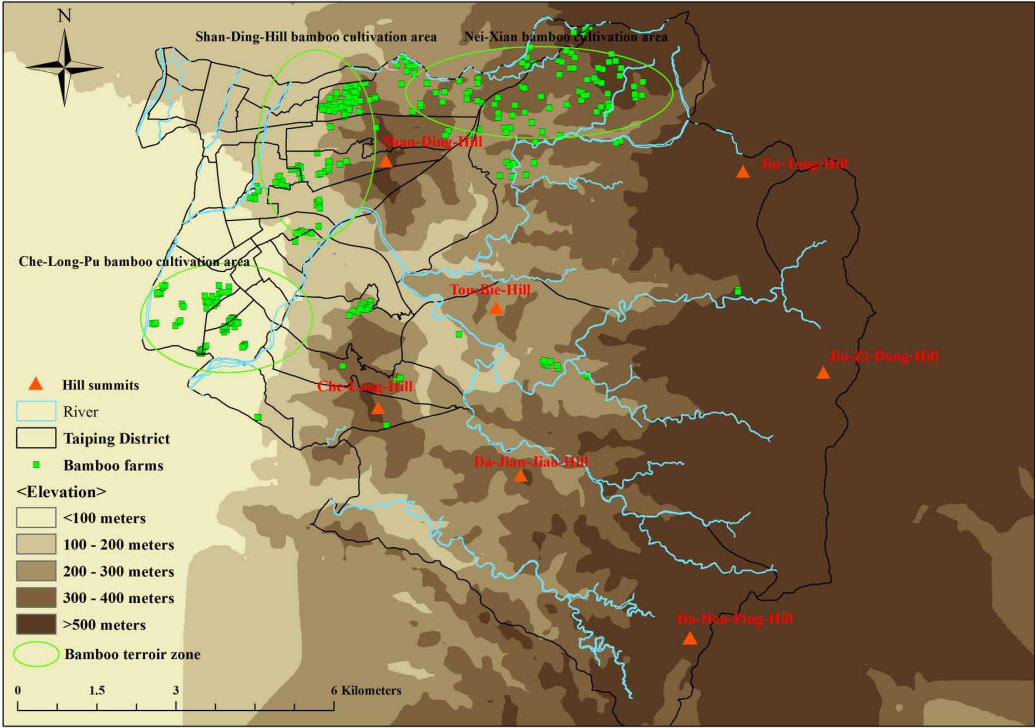


Figure 6. Point density analysis of locations of the bamboo farms in the District

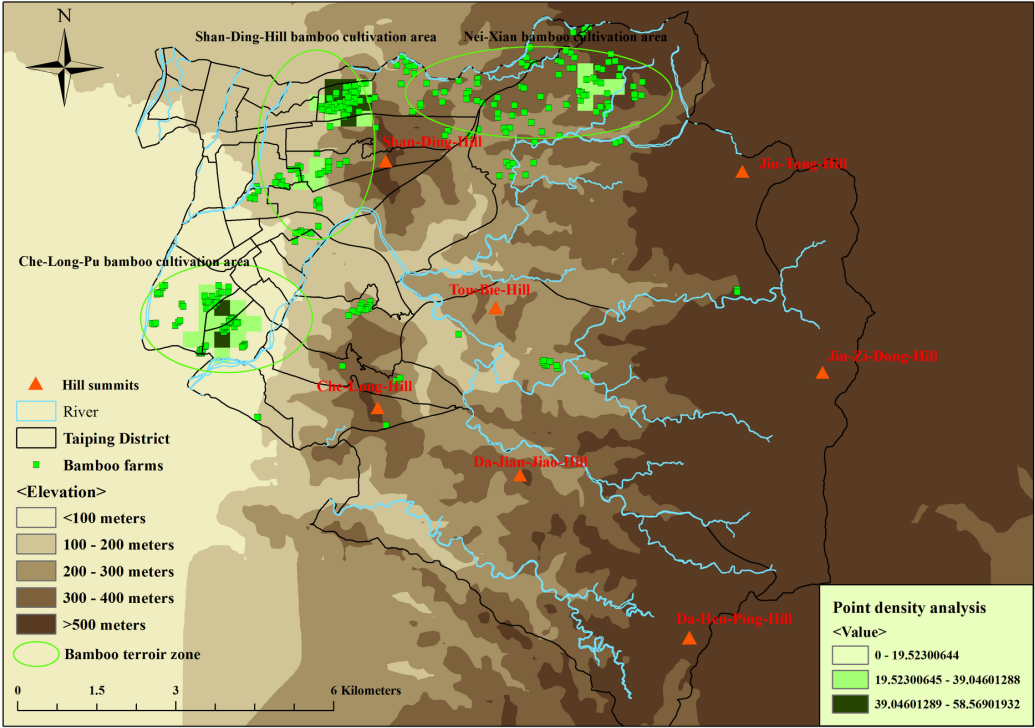


Figure 7. Lychee terroir zone in the District

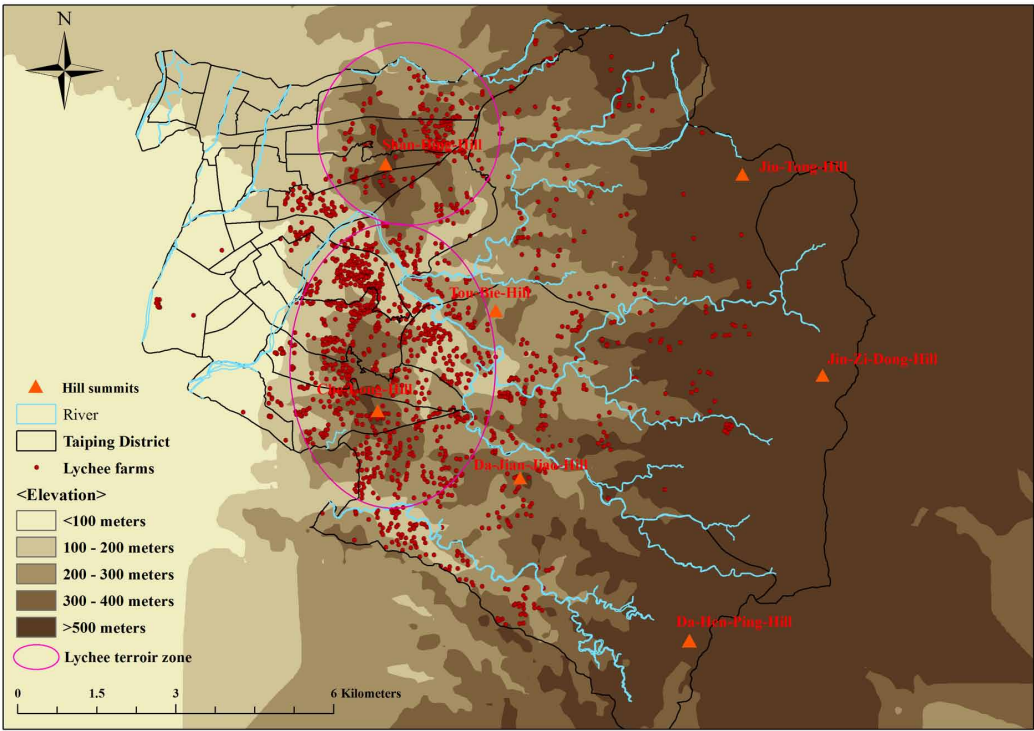
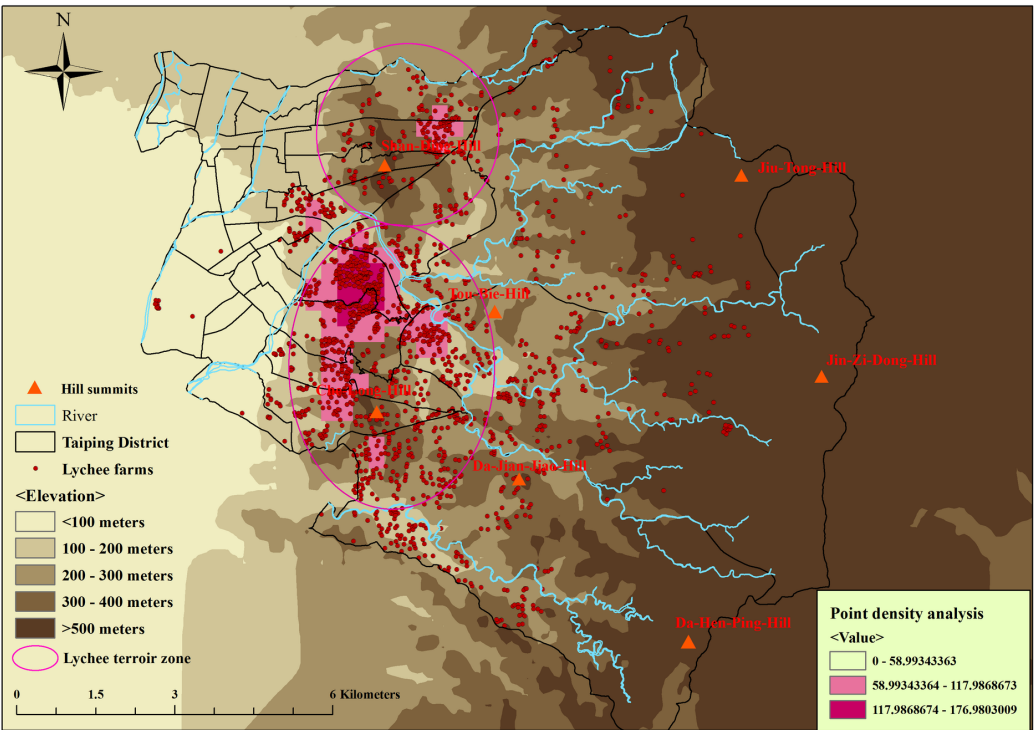


Figure 8. Point density analysis of locations of the lychee farm in the District



popular for cooking into dishes as ingredients of a variety of creative cuisine. Annually, Taichung City holds Taichung Lychee Competition for marketing lychee, and Taiping lychee often wins the championship in the competition, thus Taiping lychee is branded with the origin of “Golden Lychee”. Combined with Figure 4, Figure 6 and Figure 8, the common terroir zone of loquat farms, bamboo farms and lychee farms can be distinguished to be from Che-Long-Hill through Shan-Ding-Hill to Nei-Xian hill area.

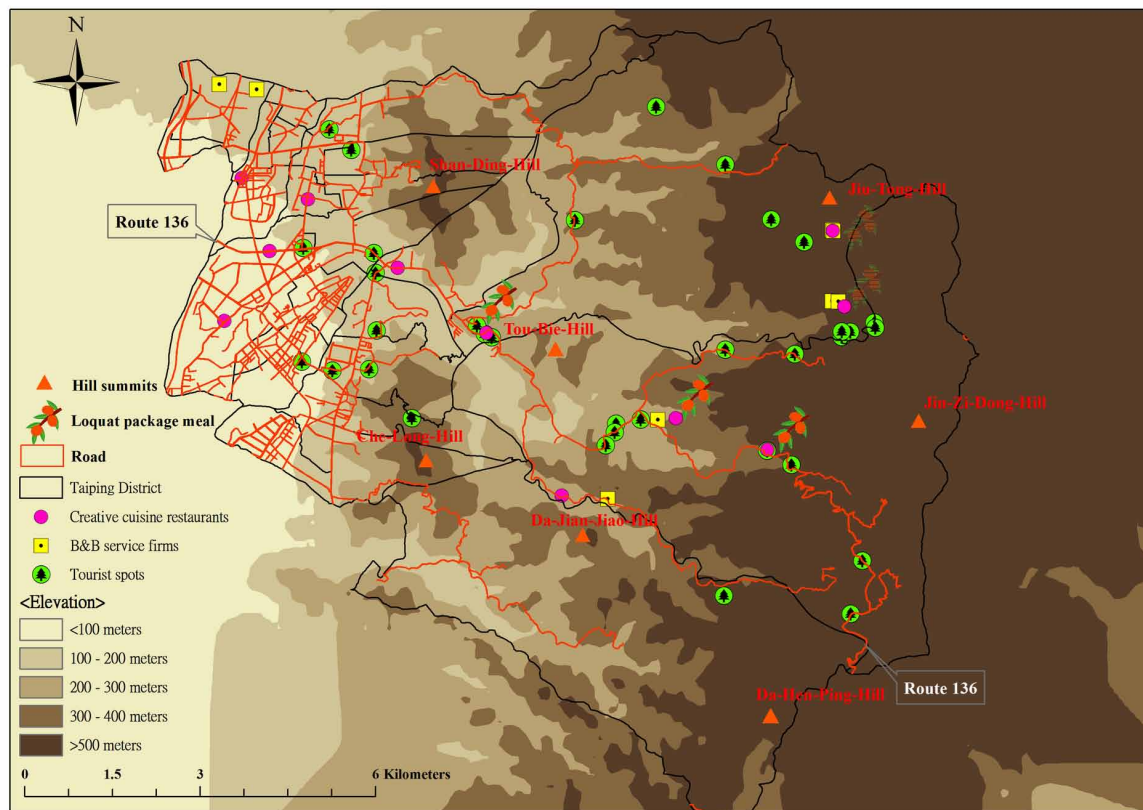
THE LINKAGE BETWEEN TERROIR ZONE AND TOURISM CLUSTER

A positive linkage between tourism and agriculture is demonstrated on the Spanish coast which indicates that tourism has been the motor for the development of agriculture in Cambrils (Hermans, 1981; Torres, 2003; Berno, 2011; Everett & Slocum, 2013; Kim & Ellis, 2015). According to Bowen, Cox & Fox (1991), tourism is supposed to regenerate agricultural production regions with gastronomic tastescape that draw on charming concept of pursuing purity and landscape. Socher & Tschurtschenthaler (1994) categorize agriculture to two dimensions of supply for tourism-direct supply, which involves the sale of agricultural products to tourists, and indirect supply, which involves agricultural landscape preservation as tourism resource. Accordingly, symbiotic relationship of agriculture and tourism is demonstrated on the classification scheme developed by the analysis of agricultural sector shaping leisure attractions on three main components: cuisines, tours, and leisure activities. Local creative cuisine can be distinguished by offering different tasting flavors as a pull force of tourist attractions. Traditional agricultural production region is transforming its nature essence to visitors, negotiating a balance between the daily operation of business and demand for new experiences of tourist consumption. When the agricultural production region is simultaneously the consumption space of landscape and leisure activity, the living space of arable land for farmers is also transformed to destinations for travelers (Everett, 2012; Rogerson, 2012).

The linkage between tourism and agriculture reveals the complex of terroir zone and tourism cluster by enhancing the supply of local agricultural products to promote the terroir specialties. On the dimension of how to transform terroir specialties to tourist foods, festival activities play an important role. In an effort to increase the consumption of tourist foods, regular meetings held between government sectors, agricultural associations and tourism related sectors example for restaurants and B&Bs. Consequently, the restaurants serving local creative cuisines, B&Bs offering beautiful scenery and popular tourist spots with historical culture are combined together to promote Taiping tourism by holding several festivals during a year regularly such as Taiping Loquat Festival and Taiping Lychee and Bamboo Festival. Figure 9 illustrates the obvious tourism cluster in the district, especially in Route 136 a number of restaurants, B&Bs and tourist spots cluster here providing a competitive advantage for the tourist foods and landscape sceneries. Route 136 is an important access of tourism cluster, along it many vendors for the sales of loquats, bamboos and lychees in different production seasons based on the place brand of “Taiping”.

Taiping’s festivals including Loquat Festival on March, Lychee Festival on June and Bamboo Festival on July not only help marketing terroir specialties but also allow tourists to experience the agricultural landscapes and appreciate the terroir zones. Taiping Depth Travel Center, Taiping Farmer Association and several local associations cooperate to market Taiping tourism with the linkage established between tourism cluster and terroir zone. Tourism promotion can focus on tourist foods which may stimulate terroir specialty demand, while agricultural promotion may focus on picking activity and lead to a growth in tourism, thus terroir specialty and tourism combine to link symbiotic relationship. Annual Taiping loquat, bamboo and lychee Festivals celebrate the terroir specialties by holding creative cuisine competitions well-known for providing creative cuisine of healthy, tasty and colorful dishes. While the festivals

Figure 9. Tourism cluster of tourist spots, B&Bs and creative cuisine restaurants



hold, a number of brochures present “creative cuisine served as loquat wine, loquat fish, loquat chicken, loquat sea food and loquat dessert combined with loquat sightseeing bus tour” to attract tourists. The restaurants contribute to promote the linkage between agriculture and tourism by providing creative cuisines, such as loquat wine baked fish, bamboo steamed fish, bamboo baked duck, lychee sweet and sour fish, as well as lychee salmon roll. A living expression of the concept of terroir refers to an area or terrain, usually rather small, a marked influence on its inhabitants believing in rooted terroir customs or idioms of interplay of human ingenuity and practice with the native place (Barham, 2003). The creative cuisines on the festivals reflect the involvement of powerful social actors, such as farmer’s associations on how to make the transformation from terroir specialties to high quality tourist foods.

In addition, Taiping’s tourism cluster not only is confined to the Route 136 but also concentrates in the loquat, bamboo and lychee terroir zones. As evident in Figure 9, several restaurants, B&Bs and tourist spots cluster in the Jiu-Tong hill area, Che-Long hill area and Shan-Ding hill area, which specify the appealing of place characteristics as well as tourism potential by holding creative cuisine festivals. On the festivals, Loquat and Lychee Tourist Bus offers various creative cuisine itineraries of package tours to visit different terroir zones for picking loquats and lychees as well as dropping off and picked up in front of the creative cuisine restaurants. In 2017, a package tour of “Loquat Tourist Bus” is promoted for experiencing the “loquat package meal” including Oxbow Lake Story Island restaurant’s lychee kiln pizza, Taiping Depth Travel Center’s loquat pineapple baked shrimp and loquat sauce ribs, Gao-Chao-

Sen-Huo restaurant's loquat package meal, Yuan-Jung 136 Coffee restaurant's loquat roasted chicken and La Fatte's loquat roasted chicken and loquat baked lamb chops.

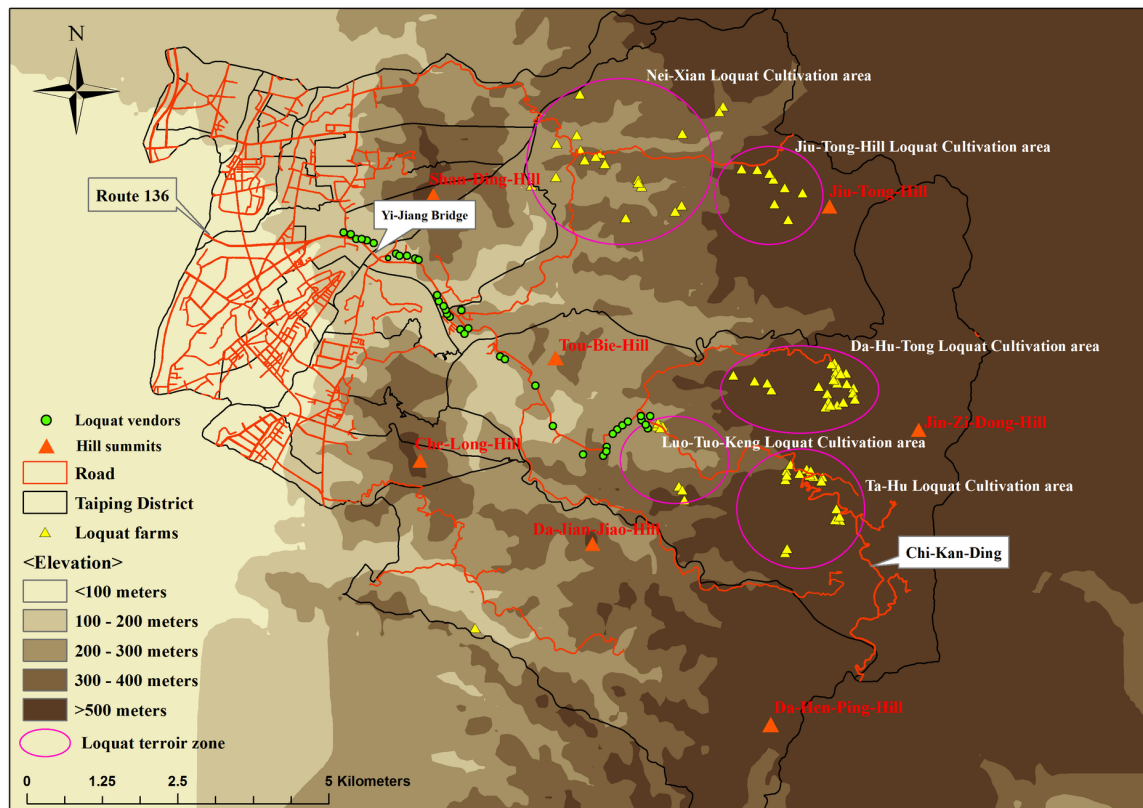
Four factors mainly determine the style of Taiping creative cuisine are government support, terrain, climate condition and making practice. Especially, making practice is the primary factor to determine the style of creative cuisine based on the indigenous knowledge on the dimension of how to cook dishes and turning terroir specialties to tourist foods. The tourism cluster of tourist spots also stimulates the demand of creative cuisines, the transformation of terroir specialties to tourist foods, and the providing places to pick agricultural products. The loquats, bamboos and lychees in the District are consumed fresh, baked, juiced or preserved in a wide variety of creative cuisines such as crushed loquats or lychees for jam, vinegar, enzyme and ice cream. The Wine and vinegar, which is made by fresh loquats or lychees, are served as beverages. The Chunks of loquats bamboos and lychees are also can be preserved as conserves. The Loquat or lychee jam can be filled to bread or cake as an ingredient. As the famous agricultural terroir zones, there are plentiful loquats, bamboos and lychees to cook dishes for creative cuisine in the District, thus the restaurants, B&Bs and vendors are flourishing to promote tourism along the main access of Route 136 in the District.

Terroir specialty can be transformed into tourist food, place identity of a collective taste memory and the level of perception of know-how in terms of timing of the growth cycle by demonstrating the characteristics of environmental complex. Tourism cluster in the District is relation to the geography proximity of locations of tourist spots, B&Bs and creative cuisine restaurants. The B&Bs and creative cuisine restaurants dedicate to make creative cuisines to celebrate the loquat, bamboo and lychee festivals. The festivals attract a number of visitors for tasting the creative cuisines featuring the best quality, seasonal and fresh ingredients from the terroir specialties. A famous creative cuisine restaurant-La Fatte, located at the elevation of 750 meters in the Jiu-Tong-Hill area is famous for taking Taichung city night view. The creative cuisines of La Fatte has expanded to more than making delicious dishes-fresh fish with loquat brew and lychee scallops garlic shrimp, in step with creating fantastic desserts such as lychee loquat pizza to emphasize stronger linkage of cuisine and terroir.

Several restaurants also offer a variety of loquat, bamboo and lychee creative cuisines in the district such as Bambino restaurant's bamboo soy-stewed pork and pickle cabbage bamboo, Peng-Cheng-Tang restaurant's bamboo soy-stewed pork, Lin-Ji restaurant's bamboo chicken, Xin-Tai-Ji-Dian restaurant's king bamboo sesame chicken, A-Lang restaurant's bamboo shrimp roll, Yan-Yang-Lou restaurant's lychee bamboo sea food, Gao-Chao-Sen-Huo restaurant's tenderloin loquat roll and loquat duck breast, Oxbow Lake Story Island restaurant's aloe loquat, and Yuan-Jung 136 Coffee restaurant's loquat coffee chicken. Apparently, loquat, bamboo and lychee have been transformed to tourist foods in supporting the development of a myriad of related products on festivals. Indigenous dishes provide tourist attractions of terroir specialties as a symbol of place brand based on the visibility of creative cuisines, which confirm the distinctiveness associated with the terroir zones.

The cycle of peak tourist season and the harvest time of agricultural products of loquats, bamboo and lychees are synchronous in the District which reveals the tourism potential of terroir specialties, which can become tourist attraction by offering terroir-related cuisines or souvenirs. Annually, the food trail of Route 136 from Yi-Jiang Bridge to Chi-Kan-Ding feature the terroir specialties of loquats, bamboos and lychees on the harvest seasons due to the geographical proximity of a number of vendor's cluster. Similar to the concept of terroir of French, the demarcation of terroir zone according to the climate, terrain and soil conditions, the loquats, bamboos and lychees are appreciated for the distinctiveness and flavors. Due to Route 136 can link loquat terroir zone, bamboo terroir zone and lychee terroir zone efficiently, this route has become a famous food trail to buy fresh loquats, bamboos and lychees

Figure 10. A number of vendors cluster along the food trail of Route 136



in different harvest seasons. As evident in Figure 10, a number of vendors cluster along the food trail of Route 136, especially in the section of Yi-Jiang Bridge to Chi-Kan-Ding accounting for 38 vendors. The food trail of Route 136 from Yi-Jiang Bridge to Chi-Kan-Ding is also called “136 cycling Route” due to the characteristics for climbing training of cycling with hairpin turns, accessible from Taichung City, and a series of rising gradients in the last section. Along the food trail, a lot of vendors cluster here has translated the “terroir zone” to a new flourishing “tourist zone” by providing tourist foods related to loquats, bamboos and lychees.

Although there is a process of globalization, tourist foods create greater demands on special local foods and indigenous cuisine (Torres, 2002). Tourism provides the opportunity for direct and indirect linkages with local agriculture and economic benefits derived from tourism in destinations by increasing the number of tourists, the stay duration of tourists and the tourists’ expenditures. A complementary way to promote tourism is to expand the economic linkage by increasing the amount of agricultural products available for sale (Telfer & Wall, 1996). Taiping’s creative cuisines from its terroir zones stimulate Taiping’s tourism cluster. By holding several festivals to market Taiping loquats, bamboos and lychees, Taiping creative cuisines attract a number of tourists to visit (Figure 11, Figure 12, Figure 13, Figure 14, Figure 15, Figure 16), and the creative cuisine restaurants are co-located nearby the terroir zones to take the advantages of spillover effect of tourism cluster and information exchange on the practices of how to make creative package terroir meals.

Figure 11. Taiping Loquat Tourist Bus for marketing loquat package meal on Loquat Festival

10



Figure 12. Taiping Lychee Tourist Bus for marketing lychee package meal on Lychee Festival



Figure 13. Taiping lychee liquor brewed with Taiping queen lychee



Figure 14. Agricultural products cultivated in the terroir zone



Figure 15. Yuan-Jung 136 creative cuisine restaurant serving for famous terroir coffee package meal



Figure 16. The food trail of Route 136 from Yi-Jiang Bridge to Chi-Kan-Ding also called “136 cycling Route”



FUTURE RESEARCH DIRECTIONS

Future research can focus on the relationship of creative cuisine and place brand with advanced aspects on tourism development to identify the importance of terroir zone, including terrain and climate conditions for agricultural products. Implementation of food tourism by marketing specialty and place brands on the aspect of integration of agriculture sector have not reached their maturity to evoke the implication of creative cuisine and terroir zone. Future research and development efforts in the direction also can be demonstrated on the research aspect of “food trail” for its geographical proximity of various specialties and tourism cluster.

CONCLUSION

The linkages between tourism cluster and terroir zones offers in the promoting creative cuisines transformed from local specialties to tourist foods in relation to tourist attractions that feedback the demand of agricultural products. For the local farmers the primary change is the increasing relevance of tourism cluster of tourist spots, restaurants and B&Bs which can offer a combination of local making practices of creative cuisines and the landscapes of agriculture. The creative cuisines of loquats, bamboos and lychees

in the District is characterized by a distinguished design in contrast to other places to take advantage of terroir zones that bring fresh agricultural products baked or cooked by local favorite ways as tourist attractions. The implication of tourism cluster in the terroir zone demonstrates how terroir specialty contribute to the success of tourism on offering creative cuisines with special flavor and promoting the tourist spots for experiencing landscapes. In order to promote the visibility of the terroir specialty, the local restaurants and B&Bs establish additional alliances with other local service sectors such as farmer organizations, farmer markets as well as souvenir shops to enhance tourism development.

Based on GIS mapping, the significant terroir zones not only are clarified but also the primary factor determining the spatial distribution of cultivation areas are examined in terms of terrain conditions. While the linkage of terroir zone and tourism cluster is established, the farmers and local service firms will have a much stronger forces to promote tourism and transform terroir specialty into creative cuisine. The significance of place brand of terroir zone increases an opportunity to promote a new form of tourist food in tourism marketing by tourism cluster combined with the route of food trail. Defining the characteristics of terroir zone aims to further realize the implications of tourism cluster and the formation of tourist zone, which offers and labels of creative cuisines such as loquat package meal, bamboo package meal as well as lychee package meal.

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KEY TERMS AND DEFINITIONS

GIS Mapping: A mapping way to define meaningful areas by spatial analysis according to different given indexes for the representation of a set of points, lines, or areas data.

Terroir Zone: A zone defined by the special agricultural practices of traditional knowledge and cultivating technology related to the environment factors such as terrain, soil, and climate conditions.

Tourism Cluster: A confined area related to tourism development including tourist spots and tourist service facilities such as restaurants, accommodations, and traveler centers.

Tourist Food: A local food with place brand to experience a place culture rather than simply physical consumption for travelers.

Marketing 4.0 and Internet Technologies in the Tourism Industry Context

10

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INTRODUCTION

The development of the Internet and Information and Communication Technologies (ICTs) have been an incredible change for Marketing studies and its classical main activities, price, product, promotion, and distribution. At present, new trends such as collaborative economy and Marketing of social CRM (Customer Relationships Management) content are emerging, affecting Marketing practices around the world (Kotler, Kartajaya and Setiawan, 2017). In this sense, the four “Ps” have been redefined by the four “Cs” (co-creation, currency, community activation, and conversation) (Kotler et al., 2017). These technologies have allowed promoting the development of co-creation activities, with the aim of creating long-term and trust relationships with end users.

Particularly, the technological revolution and value co-creation process have notably affected one of the main economic sectors of the world, such as tourism (Grissemann and Stokburger-Sauer, 2012). Highlights new models of more sustainable, personalized and efficient travel. Virtual reality tools, personalized hotel rooms, voice-activated devices, chatbots or facial recognition technology have facilitated and improved the relationship that, up to the present, companies, destinations, and consumers maintained (Hosteltur, 2019).

Certainly, the relationship between tourism and co-creation is a matter of special interest in the literature (Grissemann and Stokburger-Sauer, 2012; Binkhorst and Den Dekker, 2009; Riera et al., 2015; Prebense, Vittersø and Dahl, 2013; Lee, 2012; Cabiddu, Lui and Piccoli, 2013; Rihova et al., 2015; Suntikul and Jachna, 2016). Cutting-edge tourist companies are carrying out co-creation processes with their consumers. However, and despite its relevance in the innovation process, empirical evidence in research on co-creation in tourism is scarce. Also, there is not enough research on co-creation in tourism (Hoyer et al., 2010; Grisseman and Stokburger-Sauer, 2012; Lee; 2012; Rihova et al., 2015).

In this context, the main objective of this chapter is to study the co-creation process in the tourism sector. First, the evolution of Marketing is analyzed. Second, the value co-creation process strategy 4.0 is examined in the tourism sector. Finally, this study proposes some conclusions, limitations and further research.

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BACKGROUND

In the past half century, Marketing has been through some different stages until reaching the most current era of Marketing, Marketing 4.0. As Erragcha and Romdhane (2014, p.137) posit “*Marketing is a discipline in constant change*”.

The first focus of Marketing is Marketing 1.0 and appeared after the Industrial Revolution due to the development of production (Kotler, 2012). It is a commercial approach to unidirectional management using traditional media (radio, press, television). In this era, the consumer is a passive user and the product is the focal point for the company (Erragcha and Romdhane, 2014). With reference to the tourism sector, a clear example of Marketing 1.0 is tourist brochures, which inspire consumers to choose the destination through photographs of monuments, places of interest and hotels.

Contrary to Marketing 1.0 only focused on the product, Marketing 2.0 places the customer in the middle of its vision (Kotler, Kartajaya and Setiawan, 2010). This is the result of the development of information technology and the Internet (Kotler et al., 2010). This is a new challenge faced by companies that must take advantage of social networks to reach customers directly and individually. In this new era, customers are well informed, can easily compare offers of similar products and choose between a set of functional and alternative features. In fact, each consumer has different preferences, so companies must segment and develop a superior product for a target audience (Kotler et al., 2010). Although companies begin to “touch” the heart and mind of consumers, even in Marketing 2.0, consumers are passive Marketing objects (Kotler et al., 2010).

The idea of Marketing 3.0 was conceptualized in 2005 by a group of consultants from MarkPlus, a Marketing services company led by Hemawan Kartajaya. After two years of collaboration with Philip Kotler, they launched the draft of the manuscript. In this new era of Marketing, companies stop focusing on the consumer and move to focus on the human being. It is the age driven by values. Instead of treating people as consumers, they are treated as human beings, with mind, heart, and spirit (Kotler et al., 2010). In this sense, consumers are concerned about sustainability and the environment and seek solutions to their concerns about globalization and economic justification. This Marketing is focused on the consumer, but the companies aim to contribute to the development of a better world and propose solutions to society’s problems (Kotler et al., 2010). As these authors point out, it is the era of participation and collaborative Marketing, globalization and cultural Marketing, the creative society and the Marketing of the human spirit. In Marketing 3.0, the co-creation concept was born. This concept was coined by Prahalad and Ramaswamy (2004) as a new approach to innovation. The consumer is demanding and informed, has more power with respect to the company and can participate in the development of certain processes with the company. However, companies must develop new strategies to achieve the active and total participation of consumers as well as their emotional commitment (Zarco et al., 2019). In this sense, the key can reside in Marketing 4.0.

Based on these notions, and as a result of the evolution of Marketing 3.0, a new era of Marketing was born, Marketing 4.0, the evolution of Marketing 3.0 when it is used intensively with technology (Zarco et al., 2019). Marketing 4.0 happens as a result of complex changes caused by the increase in global competition, better informed and more demanding customers and the rise of new technologies and innovations (Vassileva, 2017). This new approach is part of the digital age and combines online and offline interaction between companies and consumers (Kotler et al., 2017). The barrage of new technologies such as the mobile Internet, the automation of knowledge management, the Internet of Things (IOTs), cloud technology, robotic advances or 3D printing has helped to develop multiple new sectors of the economy. Above all, the mobile phone has brought peer-to-peer connectivity and more consumer power. At the moment, they are smarter and better informed than in the past (Kotler et al., 2017).

Marketing 4.0 focuses on “*social relationships*”. Currently, consumers rely on the opinions of other users and can make consumer decisions at any time and from anywhere. When they are interested in things they see on television, they turn to their mobile phone in search of opinions from other consumers. When they decide to buy something in the physical store, they look for the price and quality on the Internet. However, they also love to experience things physically and value “*engagement*” when interacting with brands (Kotler et al., 2017). Marketing 4.0 is also based on connectivity. As Kotler et al. (2017) point out, connectivity may be the biggest “*game changer*” in the history of Marketing, by reducing the costs of interaction between companies, workers, partners, customers and other agents of interest (Kotler et al., 2017). Digitization has transformed the decision-making process of the consumer. Therefore, consumers seek information, evaluate products and services, interact with the organization and make purchases (Vassileva, 2017). This decision-making process has been renamed “*the journey of the digital decision of the consumer*” (17). Marketing 4.0 is also be called *Big Data Marketing* by Zarco et al. (2019) and can help Marketing to achieve the company’s objectives. Also, it facilitates the understanding of consumer behavior, and as a result, allows designing Marketing actions that allow the customer’s shopping experience to be more personalized.

Although there has been much speculation, academic journals have published little about Marketing 4.0 (Zarco et al., 2019). For example, Zarco et al. (2019) analyze in depth various concepts of this new era of Marketing, examining how the use of large amounts of data can improve the relationship between the consumer and the brand. Vassileva (2017) analyze the main challenges and opportunities that companies face due to the new digital revolution represented by Marketing 4.0. Similarly, Jara, Parra y Skarmeta (2012) study the different elements of Marketing 4.0 and its evolution from Marketing 3.0; and Świeczak (2017) examines the main challenges generated from innovation and technology. For that, they suggest the conceptual framework D_3I_2C (Design-Direct-Development-Interventions-Innovation-Capacities) that combines the actions of Marketing and digital transformation. According to these authors, Marketing 4.0 is necessary because, nowadays, customers not only demand products that satisfy their needs but also products and services that fulfill their desires or alleviate their anxieties. They are looking for products that allow them to express their creativity and find in them the values defined by Marketing 3.0. In this sense, customers want to be part of the product, contributing and interacting with the company in any stage of its value process. In addition, they want to share their experiences and verify if the product really meets or exceeds the expectations (Łukowski, 2017).

Value Co-Creation in Marketing 4.0

Another of the fundamental premises of Marketing 4.0 is to consider that the structure of power has changed. According to Kotler et al. (2017), this drastic change has been promoted by the development and evolution of the Internet. The set of communication networks has brought connectivity and transparency so that companies have gone from having a vertical structure to a horizontal structure. Now it is the market that provides the ideas and the companies who marketed it (Kotler et al., 2017).

Connectivity has transformed the knowledge of consumers. Above all, social media platforms such as Twitter, Instagram, and Facebook allow customers to show and share their experience and, in turn, inspire other users to enjoy a similar experience (Kotler et al., 2017). Thanks to the integration of technology in Marketing, consumers look for products to which they contribute creatively and want to be part of the product, that is, they want to interact with the product and share their experiences using information technologies (Zarco et al., 2019).

In this new generation, customers not only look for products to satisfy their basic needs, desires or concerns. They also want to express their creativity and the values defined in Marketing 3.0 (Vassileva, 2017). As Kotler et al. (2017) argue, users were influenced by the Marketing campaigns of companies in the past. At present, they trust more in the factor f (friends, relatives, followers and followers) than in experts' opinions. Increasingly, users take into account the comments of other users and the joint design of the brand image or the brand company, which is sometimes very different from the companies that try to project. In this way, the Internet and social media are responsible for the change that has happened in the company-consumer relationship, by providing the platform and online tools. At present, users are no longer passive objects but have become co-creators of value (Kambil, Frisessen y Sundaram, 1999, Prahalad and Ramaswamy, 2004, Binkhorst and Den Dekker, 2009; Rihova et al., 2018, Dolan, Seo and Kemper, 2019). Due to technology, consumers have acquired a new behavior, so they want to know if the goods and services are produced efficiently by the company and if it is sustainable in environmental, economic and social terms (Zarco et al., 2019).

The term co-creation was initially proposed at the end of the 1990s by Kambil et al. (1999) in their article "*Reinventing Value Propositions*". In this study, these authors identified four different functions that customers could perform in their relationship with suppliers, noting as one of these functions as co-creator. This term was referred to how customers cooperate with their suppliers to produce joint value. A few years later, the concept was coined by Prahalad and Ramaswamy in their study "*Co-Opting Customer Competence*" to describe the emerging relationship between customers and companies (Ramaswamy and Gouillart, 2010). In 2004, these same authors developed the concept with the publication of the book "*The Future of Competition*". In this book, they argue that the value is co-created at the point of interaction between the company and its customers. Also, it is created from the experience of such interaction and not derived from a physical product. Since then, the concept of co-creation has been widely studied in the context of Marketing (Zarco et al., 2019) in several areas of research and it has been used in different literature approaches. The concept has become a topic every time more complex (Galvagno and Dalli, 2014). As Ramaswamy (2011) points out, co-creation of value is a widely used term that encompasses everything that denotes the creation of mutual value by several actors. Undoubtedly, one of the most current definitions is provided by Zarco et al. (2019, p.6). These authors consider co-creation a joint creation process in which consumers participate in different value creation activities through which products and services are developed.

Value Co-Creation in Tourism

In particular, social media has completely changed the way in which information related to tourism is generated and distributed (Dolan et al., 2019). The tourism industry is characterized by high contact services, and tourists play an important role in the co-creation of tourist services (Grisseemann and Stokburger-Sauer, 2012). Co-creation in the tourism sector is understood as "*the contribution of inputs made by the customer in the planning process of his trip*" (Grisseemann and Stokburger-Sauer, 2012, p.1484). In this process, clients are considered employees of the company (prosumers) and are partially responsible for their result (Xie et al., 2008). Therefore, they have the freedom to co-create their own experiences (Binkhorst, 2006; Ramaswamy and Gouillart, 2008).

The application of value co-creation in tourism is a matter of special interest in the literature due to the unique characteristics of tourism products and services. Being intangible experiences cannot be measured or evaluated before consumption (Lee, 2012). Therefore, the suggestions and ideas of tourists and travelers are especially important and basic because they will experience if the innovation is effective

or not (Binkhorst and Den Dekker, 2009). Thus, through the process of co-creation, tourism planners and managers have the opportunity to connect with customers in more touch points and influence their level of satisfaction, loyalty, and word-of-mouth (Oliveira and Panyik, 2015).

Currently, and from the academic point of view, publications related to co-creation are increasing in the tourism sector (Binkhorst and Den Dekker, 2009; Grisseemann and Stokburger-Sauer, 2012; Neuhofer, Buhalis y Ladkin, 2012; Rihova et al., 2015; Mathis et al., 2016; Lin, Chen and Filieri, 2017; Shen, Li and Zhang, 2018). As regards work, there are many tourist companies that have developed co-creation activities with their consumers. At present, tourists are more technological and innovative users, looking to enjoy their hobbies and their stay at the destination is shorter. In general, they are looking for an authentic experience (Hosteltur, 2017). On the other hand, the consumer's relationship with tourism products has changed. The company not only informs the tourist, but also company has two-way communication with him. Thus, the process of creating tourist products has also been changed. In this sense, tourism companies not only create and innovate products and services but also co-create with customers (Hosteltur, 2017). Tourists can plan their own trip surfing the web and sharing their own experiences and other travelers' experiences through social networks. As a result of this search on the web, the image of a tourist destination is created and disseminated through these communication tools.

Because of its importance in the planning of a trip, social networks have become a key platform for companies to develop activities jointly with tourists. Through these information and communication tools, they must respond to the comments and ideas provided by users, solving possible problems and accompanying the traveler in the different stages of their trip. In this way, the collaboration and interaction between both parties will improve the travel experience for the user. As a result, this positive travel experience will be projected on social networks creating a favorable image of the destination in the different online platforms.

Then, and based on this literature review, this research work analyzes five cases of companies in the tourism industry that have successfully developed co-creation activities with consumers, using different types of social media with as an online platform.

KLM Royal Dutch Airlines

The Dutch airline KLM has launched an innovation project in collaboration with its customers and through social networks. Using these platforms, travelers can choose the person they want to sit with during the journey, simply by accessing the public profile of these people on LinkedIn and Facebook. Through the “*Meet and Seat*” program, many users are willing to share their profile on these social networks in exchange for knowing someone with common interests and travel to the same destination (ElPaís, 2012). After booking the flight ticket and selecting the personal information that you want to share, the passenger can visualize a map with all the seats of the plane and see where others are seated. Previously, they have also shared their social profile. In this way, the user can reserve the next seat that seems most interesting and then, the selected person will receive a message with all the details (ElPaís, 2012). As the director of the company, Erik Varwijk, points out “*the objective of this service is to connect passengers with similar interests and have a more inspiring journey*” (www.klm.com). For example, users can meet for coffee before the flight, select adjoining seats and decide to share a taxi when landing. The program allows users to share the information they want publicly and make the reservation of the seat from 90 days to 48 hours before departure. This program is available for free only for flights between Amsterdam and San Francisco, New York, and São Paulo. On its website (www.klm.com) there

is a video tutorial showing a map with the seats of the plane. Therefore, consumers can reserve a seat next to a person with similar interests.

In the previous year, KLM launched a contest on its Facebook page to decorate one of its Boeing 777-200 aircraft. Through the Tile & Inspire campaign, the company invited users to create a Delft-style tile with their photo and include a phrase. Four thousand photographs were chosen to decorate the exterior of the plane through tiles in white and blue colors (diariodelviajero.com).

Seville (Spain)

In 2015, through a tourist promotion campaign called “*There is another Seville ... full of experiences*”, the Spanish tourist destination invited users of social networks to send videos of their own tourism experiences in Seville. The objective was to promote the city through original and personal photographs of travelers and users who would make known different aspects and attributes of the Andalusian province. The project was divided into eight categories (Lodgings with charm, Bulls and Horses, Gastronomy, Heritage, SVQ Province Tourism, Festivities, Industrial Tourism, Nature and Active Tourism). As a result of the project, different images were selected to produce a video of tourist promotion of the province of Seville (Prodetur, 2014).

This project, promoted by the Tourism Portal of the Province of Seville, had enormous potential in terms of visual material. The images shared reflected personal experiences of the tourists themselves. The videos and photographs were promoted by individual people, like the videos produced by Marketing agencies. The prize for the most voted video was a stay of two nights and three days in the city that included different experiences, such as a scenic flight through the province, a cruise on the Guadalquivir, visit livestock, two gastronomic experiences and a stay in a hotel (Prodetur, 2014).

Barceló Emperatriz Hotel (Madrid, Spain)

Some companies have gone a step further and have decided to involve their users and followers of social networks directly in the creation of a product or service through a co-creation process. This is the case of the Hotel Emperatriz in Madrid (Spain), which has been completely renovated thanks to an innovative process of co-creating value with its customers. The hotel, belonging to the Barceló travel chain, launched a proposal in June 2015 through social networks and on its website through a platform where the clients themselves contributed their ideas and suggestions. Subsequently, the best ideas were chosen by a court. Once the proposals were approved, they were published on the social networks of the Barceló Emperatriz Hotel and their followers could continue to add new ideas in the furniture and other hotel services (Barra de Ideas, 2016).

In total, more than 1,500 proposals were received. Among these measures have included among other changes in the reception area, in the decoration, greater variety in the breakfast, greater provision of chargers and HDMI and USB ports in each room, a healthy mini bar with the preferred products by Guests and room service 24 hours. Thanks to this co-creation process, the Emperatriz Hotel has gone from being a four-star hotel to becoming a five-star hotel, building a special and different hotel and surprising the most demanding travelers. According to the director of Marketing of Barceló Hotels & Resorts, “*the objective of this co-creation project was to create a different hotel, with unique experiences and with proposals by the future customers*”. This project has allowed the company to actively listen to the customer’s needs, giving them the opportunity to participate in a project with ideas not found in other similar hotels (Expreso, 2015).

Marriot International Hotels

With 500 hotels in 60 countries worldwide, Marriot International launched a successful program called Travel Brilliantly, taking advantage of the launch of the latest Go Pro camera model, Hero 4 model. Due to this launch, the Marriott hotel chain saw an incredible opportunity for its customers to share their tourist experience in her hotel facilities. To do this, the hotel company invited its customers to use the latest Go Pro camera model for free. In return, the company requested they share their photographs and videos through social networks with the hashtags #GoPro #TravelBrilliantly and #Viajegenial, with the possibility of showing their video or photographs on the Marriot website. The objective of the company was to raise the tourist experience of its guests from the Caribbean and Latin America to the highest level. In this way, tourists can share their travel stories in a fun way and directly share their experience with friends, acquaintances, and family. Thus, travelers themselves are used as a source of inspiration and a key motivation for other tourists to stay at one of the Marriot hotels, and like them, enjoy the Go Pro camera during their stay. In addition, customers can get prizes such as Marriott Rewards points, holiday stays, and GoPro cameras. On the other hand, the hotel company can differentiate itself from similar competitors by providing its customers with the enjoyment of incredible and unique experiences.

Heineken

In 2010, Heineken proposed travelers from John F. Kennedy Airport in New York to change their travel plans and venture to visit a known destination. If they want to live a new adventure, they had to participate in Roulette Departure Roulette, a roulette created by the Heineken company to travel to the destination indicated by the game. Thanks to this proposal, the online series Dropped was launched, showing in 12 chapters the adventures of four men who were sent to different destinations in the world with only their clothes and a ticket back to their place of origin (YoungMarketing, 2013). In addition, the followers of the series could send their own experiences to the platform. Heineken's initiative wants to inspire beer consumers to be travelers, not only tourists.

Simultaneously and due to its success, the company developed a strategy for selling special packs of beer. Inside these packs, there were codes for customers to participate in an online game based on skills for survival with the option to win a trip adventure, such as space training. In this way, Heineken consolidates itself as an innovative company that is committed to new Marketing trends, effectively building strong communication relationships with its customers (YoungMarketing, 2013).

CONCLUSION

This study has conceptually pursued three objectives: (1) to examine evolution from Marketing 1.0 to Marketing 4.0; (2) to analyze the concept of value co-creation process and its application in the tourism sector; and (3) to propose several success stories of companies that have involved their consumers in the production process.

Therefore, and based on the review of tourism literature, this work has contributed to a greater knowledge of the meaning, analysis, and application of co-creation in tourism. As suggested by different authors, the value co-creation process is an area unattended in tourism and there are still many unsolved questions in this regard (Grissemann y Stokburger-Sauer, 2012; Lin et al., 2017; Rihova et al., 2018). Above all, research on co-creation and technology in tourism is scarce (Von Solms and Von Solms, 2016).

Undoubtedly, the use of co-creation activities is particularly interested in the tourism industry due to the intangibility of the services. Being intangible, consumers can not experience tourist products and services previously. So, the ideas, comments, suggestions, photographs, and videos of other tourists and travelers become a very reliable source of information when choosing a destination. As Kotler et al. (2017) point out, most consumers are influenced today by the factor f (friends, family, followers, and fans).

FUTURE RESEARCH DIRECTIONS

Despite the relevant contributions to the academic literature, this study has limitations that must be considered as an opportunity for future research. In the first place, this work is a theoretical investigation so that, future research should empirically analyze value co-creation in the tourism sector. Secondly, it would be interesting to examine the reasons that lead tourists and travelers to share their tourism experience through co-creation. Knowing the motivations of the users will enable companies to develop effective, pleasant and entertaining co-creation strategies for its consumers. These activities must generate significant interest in the consumer and, consequently, get ideas and valuable suggestions for the innovation company process. Third, this work has focused on analyzing several success stories of companies in the tourism industry that have to carry out co-creation initiatives with their consumers. However, it would be interesting to examine empirically a specific co-creation project and see what its impact on consumer satisfaction and loyalty, and the other hand, its impact on different result company variables, such as its brand image.

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KEY TERMS AND DEFINITIONS

Big Data Marketing: Set of tools and technological techniques based on the process of large amounts of information in real time, that allow a company to know consumer behaviors and attitudes in the purchase process.

Internet Technologies: Application of technologies and Internet-based communication and information tools to get, store and send data in the business context.

Marketing 1.0: The first focus of Marketing which consumer is considered as a passive user and the product is the focal point for the company.

Marketing 2.0: The second era of Marketing based on social networking sites which consumer is the focal point for the company.

Marketing 3.0: It's the era of Marketing that considers consumers as people with heart, mind and spirit. Marketing 3.0 appears due to factors such as globalization, creativity and the technology development.

Marketing 4.0: New area of Marketing where technology and digitalization have leveraged consumers to be part of companies, participating in the innovation and development of products and services through value co-creation activities.

Value Co-Creation: Collaboration and creative process between the company, consumers and other interest groups based on the interaction, and through which companies develop new products and services.

Destination@–Branding and Re–Branding of Ten European Capitals

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INTRODUCTION

Starting from a broad research programme on *Place-identity and Social Representations of European Capitals in first visitors of six different nationalities* begun by de Rosa in the 1990s (de Rosa, 1995; 2013b) - later developed along multiple interrelated research lines based on *field studies* and *media studies*, inspired by the *modelling approach* (de Rosa, 2013a; 2013c, 2014) - this contribution represents an integrative work concerning a study on the *Destination@-branding* (Morrison & Anderson, 2002) of ten European Capitals through communication via their institutional stems and commercial logos.

The brands of Rome, London, Paris, Helsinki, Vienna, Warsaw, Berlin, Madrid, Brussels and Lisbon are the symbolic tools and cultural artefacts created in different historical periods in order to contribute to the “*distinctiveness*” of the different cities.

Therefore, the first aim is to compare the iconic structural elements of the brands (ancient and modern stems and logos) of ten European capitals, which play a determinant role in the narration of urban history.

This research also compares the social representations evoked by brands (stems and logos) of the ten European Capitals among potential first-visitors.

Moreover, by considering that branding is an evolutionary process (re-branding), this contribution analyses the recent transformations of some commercial brands from a longitudinal perspective.

Finally, this contribution integrates the results of the analysis of the main graphic elements of branding in the framework of the more complex research programme (de Rosa, Bocci, Dryjanska, 2019), suggesting a preliminary overview of the Destination@-Branding focused on the iconic social representations.

THEORETICAL BACKGROUND

Destination branding constitutes a way to communicate a destination’s unique identity by differentiating a destination from its competitors (Morrison & Anderson, 2002; Mitoula, 2019).

According to different authors (Cai, 2002; Florek, Insch and Gnoth, 2006; Nandan, 2005), brand identity and brand image are critical ingredients for a successful destination branding, including two different perspectives:

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- the “marketers” who desire to create the brand identity;
- the “targets” who perceive the brand image (Kapferer, 1997; Florek, Insch and Gnoth, 2006; Qu, Kim & Im, 2011).

In particular:

- Kapferer (1997) and Konecnik & Go (2008) state that before knowing how a place “is” perceived by tourists, it is important to establish how a place “should be” perceived by its target audience; Aaker & Joachimsthaler (2000:68) define brand identity as: “a unique set of brand associations that the brand strategist aspires to create or maintain. These associations represent what the brand stands for and imply a promise to customers from organization members”; while
- following Keller (1998:93) and Cai (2002:723), brand image can be defined as: “perceptions about a place as reflected by the brand associations held in tourist memory; or as a combination of cognitive and affective evaluations stored in the consumers’ minds” (Baloglu & McCleary, 1999; Pike, 2009).

The relationship between destination brand identity and brand image can be considered as circular and dialogic:

- brand image plays a significant role in building brand identity (Cai, 2002);
- brand image is the reflection of brand identity (Qu, Kim & Im, 2011:467); “the reaction to this message in the minds of recipients” (Florek, Insch & Gnoth, 2006:279).

The distinctive and unique image deriving from the brand image differentiates the destination from the competitors and can be used by the marketers for destination branding. In fact, as stated by Cai (2002:722): “Image formation is not branding, albeit the former constitutes the core of the latter. Image building is one step closer, but there still remains a critical missing link: the brand identity”.

The model of destination branding proposed by Cai (2002) is organized around three central elements: brand identity, brand image and brand element mix featured in this contribution. The process starts by choosing one or more brand elements -identifying the destination- and goes on with the formation of “brand associations” (attributes, affective and attitudes components of an image -see also Gartner, 1993; Keller, 1998) driven by brand identity.

Moving beyond the molecular studies interested in identifying the cognitive and evaluative factors in perception, purely focused on the processes of categorization, encoding, storage and retrieval of information in memory, this article captures the multi-dimensionality of the Social Representations Theory (Moscovici, 1961/1976; Jodelet, 1989; de Rosa, 2013a; 2019; de Rosa, Dryjanska & Bocci, 2017; de Rosa, Bocci & Dryjanska, 2018).

MAIN FOCUS: DESTINATION@-BRANDING AND RE-BRANDING OF TEN EUROPEAN CAPITALS

From the recent review of the City Branding literature conducted by Kasapi & Ceia (2017:139): “it can be concluded that the field of studies of destination branding in general and that of city branding specifically are still in their infancy suggesting that more studies can be conducted in these fields”.

This chapter welcomes the above suggestion and proposes a re-interpretation of “destination branding” in terms of “destination@-branding”, considering the aforementioned ten European Capitals, not only as objects of perception, but, in a more comprehensive way, as objects of representation (Vanolo, 2010) in light of the Social Representations Theory.

Starting from the awareness that the competition for distinctiveness is very high and the cities are continuously looking for new ways to improve their identity with the purpose of attracting visitors, this chapter highlights the power of logos in Tourism Destination Branding (Blain, Levy & Ritchie, 2005) as iconic component of Social Representations. However, if logos have to be defined and re-defined because their aim is “to sell the city product” -starting from the assumption that places can be branded just like products to maximize their attractiveness and their enjoyment by visitors (Ashworth, 1994; Anholt, 2003, 2010; Freire 2005)- in light of the social representations theory it is important to take in account that: to transform the symbol means to change directly the entity that it represents (Bocci, de Rosa & Dryjanska, 2017).

Modelling Approach Research Design

Given the relevance assigned to the iconic-imaginary dimension of Social Representations by the “modelling approach”, the brands have been studied by using an appropriate research design as described in Table 1. The *modelling approach*, developed by de Rosa (2013a, 2014) is a paradigmatic option specific to the research field inspired by the Social Representations Theory. It is aimed to grasp its core value as a unifying meta-theory of the social sciences, by operationalizing the investigation about any object of this supra-disciplinary field in multi-methodological research designs. These require to be fully justified and adequately complex depending on the multi-theoretical perspective adopted and the variety of constructs selected (representations, identity, social memory, emotions, etc.), the diverse techniques of

Table 1. The main features of the research design

Objective	Hypothesis and main questions	Methodology
The research compares the social representations evoked by brands of the ten European Capitals among potential first-visitors. The first aim is to compare these iconic elements (ancient and modern) of ten European capitals (Rome, London, Paris, Helsinki, Vienna, Warsaw, Berlin, Madrid, Brussels and Lisbon), which play a determinant role in the narration of urban history. By considering that the branding is an evolutive process (re-branding) this contribution also analyses the recent transformations of some commercial brands from a longitudinal perspective. Finally, this contribution integrates the results of the analysis of the main graphic elements of the branding, in the framework of the more complex research programme, suggesting a preliminary overview of the Destination@-Branding, to be further integrated.	It is expected to identify discrepancies and/or contrasts of meaning between institutional stems and commercial logos – both in terms of structure of the elements that characterize these brands, and concerning their social representations – since, even though both are aimed at distinctiveness and recognition: 1. stems have historic roots, which often date back to the origins of the city; 2. logos were created in modern times, for well defined marketing purposes. In order to test the hypothesis, it is necessary to answer the following questions: 1. Which are the structural elements of the stems and logos? 2. Which are the main differences between the social representations evoked by stems and logos? (strengths and weaknesses; attitudes etc.) 3. Concerning commercial logos, is it possible to improve them? Finally, in light of the wider research programme, how the symbolic power of institutional stems and commercial logos is articulated in the complex scenario of the Destination@-Branding?	The social representations of the brands are identified through the “associative network” (de Rosa, 2002) using as iconic stimuli both the stems and the logos of each of the ten Capitals. Moreover, a grid has been created ad hoc to identify the distinctive elements of the brands. For a description of the methodology related to Institutional tourist websites and forum discussion on the TripAdvisor portal see: de Rosa, Bocci, & Dryjanska, 2019.

data collection (structured and projective, textual and figurative, verbal or behavioural, etc.), the choice of the data analysis strategies and the expected results.

Research Focus

In this contribution the following brands (institutional stems and commercial logos) have been considered (see figure 1):

Figure 1.



Research Instruments and Data Analysis Strategies

Structural and projective techniques have been created or developed, considering as iconic stimuli a coat of arms and a logo for each Capital -as shown in Figure 1, above city names-.

- a) The grid is a structured tool, in format of a table, realized ad hoc for this research line and aimed to detect the presence/absence of the following distinctive components of the brands:
 - Name of the capital and texts in national languages;

- Slogan;
- Acronyms and texts in Latin language;
- Royal elements;
- Elements of military origin;
- Religious or symbolic/mythological elements;
- Natural elements;
- Abstract graphic elements.

The grid has been applied to all stems and logos in order to identify the main structural elements of the different brands.

b) The “associative network” (de Rosa, 2002)

is a tool of a projective nature; therefore it is less subject to the phenomenon of social desirability, if compared to structured tools like for example a questionnaire. It enables respondents to specify the structure, content and polarity of a semantic field by themselves.

The tool requires first to associate words with stimuli (a stem and a logo for each city) and then to establish connections and branching patterns between the elicited words that are written around the brand.

The associative network requires people to attribute a particular polarity to each word (positive, negative or neutral) to describe its connotations. This allows to detect the evaluative component of the representations. A polarity index calculates the positive, negative, or neutral connotations of the free associations evoked by each of the iconic stimulus used in this study.

This index, which varies from +1 to -1 is calculated using the following formula:

Polarity Index (P) = (n° of positive words – n° of negative words)/total n° of associated words.

A second “neutrality” control index, which also varies between -1 and +1, is also calculated.

Neutrality Index (N) = (n° of neutral words - (n° of positive words + n° of negative words))/total n° of associated words.

Using the software SPAD (Lebart, Morineau & Be ue, 1989) applied to the associative network, it is possible to reconstruct the structure and content of the representational fields associated with the iconic stimuli (procedures *Talex* -contingency tables- and *Corbit* -analysis of latent dimensions, including as active variables indexes and words evoked-).

For each of the iconic stimuli the first five factors were extracted, whose cumulative percentage of variance explained more than 80% of the total.

Among the indicators useful in the interpretation of the results, the following are taken into account:

- the factorial coordinates of each word on the first 5 factors which establish their position in the axes, in terms of distance from the origin and positioning on the positive or negative side;
- the absolute contribution, which constitutes the part of the total inertia of the factor explained by each variable (Ercolani, Areni & Mannetti, 1990);
- the relative contribution, or cosine squared, which assesses the contribution the factor provides to the explanation of the variability of each modality.

The analysis makes it possible to identify hidden dimensions (factors) that are subtended to the data and summarize the relations between original variables.

The aim is that of rendering simpler the interpretation of the whole range of information through a synthesis, so that newly identified factors could represent a good approximation of the starting data-matrix. This chapter takes into account the factorial interpretation, leaving out further elaborations of geometric-structural nature.

The analysis was carried out on a group of 40 potential first-visitors, experts in training in “Marketing and Communication” (Master level) at the Faculty of Medicine and Psychology - Sapienza University of Rome. They have followed the Laboratory of Web Marketing, focusing the analysis of Social Representations of Historical Capital Cities.

The Main Structural Elements of the Different Brands

The analysis of the brands, made using the *ad hoc* designed grid, highlighted differences between stems and logos under scrutiny (see figure 2).

Figure 2 allows us to answer the following question:

Figure 2.



Question 1): Which are the structural elements of the stems and logos?

The stems origin from heraldry and evoke the prestige of the cities through rich combinations of different kinds of elements: royal, military, religious or symbolic/mythological and natural. In many cases, the history of the city contains elements of legends or religious beliefs, often recalling virtues of the Saints:

- the “armed mermaid” recalls a mythological figure prepared to protect the city of Warsaw and its inhabitants;
- the “dragons” refer to Saint George’s victory over one of them depicted in the stem of London;
- the “crows” in the stem of Lisbon lift up in the air the body of Saint Vincent, then recovered by his followers;
- the “burgundy color” of Rome recalls the legend of Ancile, one of twelve sacred shields kept in the Temple of Mars, which fell from heaven during the reign of Numa Pompilius to protect the city;
- the “Archangel Michael” pierces the black devil in the stem of Brussels.

These elements present in the stems narrate the history since the cities' foundation. On the commercial logos complex figures disappear completely, leaving space to modern elements: essential lines, abstract signs and circles innovating the brand and referring to socio-recreational, emotional, architectural and design aspects.

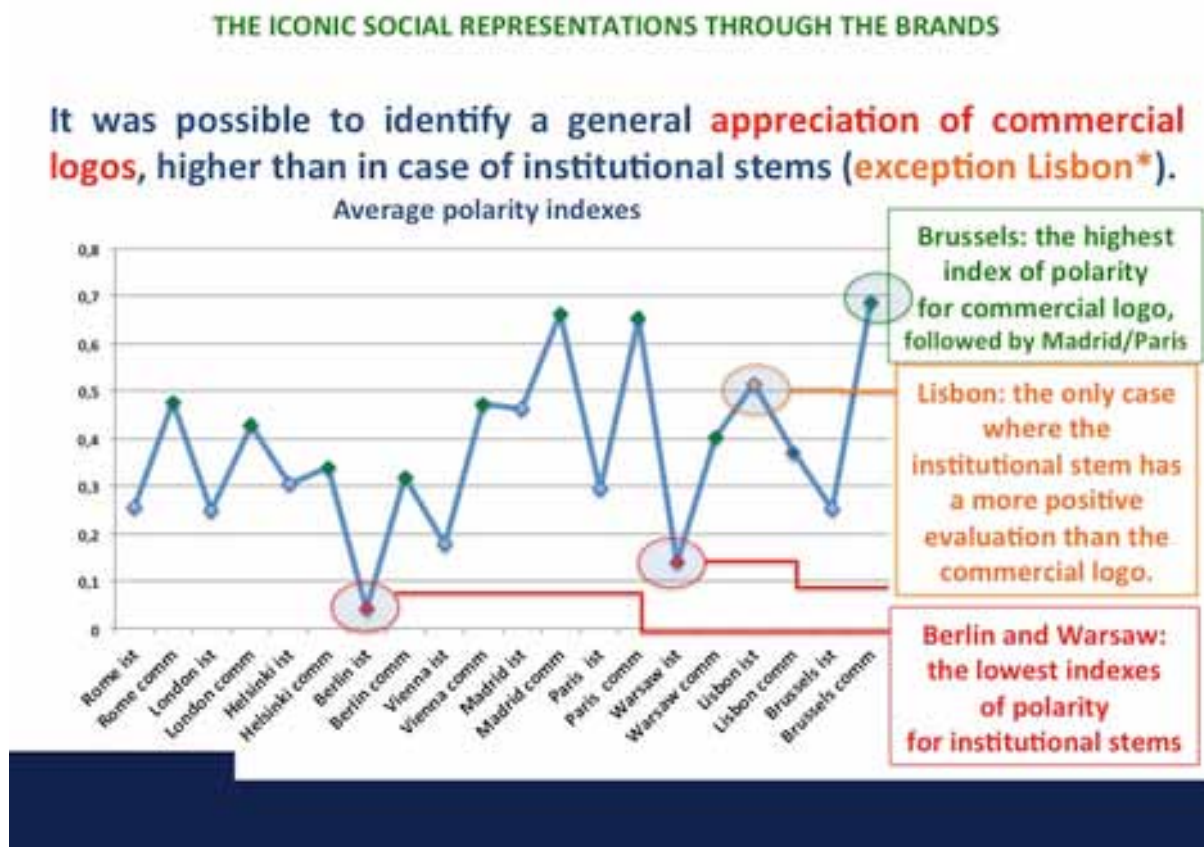
The Iconic Social Representations Through the Brands

The figure helps us to answer the question (see figure 3):

Question 2): Which are the main differences between the social representations evoked by stems and logos? (Strengths, weaknesses, attitudes)

The figure 3 compares the average polarity indexes calculated from the positive, negative and neutral assessments attributed by research participants to the associations evoked by the stems and logos of the ten European Capitals.

Figure 3.



First, the cases where the average polarity index of the representational field evoked by institutional stems is lower shall be examined. *Which social representations are evoked by these stems?*

In both cases the overwhelmingly important topic is “war”.

Concerning the city of **Berlin** (average index of polarity institutional stem 0.040), next to the functional aspects of a city considered as “organized” (first factor, positive semi-axis, a.c.3.6 r.c.0.49) appears the historic-artistic-cultural dimension with terms such as “wall” (a.c.7.9 r.c.0.78) and “museums” (a.c.3.1 r.c.0.29) on the negative semi-axis of the first factor; “Brandenburg Gate” (a.c.6.2 r.c.0.43) and “culture” (a.c.5.2 r.c.0.40) on the positive semi-axis of the second factor; the tight relationship of art/culture with the darkest period of recent history tends to be associated with a negative polarity index on the two factors (negative semi-axis of the first factor a.c.11.8 r.c.0.26; positive semi-axis of the second factor a.c.11.9 r.c.0.16).

The binominal art/culture and the history of the XXth century can be seen even clearer in the social representations of stems, as demonstrated in the first two factors: the first factor -negative semi-axis- includes such terms as: “nazism” (a.c.17.8 r.c.0.89), “East Berlin” (a.c.11.1 r.c.0.68), “war” (a.c.10.3 r.c.0.88) and “wall” (a.c.5.1 r.c.0.37) and the second factor – negative semi-axis- includes such terms as: “wall” (a.c.8.7 r.c.0.50) and “violence” (a.c.4.1 r.c.0.30). In both factors active variables elicited coincide with a negative polarity index (negative semi-axis of the first factor a.c.14.2 r.c.0.33; negative semi-axis of the second factor a.c.11.2 r.c.0.51).

The second factor in particular shows a split in the attitudinal component of social representations; while the negative polarity goes with the historical events of the last century, the positive polarity corresponds to recent cultural events (“Cinema Festival” a.c.10.2 r.c.0.60) and to ancient history of the city (“ancient” a.c.4.2 r.c.0.37).

References to the XXth century for the city of Berlin are in continuity with the city of Warsaw (average index of polarity institutional stem 0.1393) whose brands are full of events related to World War II. In reference to the commercial logo, the word “Auschwitz” occurs on the second factor of the positive semi-axis (a.c.15.2 r.c.0.53) next to “cold” (a.c.26.6 r.c.0.78) and “sad” (a.c.11.4 r.c.0.86) associated with a negative polarity index (a.c.70.6 r.c.0.96); on the positive semi-axis of the fourth factor (a.c.10.1 r.c.0.14), as well as on the negative semi-axis of the fifth factor (a.c.21.6 r.c.0.22).

The history of the XXth century also shows an impact on the social representations evoked by the stems. The first factor in particular demonstrates a rift in the attitudinal component of social representations:

- on the positive semi-axis the positive polarity (a.c.26.8 r.c.0.79) corresponds to general aspects such as “history” (a.c.5.4 r.c.0.29) and nature-related themes (“river” a.c.7.1 r.c.0.60);
- on the negative semi-axis negative polarity (a.c.43.1 r.c.0.83) corresponds to the references to the “difficult” (a.c.7.5 r.c.0.65) period of the Second World War that caused suffering and victims, with terms like “blood” (a.c.14.4 r.c.0.68) and “war” (a.c.10.6 r.c.0.63).

The word “Auschwitz” appears on the positive semi-axis of the second factor (a.c.45.9 r.c.0.73), together with “Poland” (a.c.19.0 r.c.0.82) and “antique” (a.c.14.3 r.c.0.40), contaminating time and space, and on the positive semi-axis of the third factor (a.c.11.5 r.c.0.14) together with “war” (a.c.6.4 r.c.0.23).

Next, the city of **Lisbon** (average index of polarity institutional stem 0.5135) is examined; the only case where the stem has a more positive evaluation than the logo.

What are the strengths of the institutional stem and what are the weaknesses of the commercial logo?

The richness of details -that take us back in time to the colonialism- and the predominance of yellow are the strengths of the stem; while, having taken over the central part of the emblem, using only the black colour and clean lines leads to more negative evaluation of the commercial logo.

In spite of common elements:

- for the stem the positive social representations coincide with the references to “colonialism” presented on different factors: negative semi-axis of the third factor with keywords such as “wealth” (a.c.6.5 r.c.0.32), “history” (a.c.6.1 r.c.0.66), “power” (a.c.5.4 r.c.0.43) and “sea” (a.c.3.1 r.c.0.24); positive semi-axis of the fourth factor with the keywords “Middle Ages” (a.c.6.3 r.c.0.19) and “boat” (a.c.7.3 r.c.0.37) and also on the negative semi-axis with “colonies” (a.c.9.1 r.c.0.39), “riches” (a.c.7.0 r.c.0.32), “trade” (a.c.6.0 r.c.0.37) and “discovery” (a.c.4.2 r.c.0.45); positive semi-axis of the fifth factor with the words “colonies” (a.c.11.7 r.c.0.34), “trade” (a.c.6.0 r.c.0.25), “discovery” (a.c.5.1 r.c.0.37), “boat” (a.c.4.8 r.c.0.16);
- for the commercial logo the negative polarity index corresponds to the positive semi-axis of the second factor (a.c.46.2 r.c.0.72) and to the negative semi-axis of the third factor (a.c.8.5 r.c.0.9) to the negative emotion “sadness” (respectively a.c.34.1 r.c.0.73 on the second factor and a.c.6.1 r.c.0.9 on the third factor), also associated with the “black” colour on the second factor (a.c.12.5 r.c.0.47).

The following section features the analysis of the cases where the positive polarity index of the commercial logos are higher:

Which social representations are evoked by these logos?

Social representations associated with the logo of **Brussels** (average index of polarity for commercial logo 0.6855), rich in metaphors, are centered on the topic of “multi-culturalism”. Sometimes interpreted as a “bar code” (first factor negative semi-axis a.c.54.1 r.c.0.91; second factor negative semi-axis a.c.8.2 r.c.0.6), the colors bring to mind the idea of a “game” (first factor negative semi-axis a.c.24.1 r.c.0.56), in other cases they are a synonym of the “rainbow” of races-cultures (third factor positive semi-axis a.c.5.5 r.c.0.43; fifth factor negative semi-axis a.c.5.5 r.c.0.20), an invitation to “open up” (third factor positive semi-axis a.c.8.0 r.c.0.42) and to “love” (a.c.5.2 r.c.0.19). Love appears both on the positive semi-axis of the third factor and fourth factor (a.c.4.5 r.c.0.13), here also together with “multicultural” (a.c.3.2 r.c.0.21).

The content associated with the institutional stem of Brussels appears very different from the one evoked by the commercial logo, concentrating on the historical/cultural and religious elements evoked by the legendary mythological figures.

After **Brussels**, also the commercial logos of **Madrid** and **Paris** are very positive.

For Madrid, the positivity seems related to “nightlife” that cuts across different factors, referring to socio-recreational city through more keywords: the “night life” appears on the negative semi-axis of the second factor (a.c.6.8 r.c.0.46), together with “inviting” (a.c.5.5 r.c.0.39) and on the positive semi-axis of the fifth factor (a.c.6.2 r.c.0.25), together with “happiness” (a.c.14.7 r.c.0.63), “sea” (a.c.13.7 r.c.0.59)

and “youth” (a.c.4.9 r.c.0.76); on the positive semi-axis of the third factor there is “*movida*” (a.c.3.3 r.c.0.20), together with the “sun” (a.c.4.9 r.c.0.66), “sea” (a.c.3.8 r.c.0.20) and “heat” (a.c.3.5 r.c.0.12).

Free associations related to the institutional stem of Madrid do not seem to refer to the characteristic “*movida*” (nightlife), concentrating on a descriptive/evaluative dimension of the elements represented.

Also for Paris, as in case of Madrid, the relational dimension is enhanced in the commercial logo from a more intimate perspective, which leaves room for romance, as in the third factor extracted. On the positive semi-axis it is possible to see in fact words like “charming” (a.c.16.4 r.c.0.65), “romantic” (a.c.8.7 r.c.0.63), “magic” (a.c.7.3 r.c.0.56), “evening” (a.c.4.7 r.c.0.29), “lights” (a.c.3.2 r.c.0.11); on the negative semi-axis of the same factor the dimension of values is expressed through such terms as “love” (a.c.13.0 r.c.0.72) and “Christmas” (a.c.4.8 r.c.0.28); “Christmas” (a.c.20.0 r.c.0.48), “fascinating” (a.c.9.7 r.c.0.16) and “romantic” (a.c.3.5 r.c.0.11), repeated on the positive semi-axis of the fifth factor.

The relational/value dimension is also detected in reference to the institutional stem; on the first, second, fourth and fifth factor the words “light” and “romantic” recur, repeated on the positive semi-axis of the second factor in correspondence with “love” (“lights” a.c.5.4 r.c.0.26; “romantic” a.c.5.4 r.c.0.26; “love” a.c.4.3 r.c.0.51).

Transformation of the Iconic Social Representations Through Re-branding

Question 3): Concerning commercial logos, is it possible to improve them?

By considering that branding is an evolutive process (re-branding) here we propose the recent transformations of some commercial brands in a longitudinal perspective. (See Figure 1, logos placed under the names of cities: Rome, Paris, Brussels, Helsinki, Lisbon, London, Vienna).

At a check for the three commercial logos that in Figure 3 showed the most positive attitude by the research participants (Brussels, Madrid and Paris) it is possible to observe:

- partial re-branding of Brussels with the elision of the string of colors sometimes eliciting a “bar code” in the participants;
- no re-branding in the case of Madrid;
- a very important re-branding in the case of Paris which, however, with the letter A of Paris, still refers to the Eiffel Tower, already emphasized in the logo object of our research.

Even Lisbon, whose commercial logo had registered the less positive attitudes -compared to other logos and the city’s institutional emblem-, provided a new brand.

Among the capitals with a lower polarity index for the commercial logo -Helsinki, Berlin and Warsaw- only the former made an important re-branding, while the other logos remained unchanged.

As reported by the official website of Helsinki, widely justifying the decision: “The reform of the City organization offered a good opportunity to unify the City’s brand identity. Now that the entire organization produces and uses materials based on a uniform identity, the City’s actions can draw more attention and be more efficient, as well as saving money. For citizens the reform means increasingly clear, easily understood and more resident-oriented marketing and communication about the City and its services. People working in Helsinki or visiting the city will perceive Helsinki more easily than before as a straightforward, appealing, modern, functional and enjoyable place. The uniform identity also helps Helsinki to differentiate itself from other cities and regions... The design of the brand identity was carried out by the brand design agency Werklig, which was selected through a competitive bidding process. The design work was assisted by several City experts. The adoption of the brand identity was decided

by the Mayor. The introduction of the new brand identity throughout the organization will take time. It is likely that many years will pass before the identity is fully established” (www.hel.fi).

After this study, also Rome has modified its commercial logo, the new one including a strong “relational” attachment and identification dimension (www.comune.roma.it).

However, on the occasion of the anniversary of the birth of Rome (April 21st 2016) Italian newspapers have titled that the Special Commissioner of Rome Mr. Tronca -on the basis of the numerous protests received from different sides about the relational logo “RoMe & You”- restored the emblem with the ‘acronym SPQR, canceling the logo proposed during the government of Ignazio Marino (www.iltempo.it). To those who asked him if “RoMe & You” will no longer be used he replied: “The logo that Rome has always had will be used”.

This decision encourages a reflection on the effectiveness of re-branding in particular circumstances. In fact, some symbols are so popular, loved and communicative that nobody wants to change them. This also applies to some corporate brands that are now recognized by the public as distinctive features of global companies. For example Coca Cola, Nike or Disney (www.crearelogo.it).

In fact, according to the social discourse developed on the web, the Rome relational logo seems not to have brought added value to the solid image already present. In fact, it turns out that the “chromatic bubbles” placed above the red shield - created to indicate key elements of the city like the round shape of the Colosseum, the round shape of pizzas, the round (spherical) shape of ice cream (www.underconsideration.com) - have been not very easy to decode and have been assimilated to the city holes or to the “carnival confetti” (www.romatoday.it).

The President of the XV Town Hall Daniele Torquati summarizes the controversy on Facebook in February 2015 as follows: “Those colored carnival confetti instead of the crown, the Cross and SPQR - they claim - denote little knowledge of the reasons why Rome and its history are known in the world. Above all, Rome is Rome across the globe from China to North America. Who knows how many months the Capitol scientists have used to give birth to such a dazzling logo. For millennia SPQR has never been canceled, they say” (romafanpage.it).

The choice of the “return to the past”, to the timeless red shield, would have agreed Romans and politicians who had expressed polemical representations towards the logo proposed during the Marino Government (Mayor of Rome with the support of a centre-left alliance in 2013-2015) and, even before that, also towards the one born during the Giunta Alemanno (Mayor of Rome for the centre-right during the period 2008-2013).

Moreover, in the corporate environment, such changes have also been adopted by private companies, which, following the protests of the customers, have returned in some cases to the old logo. Cfr. for example the GAP logo or the Benetton Company -that had a return to the past, rather in terms of advertising-. Following a long period characterized by a communication that remained famous for the numerous scandal advertisements, which led to an increase in social discourse for years and also a strengthening of the brand, the company - after the umpteenth provocation that had a huge media impact and different protests from the public- dissolved the “marriage” with the famous creative photographer Oliviero Toscani and chose to return to traditional images, moreover more in line with the company philosophy “all united in the name of Benetton” (United Colors of Benetton) (de Rosa & Bocci, 2013b).

Coming back to the ten European Capitals, finally, London opted for re-branding, while Vienna has only updated the payoff from “now or never” to “now forever”.

The Iconic Social Representations for Destination@-Branding

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Question 4: In light of the wider research programme, how is the symbolic power of institutional stems and commercial logos articulated in the complex scenario of the Destination@-Branding?

In order to furnish a first overview of the role of the main graphic element of branding, in the framework of the more complex research programme, here we summarize some results (de Rosa, Bocci & Dryjanska, 2019) related to the analysis of the institutional tourist websites (brand identity) and forum discussion on the TripAdvisor portal (brand image).

Each city under scrutiny can be positioned according to the similarities/differences between the social representations of the top places communicated via institutional tourist websites (assumed as vehicles of brand identity) and the free spontaneous conversations of online communities (assumed as vehicles of brand image).

For Berlin, there was the closest coincidence between the “Top Places” (7 out of 10) identified by the institutional tourist websites (assumed as vehicles of the city’s brand identity) and by the TripAdvisor online community members (assumed as vehicles of the city’s brand image).

For Helsinki and Rome three places out of 10 coincide; for Madrid, Brussels, Lisbon and Paris two places out of 10 match, for Vienna and London only 1 out of 10, none for Warsaw.

Three cities (Berlin, Helsinki and Rome) stand out among the others; they are profoundly different from each other, but their differences converge in terms of a preliminary analysis of *destination@-branding*. On the one hand Berlin has followed the line to make the history a protagonist accessible to its visitors.

For Rome the artistic-architectonic dimension plays an important role in terms of convergence of brand image and brand identity.

On the other hand, Helsinki is the capital that, from the point of view of communication via Internet, is least focused on cultural history but instead emphasizes other aspects, such as socio-recreational dimensions.

For these three cities, this research has highlighted distinct “landmarks” like the “Reichstag”, as well as other places of memory in the case of Berlin; the “Trevi Fountain”, “Vatican” and “Villa Borghese” in that of Rome; and “Helsinki Zoo” and “Linnanmäki amusement park” as socio-recreational places in the case of Helsinki.

Despite their differences, these three capitals converge in the importance assigned to specific Top Places, demonstrating that destination@-branding is emphasised via this iconic component of social representations of cities (the landmarks).

In this scenario, actually, Rome, Helsinki and Berlin do not fully benefit from the commercial logo: Rome because of the constant changes that seem to echo political developments; Helsinki being in the middle of a well-argued transition phase; Berlin, following the results of this research, is placed on the lowest positions compared to the attitudes of the participants towards the brand, but has not yet invested in re-branding.

In the awareness of the volatility of research data, the survey in longitudinal perspective will be able to study the echoes of the transformations (in light of the Social Representations Theory) currently underway also for: Lisbon, whose commercial logo had detected some critical issues; Paris that although it has adopted a new logo has continued to focus on the Eiffel Tower; Brussels that has decided to delete multi-colored bars evoking multi-ethnicity.

Instead, the position of Madrid (not rebranded) can be considered strengthened by the results of this research in terms of attitudes of the participants.

Finally, in this summary scenario Vienna, London and Warsaw do not appear to be particularly strengthened by the commercial logo. Indeed, only London opted for a complete re-styling of the brand -whose representations could be analyzed in further studies- while Vienna only changed the payoff and Warsaw left the logo unchanged. However, both these last ones could have benefited from an adequate and consistent re-branding.

RECOMMENDATIONS

In proposing recommendations, however, as discussed above, it should be noted that the changes often become the subject of a polemical social discourse that is increasingly divided over the Internet (especially websites, blogs and social networks) and can even last for years, as was the case for commercial logos used in this research related to London (on the websites of Moving Brands and London and Partners) and Rome (blog.adci.com; www.06blog.it; www.tgcom24.mediaset.it).

The controversies triggered by the web show that: touching iconic symbols generates more controversies than replacing words, as de Rosa learned investigating the controversial representations provoked by the change of the logo of the Italian Communist Party (P.C.I.) (de Rosa & Farr, 2001; de Rosa, 2014).

The symbols seem to possess the power of materialising the deepest dimension of the figurative nucleus of the social representation. More specifically, some of the elements that can be included under the label “brand element mix” possess, as Rouquette noted (1994), the following properties:

- they embody the emotive dimension of the central nucleus of a social representation -dimension defined by the author with the term “nexus”-;
- merge denotation and connotation;
- reify (objectify) a system of cadences and values;
- are hard to modify through analysis and rational reflection;
- constitute a system of communication relatively independent vis-à-vis that of the discourse. (...)

In the symbolic order, in fact, to act on the symbol of a person or of an object, means to act on the person or on the object itself. To strike the symbol means to strike directly the entity that it represents (de Rosa & Farr, 2001; de Rosa, 2014).

FUTURE RESEARCH DIRECTIONS

Given the continuous evolution of some of the commercial logos, like the logo of Rome discussed above, the future research should include the new logos and compare them with the previous ones. Moreover, starting from the preliminary analysis of the iconic social representations for Destination@-Branding, presented here, the results obtained by analyzing the institutional and commercial logos as elements of the “brand element mix” should be further re-read together with the more comprehensive data concerning the divergence/convergence of the City@-brand identity and City@-brand image, including:

- virtual City brand identity (Aaker & Joachimsthaler, 2000) created by marketers through institutional websites (de Rosa et al., 2012, 2013) and institutional tourist websites (de Rosa & Bocci, 2014) of the ten European Capitals;

- virtual City brand image (Cai, 2002; Keller, 1998) shared via commercial sites like Tripwolf and Booking.com, spontaneous conversations and exchanges of experience among the members of Social Networks like Facebook and Yahoo Answers, Twitter, Instagram and YouTube, portals like TripAdvisor, which are employed as a vehicle for dissemination of common sense knowledge (de Rosa & Bocci, 2014).

CONCLUSION

Following the hypotheses, the main differences between stems and logos emerged through the use of the ad hoc grid that showed the divergences in the structural elements of stems and brands (hypothesis1) and also through the calculation of the indexes of polarities that allowed us to detect a more positive attitude towards commercial logos than towards institutional stems (hypothesis2).

On the contrary, shared contents between stems and logos have been found -for example- referring to:

- the “history” - the “Second World War” in the brands of Berlin and Warsaw and the “colonialism” in the brand of Lisbon.

Concerning commercial logos, especially the “emotional” and “value-related” dimensions affected in the opposite way (negative vs positive) the social representations:

- negatively: in the cases of Warsaw and Lisbon (sadness);
- positively: in the cases of Brussels, Paris or Madrid (happiness).

The polemical social discourse activated among citizens confirms: the dynamic of resistance/acceptance in the social representations provoked by changes related to their symbolic and iconic dimensions; the interest for investigating the social and communicative phenomena related to the iconic narratives about cities evoked by the brands and the city destination@-branding” (Bocci, de Rosa, & Dryjanska, 2017).

Besides their descriptive value and possible function in guiding city’s institutional and tourist communication managers, the results have a historical value with respect to the evolution of the Institutional communication, assuming a particular interest for further comparative analyses (de Rosa & Bocci, 2013a; de Rosa, Bocci & Picone, 2012) concerning the specific component of the brand element mix (Cai, 2002), here analytically described through structured and projective tools aimed at identifying both the structural (distinctive elements) of the brands and the structure, contents and polarities of the social representations associated with them.

This study is part of a more general attempt to deal with the complexity of the new communicative web scenario based on multi-channels, assumed to be influential for the genesis, transmission and negotiation of the social representations of Capital Cities. The policy makers should therefore take into account social representations and test innovative design ideas in order to verify that a new logo for example includes elements considered as essential in how people represent a city.

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KEY TERMS AND DEFINITIONS

Associative Network Technique: A tool developed by de Rosa of projective nature used in order to study the Social representations of iconic and verbal stimuli, by considering structure, contents, and attitudinal dimension of a semantic space.

Destination-Branding: An articulation of different interrelated components: brand identity, brand image, and brand element mix.

Destination@-Branding: Extension of the concept of destination-branding to the digital world of the Internet, including websites, social networks, portals, etc.

Index of Polarity: An index created by de Rosa aimed at detecting the evaluative component of social representations, on the basis of the polarities (positive/negative) attributed to the words associated by the subjects to the stimuli.

Modelling Approach: A paradigmatic approach to Social Representations developed by de Rosa that integrates different methods and techniques coherently with the articulation of different theoretical constructs and dimensions.

Nexus: The emotive dimension of the central nucleus of the social representations.

Social Representations: Naïve theories of common sense that express systems of values, convictions and norms of behavior, with a double function of organizing the perception of the world and serving as a shared system of social communication and interpersonal exchange.

Rapid Changes in Approaching First-Time Destination Historical Cities

10

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INTRODUCTION

The Internet is rapidly changing the way first-time visitors approach a new urban destination. On the one hand, new media influence public spaces and infrastructures (Puel & Fernandez, 2012) but they also play a crucial role in how a person perceives a city prior to the direct experience.

European Capitals are well-established destinations among visitors from different countries who arrive with some preconceived ideas and various expectations that affect their behaviour during the visit.

According to Kalandides (2011, in Castillo-Villar, 2018:33): “The city’s image blends and simplifies all the tangible and intangibles elements that relate to the city. The image is formed from the encounters that we have with the messages communicates the city. These messages can be taken from the media, the culture or the direct experience”.

Moreover, for Castillo-Villar (2018:33): “Each individual forms his or her own particular city’s image, but also shares collective images due to a common physical and cultural environment. Therefore, city branding should focus on these public images to project an image true to the values, beliefs and ideas shared by locals and visitors.”

In order to understand the images of urban social space, the theory of social representations (Moscovici, 1961/1976; 1984) has over the years offered an efficient framework. How is it changing in the era of readily accessible Internet-based sources? This chapter attempts to answer this question by taking into account the diversity of Internet-based sources of information about three European Capitals: London, Madrid and Warsaw, including the voice of those who visit a city for a limited period of time. Based on feedback from the field studies conducted in European Capitals, a special consideration is given to specific ways of exploring the destinations prior to the visit, such as turning to Institutional websites, social networks and Google Earth. While some of these tools have been examined in the context of urban studies (Diekmann & Cloquet, 2012; Porta et Al., 2014; Zhou & Wang, 2014; Fierro et Al., 2015), an integrative framework to consider Internet-based resources that shape social representations of cities has not been proposed yet. The aim of this contribution is the development of a new classification of sources of information, reflecting the complexity of tools available to city users today.

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THEORETICAL BACKGROUND

Within the theoretical framework of social representations (Moscovici, 1961/1976; Farr & Moscovici, 1984; Moscovici & Duveen, 2000; de Rosa, 2011; 2013a; Sammut et Al., 2015; Lo Monaco et Al., 2016), this chapter features the web-based multi-faced sources of information about three European Capitals: London, Madrid and Warsaw.

The social psychological construct of social representations introduced by Moscovici (1961/1976) has been successfully applied to urban studies since decades. Milgram (1984) conceptualised cities as social representations, attributing as much importance to the characteristics of neighbourhoods' residents as to physical features of places. Subsequently, the construct of social representations has been used to explain how urban entrepreneurs influence perception of the city to their convenience (Hubbard, 1996). In urban context, the theory of social representations provided a more complex manner of considering residents' attitudes towards tourism (Andriotis & Vaughan, 2003). However, in the contemporary hustle of European Capitals it becomes increasingly common to find more tourists or commuters than actual residents, at least in some areas. In fact, for years the theory has also been applied to study how tourists represent cities as a whole as well as specific places or urban areas before and after the visit (de Rosa et Al., 1995; de Rosa, 1997, 2013b; de Rosa & D'Ambrosio, 2011).

First-time visitors form an especially interesting population, particularly useful when studying the city's image (Richards & Wilson, 2004), due to the fact that their knowledge about a destination stems from multiple sources of information, excluding direct physical experience. Quite often interpersonal communication plays a crucial role in enticing potential visitors to see a new city with their own eyes, as they seek referral from repeat visitors (Chi, 2012). While exploration tends to be the dominating tendency of first-time visitors, as opposed to acquisition preferred by repeat visitors (Lau & McKercher, 2004), such exploration begins prior to the trip and occurs through numerous channels. From conversations with family and friends, through consultation of newspaper articles, books and other printed and audio-visual materials such as movies, a potential visitor seeks information in an active way.

Today, the Internet offers numerous sources of information about cities. Concerning modern technologies and differentiation between specific forms of Internet-mediated communication in urban context, there have been some studies related to exploration of cities with Google Earth (Porta et Al., 2014), including the presence of places of interest in the satellite imagery (Zegras et Al., 2012); however, the relevance of this particular tool for social representations has not been discussed. In the era of Internet -where an integrative framework to consider Internet-based resources that shape social representations of cities has not been proposed yet- the paper furnishes an overview of the online city brand identity (Aaker, 1996) and image (Pike, 2009) of the European Capitals online. Overcoming the weaknesses regarding the literature focused solely on cognitive and evaluative factors in perception (processes of categorization, encoding, storage and retrieval of information in memory) the added value of this study is to re-read these constructs through the comprehensive multi-dimensionality of social representations (Vanolo, 2010). Moreover, in valorising the identity-related dimension of the cities, it refers to Proshansky's (1978) definition of place-identity as a sub-structure of self-identity characterized by clusters of cognitions, memories and affections concerning experienced places. The importance of the intersection between the constructs of the place-identity and the social representation of the European Capitals has been discussed by de Rosa (1997, 2013b).

APPROACHING FIRST-TIME DESTINATION HISTORICAL CITIES

10

This paper presents selected results of a wide research project dedicated to social representations of European Capitals, which began more than twenty years ago and still continues today (cfr. Inter alia: de Rosa, 2013c; de Rosa, Dryjanska & Bocci, 2017).

The methodology has been inspired by the modelling approach to social representations (de Rosa, 2013a,b; 2014), based on the integration/differentiation of multi-theoretical constructs and multi-methodological research designs, coherently justified beyond the simple sum of various techniques.

The modelling approach is aimed at grasping the core value of the social representations as a unifying meta-theory in the social sciences, by operationalizing the investigation of any object of this supra-disciplinary field in multi-methodological research designs. The diverse techniques of data collection (structured and projective, textual and figurative, verbal or behavioural etc.) and even the choice of the data analysis strategies require adequate complexity depending on the multi-theoretical perspective adopted and the variety of constructs selected (representations, identity, social memory, emotions etc.) and full justification with regards to the specific hypotheses, also related to the expected results depending on the different techniques employed and their communicative channel.

The research starts from the first line of the field study -involving 420 first-time visitors from 7 countries, contacted before and after their first-time visit- and compares the results with those from the second interrelated line on the media study.

A set of three hypotheses concern each considered web-based media source: a) Institutional websites; b) social networks; c) Google Earth (de Rosa, Bocci & Picone, 2013; de Rosa & Bocci, 2014) and its relationship with more traditional forms of communication (de Rosa, 1997; 2013c). The communicative capacity of the Institutional websites and the manner of creating virtual itineraries by Google Earth are related to the overall self-rated importance of sources of information about cities; while exchanges about the same target cities through social networks reflect the interactive nature of interpersonal communication.

METHODOLOGY

The results of the field study are extracted from data collected in London, Madrid and Warsaw between 2011 and 2013 by 420 first-time visitors from the following countries: France, Germany, Italy, Poland, Spain, United Kingdom and U.S.A. Each respondent was selected according to the main criterion “to visit the city for the first time”. Contacted using the snowball sampling technique, the participants - on a voluntary basis - filled out questionnaires in their native language, starting from socio-demographic information, reason of residence in their current location and the additional reasons for visiting the city apart from tourism (study, work, etc.). Concerning gender, two thirds of participants are women in case of each city. According to age, the research participants have been categorized in three groups: less than 26 y.o.; 26-40 y.o.; 41- 60 y.o. The average age was 27 for London, 26 for Madrid and 34 for Warsaw.

The participants have been contacted before and after their first-time visit to the city, approached through travel agencies, language schools, professional associations and using the snowball sampling technique, a tool for finding research participants. According to this technique, one subject gives the researcher the name of another subject, who in turn provides the name of a third, and so on (Vogt, 1999); like a rolling snowball, initially selected research participants contribute to recruit future subjects from among their acquaintances.

As far as it concerns the media studies, the “Institutional website identity” has been explored, to convey the city-brand identity through Institutional websites. Comparative analysis of the Institutional websites of the three European Capitals (www.london.gov.uk; www.munimadrid.es; www.e-warsaw.pl) has been conducted starting from the assumption that the websites constitute official ‘business cards’ presented by the municipalities to residents and tourists.

Moreover, the study explores various forms of technologically mediated information available on the Internet. For the Institutional websites the Usability Test (Nielsen & Loranger, 2006) has been performed (de Rosa & Bocci, 2014); subsequently, the content analysis has been applied, with the grid designed by de Rosa & Picone and the ATLAS.T software (de Rosa, Bocci & Picone, 2013).

H1: The first hypothesis predicts a positive relation between the importance of different sources of information indicated by the first-time visitors (field study) and the degrees of usability and overall communicative capacity of the websites (media study).

H2: From the top-down approach it is possible to move into an interactive communication of social networks, considered as a contemporary form of interpersonal mediated communication. Therefore, it is expected that the social representations of the most important places in the cities (field study) will correspond to those evoked in the social networks, Facebook and Yahoo!Answers (media study). The results of interpersonal communication through the social networks concerning places have been analysed using descriptive statistics and Lexical Correspondences Analysis with SPAD software. The Correspondences Analysis makes it possible to identify hidden dimensions that are subtended to the data and summarizes the relations between original variables. The aim is to simplify interpretation of the whole range of information through a synthesis, so that newly identified dimensions (factors) could represent a good approximation of the starting data-matrix. Among the indicators useful for the interpretation of the results of Correspondences Analysis - as far as it concerns the first two factors extracted by SPAD - the following are taken into account:

1. the absolute contribution (a.c.), which constitutes the part of the total inertia of the factor explained by each variable;
2. the relative contribution (r.c.), or cosine squared, which assesses the contribution the factor provides to the explanation of the variability of each modality.

H3: Finally, the third hypothesis regards a relationship between the level of information about a city (field study) and the manner of virtual exploration of it using Google Earth (media study). According to this hypothesis, the less known the city among first-time visitors, the more variations it is possible to expect in the itineraries between low and high level of information enabled in the software settings. In this last task the participants were asked to create an itinerary of a city in Google Earth with a low level of information, succeeded by a high level of information. The results of this virtual exploration were assessed by content analysis and descriptive statistics.

The aim of this chapter, enriching the classification of sources of information about an unknown city, thanks to a thorough consideration of the Internet, is based on the premise that technologically mediated communication plays an ever-increasing role in the genesis, transmission and transformation of urban social representations.

PRESENTATION AND DISCUSSION OF RESULTS

10

The results of the field study in London, Madrid and Warsaw focus on the increasing role of the Internet as a source of information and therefore a major factor in shaping social representations of European Capitals. Interpersonal information, even when transmitted using modern technologies, tends to be very significant, especially in case of close ties such as kin and friends (Mok, Wellman & Carrasco, 2011). In fact, the participants of the field study have attributed the highest importance to the interpersonal communication, while the Internet appears as the second most important source of information.

Based on this finding, the research further explores different ways in which the Internet contributes to shaping social representations of contemporary urban settings, through: Institutional websites (H1), social networks (H2) and Google Earth (H3).

On a scale from 1 to 10, on average the participants of the field study have attributed the highest importance of the Internet to information about London followed by Madrid and Warsaw.

The social representations reflected in the overall average self-rated importance of various sources of information about cities have been compared with the communicative capacity of the websites of the three European Capitals.

While more details and information about additional European Capitals have been reported elsewhere (de Rosa & Bocci, 2014), the concise results of the analysis of Institutional websites under scrutiny are summed up in the following paragraphs.

Although overall the Institutional websites do not appear highly attractive from the point of view of usability, there are some clearly marked differences between the three cities:

- London. The Institutional website emphasizes innovation and dynamics concerning urban services, in particular transportation and sports. In the contemporary scenario of the on-going financial crisis, attention has been given to leadership in business, work opportunities and competitiveness. While many clear and useful solutions have been proposed to Londoners, from the perspective of visitors, especially those coming from abroad, the website appeared somewhat self-referential. Concerning images available on the home pages, London's municipality offered dynamic photos corresponding to the highlighted topics.
- Madrid. Imbalance in favour of residents has been detected in the Institutional website of Madrid. Nonetheless, it demonstrated a medium-high level of reliability and a fairly well developed content, although overall usability was rated as medium-low. Concerning images available on the home pages, Madrid promoted itself using static photos focused on nature.
- Warsaw. The Institutional website of Warsaw displays the highest discrepancy between usability and reliability. The content appeared as the least complete, although quite highly aimed at visitors, with special attention paid to cultural events. Concerning images available on the home pages, Warsaw promoted itself using static photos focused on monuments (Royal Castle). According to Michaelidou et Al., (2013), it would be more advantageous to use holistic images of the destination that better reflect the preferences of city users, based on online visitor-generated photography.

On the whole, London's website had the highest communicative capacity, followed by those of Madrid and Warsaw. This is the same order observed when comparing the overall average self-rated importance of information about these three Capitals. Therefore, the hypothesis concerning correspondence between the results of the field study and analysis of the Institutional websites has been confirmed (H1).

Just as interpersonal communication is considered highly credible and therefore important, social networks tend to be perceived in a similar manner (Ayeh et Al., 2013). In order to be able to compare the results of the field studies in London, Madrid and Warsaw with the results of conversations available on Facebook and Yahoo!Answers, the following paragraphs focus on the “places”:

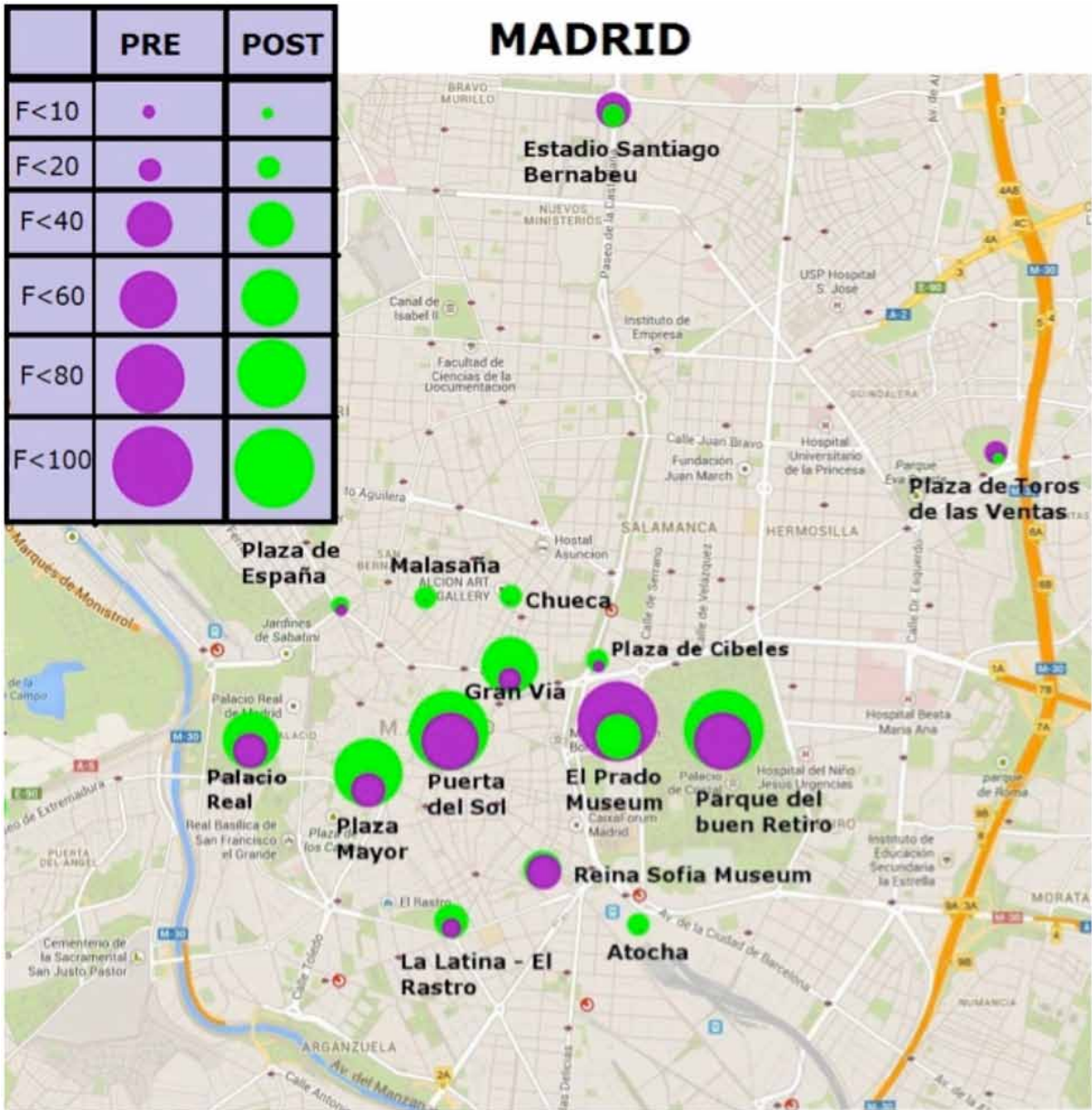
- London. The data related to the most meaningful and frequently mentioned places prior to the visit (field study-Figure 1) resemble the data from social networks. As a result of Lexical Correspondences Analysis of social networks, the main two factors explain the organization of social representations of the most important places in London. This can be clearly observed taking into account the example of Buckingham Palace, one of the most significant places before the visit (but not after it –field study) and in the social networks (where it is present with high frequencies of $f=37$ –dim.2 a.c. 3.8 r.c. 0.14- together with: Piccadilly Circus $f=44$ –dim.2 a.c. 1.9 r.c. 0.17-; London Eye, $f=36$ –dim.2 a.c. 3.1 r.c. 0.10-; Westminster $f=35$ –dim.1 a.c. 1.1 r.c. 0.33- and Trafalgar Square $f=28$ –dim.2 a.c. 1.2 r.c. 0.17). Direct experience therefore manifests itself as a factor that shapes social representations in a different way than the interpersonal communication, whether traditional or mediated by technology.

Figure 1. The most important places in London before and after the visit



- Madrid. For Madrid an opposite trend has been detected: the places mentioned after the visit (field study-Figure 2) appeared as much more similar to those mentioned in social networks (media study) where specific places are present with high frequency: Puerta del Sol ($f=32$) –dim.2 a.c. 0.3 r.c. 0.04-, Parque del Buen Retiro ($f=27$) –dim.2 a.c. 3.6 r.c. 0.18-, Palacio Real ($f=24$) –dim.2 a.c. 3.0 r.c. 0.16- and Atocha Station ($f=5$) –dim.2 a.c. 0.3 r.c. 0.16-. All of them gained importance as a result of direct experience. Unlike for London, places mentioned after the visit had much more in common with the social networks than those indicated prior to the visit.

Figure 2. The most important places in Madrid before and after the visit



This finding could suggest that social networks can play an active role in shaping urban social representations, not only as a source of communication, but also as a transformative agent in a way similar to direct experience, due to their capacity to build on actual experiences of the users much more than Institutional websites, for example.

- Warsaw. For Warsaw, first-time visitors enlisted a high number of specific monuments and parks, paying attention to the history and patriotic aspects; on the contrary, the Capital has been mentioned in a brief manner in the social networks (f=17 in total, including only: Castles, Old Town, Palace of Culture and Science, Palace on the Water). Facebook and Yahoo!Answers users have

mentioned many more generic places, such as palaces, districts and shops than in case of other cities; therefore, the comparison with the field study data would not be appropriate in the same way as in case of London and Madrid.

Concluding, the second hypothesis -related to the correspondence of the social representations of the most important places in the cities with those evoked in the social networks Facebook and Yahoo!Answers- has been only partially confirmed. While in case of London and Madrid it has been possible to verify such correspondence, the city of Warsaw constituted an exception (H2).

As already stated, the overall self-rated importance of sources of information has been the highest for London, lower for Madrid and the lowest for Warsaw. According to the third hypothesis, for less familiar cities the differences between high and low level of information enabled in the software settings shall be greater than for more familiar ones. The research presents the most frequent itineraries consisting of ten places proposed for each city in two different modalities: low level of information (only basic view available) and high level of information (images, Panoramio and information from Wikipedia available to users).

- London. The places enlisted for London in both modalities are identical and include: Natural History Museum, Buckingham Palace, Westminster, Big Ben, London Eye, Tower Bridge, London Tower, British Museum, Madame Tussauds and Camden Town.
- Madrid. For Madrid, with a low level of information set in Google Earth the participants most frequently chose the following sequence: Puente de Toledo, Centro de Arte Reina Sofia, Museo Thyssen-Bornemisza, Parque del Buen Retiro, Alcala Gate, Circulo Bellas Artes, Plaza Mayor, Plaza de Oriente, Palacio Real and Estadio Santiago Bernabeu. The high level of information has an influence on the choice of places included in the virtual itinerary in the following order: La Latina, Palacio Real, Tempio di Debod, Plaza de Espana, Gran Via, Plaza Mayor, Circulo Bellas Artes, Museo Thyssen-Bornemisza, Parque del Buen Retiro and Plaza de Toros. The two itineraries have in common only five out of ten places, which demonstrates a much stronger influence of Internet-based sources of information enabled through Google Earth than in case of London.
- Warsaw. The first-time visitors who participated in the field study have assigned the lowest self-rated overall importance of various sources of information about Warsaw. In line with the hypothesis, this has affected the differences between virtual itineraries proposed in Google Earth in high and low modalities. The first difference concerned the form of the most frequent itineraries, which changed from linear to a combination of linear and circular. Moreover, the list of places has changed, since in the first modality the participants proposed the following places: Ghetto, Old Town, Royal Castle, University of Warsaw, National Stadium, Three Crosses Square, Lazienki Park, Palace of Culture, Monument to the Unknown Soldier and National Opera House. In the second modality the places were: Sigismund's Column, Royal Castle, Mermaid Statue, Barbican, Our Lady's Church, Monument to the Heroes of the Warsaw Uprising, Royal Route, University of Warsaw, Palace on the Water and Chopin Statue. Only two out of ten places remain the same in both modalities. It is also possible to notice that with more information available, such as images, participants tend to focus on single monuments rather than areas, for example Sigismund's Column and Mermaid Statue are both single monuments in the area of the Old Town, just like the Palace on Water and the Chopin Statue are located in the Lazienki Park mentioned in the first modality.

The third hypothesis has been verified. According to it, a high level of information from different sources, as observed among first-time visitors to London, strongly influences decision-making when planning a virtual itinerary, similar in both modalities. On the other hand, for Madrid and Warsaw the virtual itineraries proposed display important differences depending on modality, since the self-rated level of information about these Capitals tends to be much lower among first-time visitors. (H3).

RECOMMENDATIONS

Assessing how social representations are generated, transmitted and transformed in this particular virtual environment may certainly be useful to policy-makers. This chapter proposes a well-tested model of the relationships among results and offers some practical implications of findings from the point of view of urban governance (Graham & Aurigi, 1997; Edwards, Griffin, & Hayllar, 2008).

FUTURE RESEARCH DIRECTIONS

The research can be extended by further comparisons between field studies and media studies related to other historical Capital cities under scrutiny -Rome, Paris, Berlin, Brussels, Helsinki, Lisbon and Vienna-, also including more articulated focuses on the composite world of Internet and its multiple environments, contributing to the reconstruction of brand image (Pike, 2009) like Booking.com, Twitter, Instagram, YouTube and TripAdvisor as vehicles for dissemination of common sense knowledge (de Rosa & Bocci, 2014). Moreover, certain mobile phone applications or blogs, which constitute a fertile material of analysis (Magnini et Al., 2011, 2012) can be included.

Reinterpreting the construct of destination branding in terms of destination e-branding under the “umbrella” of the social representations of European Capitals, it is possible to stress the interest of considering diversified multi-channel communicative tools in the Web 2.0 scenarios as asynchronous vehicles of the virtual city brand identity/image, which co-construct social representations of symbolic and historically embedded realities, such as the European Capitals. The comprehensive study is an attempt to deal with the complexity of the new communicative web scenario based on multi-channels, assumed to be influential on the genesis, transmission and negotiation of social representations.

CONCLUSION

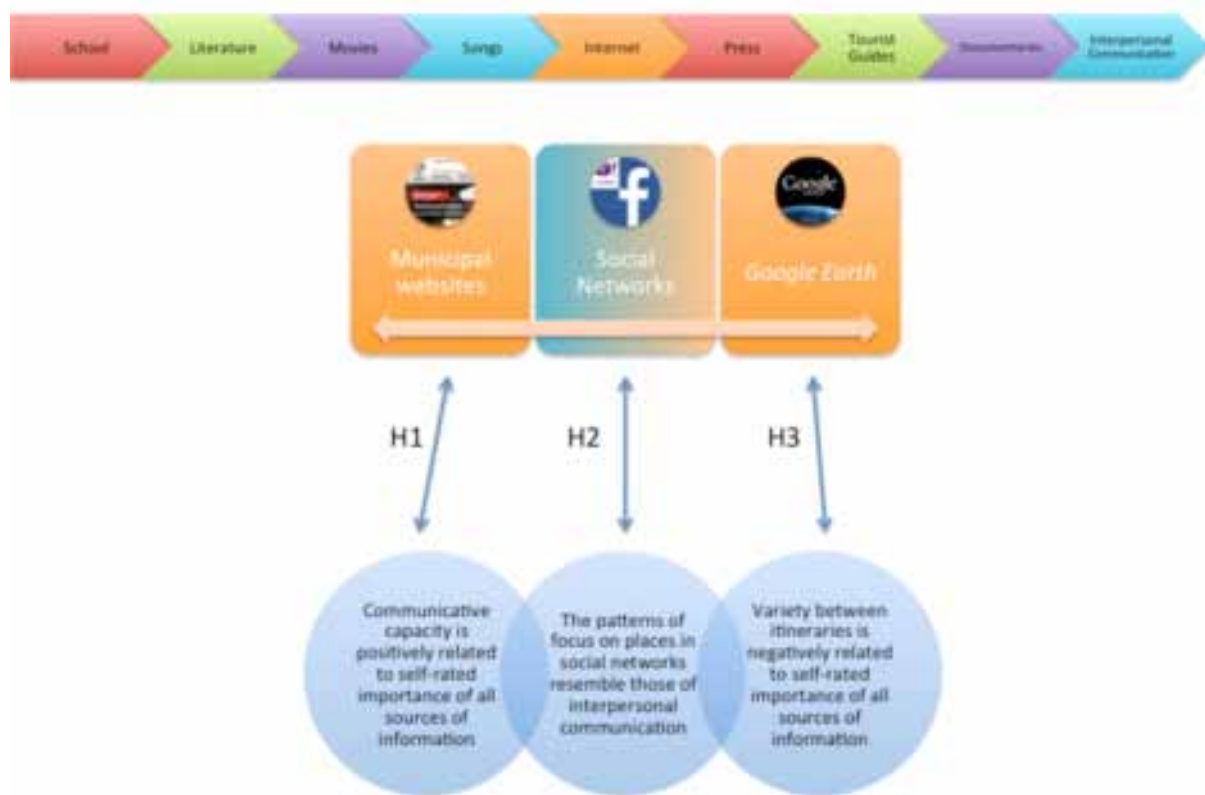
The aim is to demonstrate links between such sources and traditional means of communication, overcoming the model where the Internet is positioned on the same level and analysing it in a parallel way. According to the modelling approach to the study of social representations applied in environmental psychology in urban social context (de Rosa, 2013b) each hypothesis – in this research three – determines the most appropriate tools and techniques of analysis. Combined, they reflect social representations of cities examined from different angles.

As a result it is possible to propose a new model (Figure 3).

This model can be further extended to consider other Internet-based sources of information about cities, which influence their social representations.

The results demonstrated that:

Figure 3. Sources of information about a city with a special focus on the Internet



- 1) The Internet has become one of the most important sources of information about the cities;
- 2) Among the three Institutional websites under scrutiny, the website of London has the highest communicative capacity;
- 3) There is a positive relationship between the self-rated importance of different sources of information and the communicative capacity of the Institutional websites of the three cities (H1);
- 4) There is a correspondence between the field studies conducted in London and Madrid and the social representations of the cities detected when analysing the social media (H2);
- 5) The Internet influences the social representations of urban social space, especially in cases of Madrid and Warsaw, when the self-rated level of information about these Capitals tends to be much lower (H3).

The Internet is rapidly changing the way first-time visitors approach a new urban destination. As the research demonstrates, the multiple digital worlds of Internet play a crucial role in how a person perceives a city prior to the direct experience. Moreover, they can shape urban social representations, not only as a source of information, but also as a transformative agent in a way similar to direct experience, due to their capacity to build on actual experiences of the users.

These results show the strength of the modelling approach; its capacity to integrate in an organized rationalized and justified way various methods coherently with the multiple theoretical constructs that social representation pretends to articulate, when compared with the fragmentation of the micro-paradigms in the mainstream social psychology tradition.

The local governments of European Capitals should take advantage of the sources of information in order to meet the increasing demand for genuine and creative cultural tourism by implementing “landscapes of creativity” (Russo & Sans, 2009).

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KEY TERMS AND DEFINITIONS

European Capitals: Capital cities in Europe, which include an area that can be identified as a historic center (sometimes called “Old Town”, like in the case of Warsaw).

First-Time Visitors: People who visit a given place (for example a city) for the first time in their lives.

Geo-Cultural Context: Specific geographic location that takes into account the cultural characteristics of inhabitants, such as common language, history, customs or art; for example, insular, Mediterranean or North-European geo-cultural contexts.

Modelling Approach: A paradigmatic approach to Social Representations developed by de Rosa (2013a, 2013b).

Social Networks: In the definition of social networks, inter-relationality among diverse social actors, such as individual private users and organizations, is a core element.

Social Representations: A complex construct created by Serge Moscovici (1961), which, according to de Rosa (1994), can be operationalized on three different levels: a) social representations as a phenomenon; b) theory of social representations; c) meta-theory of social representations.

Urban Tourism: A form of tourism aimed at visiting a city while traveling for recreational purposes.

An Exploratory Study of In-Flight Safety Videos and Airline Marketing Strategy

10

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INTRODUCTION

In today's modern world, traveling has become more common. With the emergence of social media platforms such as Instagram and Snapchat, air travel has increased tremendously in recent years as travelers share first-hand experiences online (Borgogna, 2016). In the aviation industry, a government entity known as the Federal Aviation Administration (FAA) ensures passengers' safety as a top priority. In an effort to promote safety awareness to the passengers, the FAA mandated the commercial airlines to present passengers on board with an in-flight safety video. The in-flight safety video is a pre-recorded video that explicitly presents safety instructions and procedures aimed to be delivered to passengers onboard.

Passengers have often reported these pre-safety briefings to be considered boring and repetitive, and are sometimes ignored (Seneviratne & Molesworth, 2015). This presents the argument that numerous airlines have considered and have therefore transformed their safety videos into more interesting means to attract passengers' attention, such as Air New Zealand (Plautz, 2016). However, recent trends from commercial airlines such as Air New Zealand and Virgin America have attracted millions of YouTube views through their pre-flight safety videos, encouraging viral marketing (Plautz, 2016). This begs the question as to whether airlines are incorporating entertaining content to the in-flight safety video to market their own airlines, or for passenger information retention purposes. As such, the objective of this chapter is to explore in-flight safety videos presented to passengers as a form of marketing, for numerous airlines ranging from premium to budget airlines. The remainder of the chapter includes the background of the in-flight safety video, addressing varying perspectives from the academic literature, followed by research methodology, contribution, and managerial implications.

BACKGROUND

Relationship Between In-Flight Safety and Customers

Customer retention is certainly a priority for many industries. For the aviation industry, factors such as a customer loyalty program, satisfaction, reliability, and perceived risks are important determinants of customer retention (Climis, 2016; Atalik and Ozel, 2007; Johnson; Garbarino and Sivadas, 2006). Climis (2016) suggests that a positive relation exists between perceived safety and satisfaction and that the reputation of the airline in terms of safety, and cabin crew knowledge were key elements for customers to

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repurchase and fly with the specific airline. This result is also consistent with related studies conducted earlier (e.g. Atalik and Ozel, 2007; Johnson, Garbarino and Sivadas, 2006).

Previous studies highlight various major problems in aviation safety such as equipment failure, weather conditions, unfastened seatbelt during turbulence, pilot error, air traffic control, cabin crew error, other aircraft collision, terrorism, or unknown (Oster Jr et al., 2013; Lofquist, 2010; Madsen, 2013). Madsen (2013) suggests that a positive link exists between safety risks and profitability when examined the US aviation industry. Aviation safety is an integral part for all concerned stakeholders, particularly passengers and cabin crew. As such, a recent study has looked into virtual reality (VR) as a method of knowledge transfer, specifically safety aviation instructions (Chittaro et al., 2018). The VR tool is proposed to be delivered on smartphone or mobile devices. The use of the mobile VR tool was also compared to the traditional briefing card. Results of the study show that knowledge transfer was significantly faster, more effective, and more accurate when participants used a less traditional tool (Chittaro et al., 2018). This is of great importance since the real-world application of safety knowledge is a fundamental survival factor in a life-or-death situation (Chittaro et al., 2018). Aviation safety is also associated to cabin crews' perceptions of safety culture (Sexton & Klinect, 2017). A study in the field of psychology suggests that a happy crew, with a positive perception of the safety culture are considered safer and less likely to conduct errors. This places emphasis for training departments to ensure teamwork, leadership skills, open communication, and less stress on performance are laid out to pilots and cabin crew to enhance the safety culture (Sexton & Klinect, 2017).

It is an important consideration for the aviation industry to understand what factors are taken into account for travellers in deciding which airlines to fly with. An econometric study was conducted using surveys to measure young travelers' flight choice (the average age of participants was 22 years old). The first questionnaire was generally asking which factors were most important to young travelers. It was found initially that young travelers did not take aviation safety as a factor in their decision making, but price was (Koo et al., 2015), which is contradictory to another study which stated that safety is ranked 7th and 8th for low-cost and budget airlines (O'Connell & Williams, 2005). However, when participants were prompted using a novel approach which specified four important factors: number of incidents (safety), price, flight duration and inflight service (food, entertainment, cabin crew service), safety then became a significant factor in decision making, particularly when risks are involved (O'Connell & Williams, 2005). Therefore, researchers suggest that there is a need for marketers to include safety as an important outline to advertise airlines (Koo et al., 2015, O'Connell & Williams, 2005). Although safety is a major key factor in customer satisfaction with airlines, passengers' perception of safety as an important factor differs from one passenger to another, especially between leisure and business travelers. Leisure travelers are more greatly concerned with safety perception of commercial airlines than business travelers (Ringle et al., 2011) leading to another implication for airlines to strengthen marketing activities involving safety aspects for the general public specifically leisure travelers (Ringle et al., 2011).

In-Flight Safety Requirements

Federal regulators such as the Federal Aviation Administration (FAA), and the Australian Civil Aviation Safety Authority (CASA), place a large focus on in-flight safety. In-flight safety instructions were traditionally delivered verbally by the cabin crew to the passengers on board. This practice still occurs in low-cost airlines that do not provide the technology such as screens onboard. Along with federal regulatory bodies, the International Civil Aviation Organization (ICAO), United Nations specialized agency, aims to work closely with its members in order to coordinate assistance among members in the aviation

civil sector industry. The ICAO has also set Standards and Recommended Practices (SARPs) adopted by the Council of the International Civil Aviation Organization. There are a set of standards that is expected for airlines to comply with. The International Civil Aviation Organization has set required messages that is mandated to be covered in any commercial flights' safety briefing (Seneviratne & Molesworth, 2015; "Pre-flight safety demonstration", 2014):

- the locations of emergency exits
- the attentiveness to emergency floor lighting
- the use of the seatbelt and adherence to the fastening of seatbelts during turbulence
- the brace position demonstration in case of an emergency occurrence
- the use of oxygen masks, and the importance of a passenger fitting his/her own mask before assisting others like children, disabled passengers, or others that require assistance
- the location and use of life vests, life rafts, and flotation devices in the event of an emergency landing occurring near a large body of water such as an ocean or sea,
- reminder of prohibition of smoking inside the plane, and more recently prohibition of any electronic smoking devices as well
- ensure mobile devices are switched off during take-off and landing (or kept to "flight mode")
- keeping seatbacks and tray tables upright and locked prior to takeoff and during landing, and stowing carry-on luggage inside the overhead locker or underneath a seat throughout the entire flight

As per Operation of Aircraft, Part I — International Commercial Air Transport, the ICAO has also set standards related to cabin safety, particularly to ensure international civil aviation sector provides cabin crew with sufficient trainings. The SARPs include the following (ICAO, 2018):

- The operator's in-flight procedures
- Passenger safety
- Carry-on baggage
- The minimum number of cabin crew required for each type of airplane
- The assignment of cabin crew members' emergency duties
- Cabin crew at emergency evacuation stations
- The protection of cabin crew during flight
- Cabin crew training programs
- Equipment required on board airplanes
- Cabin crew members' fatigue management
- Security-related procedures and security training programs (for the prevention of illicit acts against civil aviation)

In-flight Safety Videos Overview

With the increase of travelers in the commercial aviation industry, there has been an overall 7% increase in air travel in 2017 versus 2016 (IATA, 2017). Although the airline industry faces a low risk in terms of accidents, it is still highly susceptible to potential hazards that may occur due to pilots' inefficient decision-making skills or with the cabin crew's poor knowledge in dealing with an in-flight threatening situation (Molesworth & Wiggins, 2004). It is important to note that the low risk present in the aviation industry is associated with the regulations presented by the United States' FAA, and the Australian Civil

Aviation Safety Authority (CASA) (Tehrani & Molesworth, 2015). Moreover, aviation research findings revealed that online media streaming enhances the safety knowledge of crew members as opposed to traditional training methods (Bellazzini et al., 2008). This also implies that the easy accessibility of the material allows learners to re-watch air safety-training video and enhance knowledge retention (Bellazzini et al., 2008). Academic researchers attempted to compare the effectiveness of safety briefings in terms of card provided on the aircraft versus traditional in-flight videos versus in-flight videos that utilize more interactive technology (Chittaro, 2017). The findings show that there is no significant difference between in-flight videos incorporating interactive technology and traditional videos, but a significant difference compared to briefing cards (Chittaro, 2017). The results of the study raise the question as to why commercial airlines release less conventional in-flight safety videos.

It is crucial that any airplane that takes off must adhere to the regulations set by these government entities, which includes for any commercial airline to present its own in-flight safety briefing to all passengers on board. These requirements were stated in the earlier section. The aviation government entities have established a set of elements that is expected of commercial airlines to cover (Seneviratne & Molesworth, 2015). These aspects include providing the location of emergency exits, emergency lighting, demonstration of the brace position in case of an emergency occurrence, oxygen masks, location of life vests, and other reminders such as no battery operated gadgets, no smoking is permitted anywhere in the aircraft, and ensuring to keep mobile phones on flight mode during take-off/landing (Seneviratne & Molesworth, 2015).

Research findings from aviation journals suggest that paying attention to the in-flight safety video is a challenge to many passengers (Molesworth, 2014). Although the aviation government bodies such as FAA and CASA did not limit airlines' creativity in terms of in-flight safety delivery, most commercial airlines followed a dry, similar script (Molesworth, 2014). Commercial airlines face a greater challenge from frequent flyers, who already assume familiarity with the content, and therefore pays almost no attention to the safety information on board (Parker, 2006). A challenge stated by ICAO is FAA allowing all passengers to use portable electronic devices (PED) during the entire flight, except during take off and landing (Tang, 2013). This may suggest that when passengers are using their PED, they are less likely to pay attention to safety videos.

Traditional Factors in In-flight Safety Videos

Airlines need to ensure that apart from the regulated elements that need to be incorporated, there are several identified traditional factors that commercial airlines tend to tackle. The term traditional factors can be understood as factors that are expected and customary to any in-flight safety video. Similar to any video design and production team, these factors include the overall quality of the video in terms of its visual and audio aspects, video length (most safety videos range from 3 to 5 minutes in length), resolution, presence of subtitles, or clear voice-overs in other languages (Molesworth, 2014).

It is particularly important to ensure that consideration and provision are provided to passengers with needs and disabilities. To exemplify, for those passengers who may need to be accommodated due to hearing deficiency, airlines can incorporate sign language either in the video itself or appoint cabin crew to present the safety video as sign language. The recent trend that some commercial airlines started paying attention is how to successfully keep passengers engaged throughout the video. Premium airlines such as All Nippon Airways, Cathay Pacific, and Emirates Airlines, who had recently bagged the world's best airline inflight entertainment award (Rosen, 2017), still prefer a more traditional form of in-flight safety videos.

In addition, many organizations wanting to promote their brand name engage in brand name imprinting. This can be simply defined as displaying or exposing consumers with the brand name in a promotional aspect. Research confirms that imprinting brand name before presenting beneficial information facilitates consumers' ability to retain that information in their memory (Baker, 2003). This is particularly important for marketers who choose to only present the brand name at the end of a video.

Non-conventional Factors in In-flight Safety Videos

The Air New Zealand is considered a first mover in the game to revamp their in-flight videos. Other airlines then became fast followers, such as Cuba Pacific Airlines, and Qantas - they have moved away from what seemed to be a more conventional approach (Molesworth, 2014). Air New Zealand, as a leading airline to adapt an eye-popping approach, had not only achieved to gain passengers' attention, but also attract millions of views through viral marketing. Air New Zealand's Hobbit themed in-flight safety video have reached more than 18 million views in 2017 (Meltzer, 2017).

Commercial airlines have applied varying themes in an attempt to provide striking in-flight safety videos. Humor, celebrity involvement, or coinciding with a particular occasion are a few examples that airlines have successfully implemented in their in-flight safety videos (Molesworth, 2014). Research findings show that the economic value associated with celebrity endorsements reach up to \$10 million on an annual basis (Elberse & Verleun, 2012). Celebrity endorsements and involvement with brands is also found to positively enhance brand equity (Dwivedi, Johnson, & McDonald, 2015). A premium airline, Qatar Airways, decided to follow this path and release their in-flight safety video featuring football stars FC Barcelona creating another campaign that went viral (Platt, 2015). While this strategy certainly achieved gaining the attention of their passengers, it is unclear whether airlines do this for marketing purposes, or for the mere safety focus of passengers. However, it is important to consider the problem in the aviation sector: finding the optimal balance between flight safety and cost-effectiveness for the airline. The role of the ICAO comes into play as a way of harmonizing standards across the aviation sector to ensure safety is not compromised, while still remaining efficient (ICAO, 2016). The main advantage that viral marketing presents to airlines is that it does not require a large budget, but instead analyzing trends that create a buzz (Camarero & San José, 2011).

Another technique used by commercial airlines to overcome passengers' overfamiliarity and boredom, is the integration of humor (Molesworth, 2014). In a survey conducted to advertising agencies, results show that 90-92 percent of advertising experts confirmed humor as an effective tool to gain attention (Madden, 1984). Notable airlines such as Air New Zealand, Qantas and Virgin America have utilized this technique. Research findings show that passenger recall of safety information is more prominent in videos incorporating humor than celebrity endorsements (Seneviratne & Molesworth, 2015). On the other end, a comparative study found that participants' retention scores on safety instructions were the same for both humorous and non-humorous safety videos, which infer that passengers' safety may not be compromised by the use of humorous in-flight safety videos (Molesworth, 2014).

Other airlines prefer to promote the destinations that passengers can visit during their stay. The content of their in-flight safety videos revolves around tourist spots and breathtaking sceneries. Qantas and Singapore Airlines have effectively executed this technique. It also presents a more corporate image of the airline brand, compared to the use of humor or celebrities. Although it does reach a large number of views on social media platforms, approximately 300,000 to a million, it does not gain the viral marketing effect, unlike the use of pop culture and humor.

Numerous academic studies have explored online tailoring, or to simply put, adjusting the content of online information presented to varying individual characteristics such as demographics or gender. A recent study explored the use of online tailoring to understand its effects of attention and recall of online information between young and older adults (Nguyen et al., 2017). Findings show that tailoring information has a positive effect in information recall for older adults, but attention and recall for younger adults is the same for tailored or non-tailored online content (Nguyen et al., 2017). Air New Zealand was one of the airlines that have attempted this strategy by inviting celebrity comedian Betty White in their safety video (Air New Zealand, 2013, October 9). According to passengers, while some of the younger passengers did not fully relate, the rest of the older crowd definitely had a good laugh from the safety video.

Viral Marketing as a Strategy

Due to the success of airlines' non-conventional approach to in-flight safety videos, this has created a viral effect for many of their videos. A viral effect in marketing can be understood similar to virus that has rapidly spread across a large network through the sharing of a brand's information to both current or potential users (Dobele et al., 2007). After the proven success of in-flight safety videos that went viral, such as the Hobbit-themed safety video of Air New Zealand that gained millions of views throughout social media – although unsure of whether initially intentional or not, other airlines such as Qantas and Virgin airlines, have followed their fruitful path (Air New Zealand, 2014, October 22).

While the ICAO and federal regulators ensure that standardization is met across the aviation sector, there is a need for airlines to find the optimum balance between safety, management, and cost. The ICAO has set strategic objectives and Global Safety Aviation Plan (GASP) that is expected for airlines to achieve (ICAO, 2010). These objectives involve making sure staff is well-trained so that airlines are capable of responding to risk, conducting safety audit, and incorporating civil/military cooperation (ICAO, 2010). Commercial airlines can still comply with safety regulations, while adapting a less traditional marketing strategy, such as viral marketing.

Low cost and effective reach to mass audience are key conditions that make viral marketing as a strategy becomes very intriguingly attractive to many organization seeking to obtain effective communication channels to customers (Camarero & San José, 2011). Viral marketing utilizes technological communication through social media platforms to trigger the widespread of brand messages to a large network (Dobele, Toleman, & Beverland, 2005). To exemplify, airlines communicate their in-flight safety videos on social media platforms such as YouTube or Twitter that gain a wide reach of network. Hashtags are also used by airlines to enable social media users to quickly comment or share discussions on a particular thread, such as Emirates airlines' slogan, #HelloTomorrow or Air New Zealand's #AirNZMerryXmas during the holiday season.

Research findings have identified that successful viral marketing campaigns trigger an emotional response in recipients (Dobele et al., 2007). Results of a study suggest that in order for viral marketing to effectively take place, it is essential that the intended viral messages need to contain an element of surprise (Dobele et al., 2007). Additionally, it is not uncommon practice to recognize brands' efforts to tap social media platforms to introduce a new product or service. This is conducted hand-in-hand with viral marketing as a strategy. For example, researchers have discussed the strategy of the pop culture Britney Spears universe – how their aggressive attempt to promote a music video, with the objective to make it viral. In order to accomplish the viral effect, the video is discussed and posted on numerous

social media platforms such as Facebook, Twitter, and Youtube, to encourage and attract a large network of social media users (Kaplan & Haenlaine, 2012).

FOCUS OF THE ARTICLE

This chapter takes an exploratory approach, and primarily investigates numerous in-flight videos from various commercial airlines whose content is readily available on the YouTube platform. The systematic process searched for all airlines listed on Forbes' 2018 best airlines of the year list (Rosen, 2017). Each airline was then searched on YouTube for the last five years of in-flight safety briefings. These videos were then analyzed using a qualitative method known as content analysis (Bryman, 2008). Qualitative content analysis is a research methodology analyzing the content of messages, and translating it to meaning in the most objective manner (Bryman, 2008). The chapter also focuses and utilizes findings from literature reviews and news articles to interpret real-life secondary data. It is important to note that this is an exploratory study that focuses on elaboration of existing theory. The content analysis performed in this chapter mainly looks at the presence of non-traditional factors in the safety briefing videos of commercial airlines. In addition, it is also important to note that social media data is dynamic, therefore the results might not hold in the long run. This limitation can be addressed in future research studies by combining content analysis with descriptive statistics and trend analysis tool.

Although in-flight safety videos are discussed in academic literatures, there exists an underlying question as to whether airlines are jumping on the bandwagon producing entertaining content for marketing purposes or for passenger information retainment. This chapter then aims to fill the gap present in academic literature, and provide insights to the effectiveness of in-flight safety briefings, and explore whether premium or budget airlines present various strategies in the aviation industry.

SOLUTIONS AND RECOMMENDATIONS

Linking Airline Ratings to Presence of Non-conventional In-flight Safety Videos

This section of the chapter aims to shed light on the link between airline ratings and the utilization of non-conventional variables in in-flight safety videos. Table 1 presents a summary of the content analysis conducted of Forbes' 2018 best airlines against different elements that may or may not be present in in-flight safety videos. The five factors: traditional approach, utilization of celebrity or humor, promoting the destination, or accomplishing the viral effect. These key features were discussed in the background section of the chapter, and are important variables to consider in content analysis. As seen in Table 1, it is evident that the top best airlines have all boosted their in-flight safety videos using non-conventional factors to meet the innovative trends of recent years.

This may suggest a positive link between the use of less traditional factors and positive ratings of airlines. Another important observation is that top airlines, particularly, Air New Zealand and Virgin airlines, are not mere one-hit wonders. These airlines ensured to release more than one creative in-flight safety videos, addressing the struggle to keep passengers attentive, especially frequent flyers. Out of the list presented, Air New Zealand displays the most dedication by producing a total of 14 innovative in-flight safety videos since establishing the trend. This may create excitement and curiosity for pas-

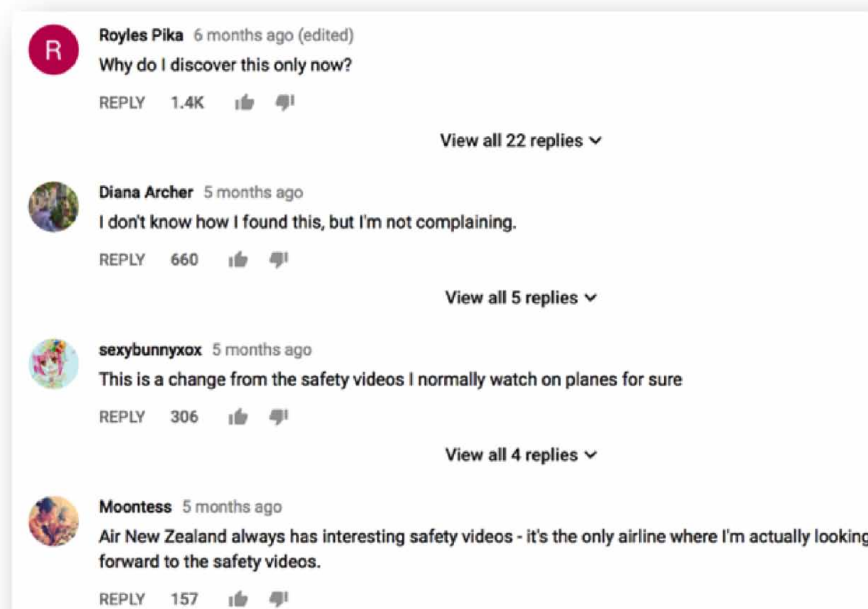
Table 1. Factors Considered by Airlines

Rank	Airline	Traditional	Celebrity	Humor	Destination	Viral Effect
1	Air New Zealand		x	x	x	x
2	Qantas		x		x	x
3	Singapore Airlines	x			x	
4	Virgin Australia		x		x	x
5	Virgin Atlantic			x		x
6	Etihad Airways	x		x		x
7	All Nippon Airways	x			x	
8	Korean Air	x				
9	Cathay Pacific	x				
10	Japan Airlines	x				

sengers about to board on their flight, and also maintaining passengers' attention before the in-flight safety video is played.

Through content analysis, it was also found that some airlines developed an entire campaign revolving around their in-flight safety videos. To exemplify, airlines such as Virgin and Air New Zealand promoted their hashtags in their in-flight safety videos published on social media platforms, such as #AirNZSafetyVideo (Air New Zealand, 2014, October 22). Evidence has shown that by doing so, airlines have started conversations around their videos on social media, by not only their passengers but also thousands of social media users. Figure 1 exemplifies social media users' excitement in not only the current in-flight safety video, but for the airline's future production as well. Therefore, it is safe to assume that if the user were to board the plane of the specific airline, he/she will most likely be paying close attention.

Figure 1.



Another important observation is the integration of the marketing campaign. Airlines from the top five of the list have incorporated elements of their in-flight safety video to other advertising campaigns. For example, Air New Zealand used the hobbit theme for additional areas of promotion, other than their in-flight safety video. This may portray the airlines' intention as to solidify their image to passengers, thus enhancing brand equity.

For the top rated airlines, it remains unclear whether the intention for the introduction of non-conventional factors was to eliminate boredom of passengers towards in-flight safety videos, or merely to promote their brand image through viral marketing. Nevertheless, the viral effect was achieved by most airlines, particularly due to the stimulating content triggering passengers' and other social media users' emotional connection, encouraging the exchange, likes, views, tweets, and comments on social media platforms (Dobele et al., 2007).

Due to the success received by airlines such as Air New Zealand, the added-value effect can be optimized from the enhancement of in-flight safety videos. Particularly when welcoming frequent travelers, it is essential that they still pay attention to the content and are engaged throughout, as it also enhances information recall in case of an emergency crisis. With this, marketing managers aiming to boost their brand value to customers and enhance customer-perceived brand equity can incorporate innovative ways to engage passengers during in-flight safety videos. Additionally, when recognized as an airline brand that is a dominant player in the creative side of inflight videos, airlines such as Virgin or Air New Zealand have proved to not simply be one-hit wonders. This has proven to encourage both frequent and new passengers to look forward to watching their in-flight safety video (Air New Zealand, 2014, October 22).

Airline marketing managers may also consider viral marketing as an effective strategy through the introduction of appealing hashtags, and integration of the overall brand promotion on numerous social media platforms to achieve a widespread interest from a large network of users. The network of social media users themselves create the viral effect through constant discussion, exchanges, and sharing in the social media community. This was also proven to be a low cost, yet successful to reach mass audience (Camarero & San José, 2011).

FUTURE RESEARCH DIRECTIONS

This chapter discusses a topic that is critical to airlines' implementation of successful in-flight safety videos. It also highlights its importance in airlines' potential marketing strategy. Numerous academic findings have suggested that passengers do not pay attention to in-flight safety videos due to boredom and overfamiliarity. With this, commercial airlines have integrated their in-flight safety videos with non-conventional factors such as humor and celebrities to address this issue. In addition, it is apparent that airlines have also attended to marketing opportunities that lie in safety videos. Air New Zealand, the airline rated number 1 according to Forbes 2018 list, was one of the first movers to capitalize on its in-flight safety videos. Their videos achieved a trend-setter status and phenomenal viral marketing effect with millions of views on social media platforms.

As discussed in the earlier section, an exploratory study was conducted. This is a limitation that will be addressed in future research by expanding the methodology from qualitative content analysis to descriptive statistics or trend analysis tools as form of mixed methodologies. In addition, for future research, it would be interesting to pursue a primary research, by conducting interviews to analyze passengers' perspective on airlines' in-flight safety videos. It would also be interesting to conduct a comparison between frequent flyers' perspective versus passengers who seldom travel. Passengers can be asked which

safety videos do they recall, and what factors should airlines consider when designing in-flight safety videos. Since it remains unclear as to whether non-conventional factors disrupt the recall of passenger safety information, this can also be tackled in a future primary research.

CONCLUSION

In-flight safety videos can be used as competitive advantage for airlines. There is certainly a trend for popular and successful airlines such as Air New Zealand to move towards less conventional forms of safety instructions. Numerous airlines have ventured onto creative means to capture passengers' attention, which is integral for surviving any critical emergency. It is also important to highlight that while creating creative methods to enrich passenger safety onboard, airlines are also able to capitalize on enhanced brand equity, and increased brand awareness through viral marketing with a wide audience through various social media platforms. While the main intention of previous airlines who have conducted successful in-flight safety campaigns remains unclear, other airlines can strategically attempt in-flight safety videos for the aforementioned benefits.

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KEY TERMS AND DEFINITIONS

Brand Equity: The perception of value that consumers have about a brand name that is independent of the actual quality of the product or services.

Brand Name Imprinting: A marketing process or effort that businesses take in order to strengthen their brand in the market.

Commercial Aviation: The use of aircraft for hire by the public to transport passengers or goods.

Frequent Flyers: People who travels by air regularly.

Hashtag: A type of tag that is commonly used on social networks to allow people to search for a specific post.

In-Flight Safety: The safety of the passengers during flights.

In-Flight Safety Video: The required safety instructions in the form of a video that is played by an airline to the passengers before take-off.

Viral Marketing: A marketing strategy or gimmick that focuses on controversial topic or issue to encourage sharing of information by consumers.

Model/Anti-Model Advocacy Responses to Hospitality Industry Sexual Harassment

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INTRODUCTION

In 2006, Tarana Burke, an African-American civil rights activist, started a nonprofit organization, Just Be Inc. to aid survivors of sexual harassment and assault. She named the movement “me too” and began a campaign to help survivors, especially young women of color from poor communities to begin to heal from their experiences (Me Too, 2018). Actor Alyssa Milano used the #MeToo hashtag to promote the effort to recognize and give a voice to sexual harassment and abuse victims as the first accusations against Hollywood producer Harvey Weinstein were revealed across social media in 2017. That tweet quickly went viral and helped to launch the #MeToo campaign.

Since April 2017, other victims of sexual harassment and assault have spoken up around the country and the world to reveal their experiences and to expose their attackers. More than 263 people; including leaders and celebrities, in fields such as arts and entertainment, media, business, technology industries, politics, religion, education, hospitality services, and others; have been the subject to allegations of a variety of inappropriate and illegal activities including sexual harassment and assault (North, 2019).

These cases have revealed some challenges to effectively responding to these accusations. On the one hand, the individuals accused must be confronted and their specific behaviors and consequences identified and acted on. Many of those accused have been publicly shamed, their private lives and relationships damaged, others have lost their jobs, criminal and civil charges have been filed, and they have had careers and reputations ruined. At the same time, these cases have been held up as representative of larger problems in a variety of industries and institutions; including arts and entertainment, hospitality, media, business and technical organizations, politics and government, sports programs, and more. Identification and punishment of transgressors can only be a starting point for reforming the recurring and systemic conditions responsible for these actions. Transformations of organizational culture, institutions, and social expectations are necessary. Organizations have the opportunity to learn from these accusations and improve themselves and their industries.

The ongoing discourse surrounding the identities of people accused of harassment and other actions, along with efforts to address these issues within the organizations where these offenses have occurred, call for a scholarship that will extend beyond describing and categorizing accusations. Scholarship that should identify how this movement and its victims might see changes in the institutions and industries that created and allowed conditions for these behaviors to become “normalized.” Advocacy that is capable of transforming these institutions is necessary and can be identified in cases where accusers and institutions have made responsible efforts to change.

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This chapter explores a case study in the hospitality industry by evaluating accusations against John Besh, a celebrity chef, and his organization, the Besh Restaurant Group (now BRG Hospitality). Applying the work of Perleman and Olbrechts-Tyteca (1969) and their identification of model and anti-model argumentation schemes, this study reveals how organizations and industries can address accusations against members (anti-model) and also propose and advocate for changes (model) to improve both symbolic and material conditions for their industry, their employees, and their stakeholder communities. Three objectives are established for this chapter. First, provide an evaluation of the discourses by leaders and members of the hospitality industry, celebrity chefs, and the mass media for their responses to sexual harassment and assault accusations. Second, reveal how the hospitality industry can employ model and anti-model arguments to advocate for changes in their industry and practices. Finally, identify the strategic purpose for using model and anti-model argumentation as an alternative to other reputational repair strategies for any organization facing accusations of wrongdoing.

BACKGROUND

Ulmer, Sellnow, and Seeger (2019), define an organizational crisis as “a specific, *unexpected*, and nonroutine event or series of events that create high levels of *uncertainty* and simultaneously present an organization with both *opportunities* and for threats to its *high-priority goals* (p. 7).” When individuals face accusations of harmful, inappropriate, and/or illegal behavior; their actions become the focus for judging their character, decision-making, and actions. When those same individuals are also in positions of power and influence; as celebrities, leaders, bosses, and other public roles of responsibility; the organizations and industries they lead and represent are impacted by their actions. Harmful actions by employees, leadership, and spokespersons can reflect back on the organization’s goals as well as the entire industry they represent. Tieying, Sengul, and Lester (2008) refer to these as a “spillover of negative impacts” created by crises that may impact their entire industries (p. 452).

Corporate America has a history of dealing with attacks to their image and reputation due to actions within and beyond their control. Many of the strategies are for responding focus on image restoration efforts to protect reputation. Benoit (1995) identified five image restoration strategies: denial, evading responsibility, reducing offensiveness of the event, corrective action, and mortification. Corrective action is seen as an effective response because “unlike compensation, which seeks to pay for a problem, corrective action seeks to prevent or correct it” (p. 45). Such a strategy of action and discourse is appropriate in a situation that encompasses organizational practices and corporate values.

The issues surrounding the #MeToo movement include values and beliefs related to organizational culture and social values that impact many stakeholders and industries. Organizations often serve as value advocates in addition to their central function as profit centers. To remain socially legitimate, organizations should represent and protect larger social purposes, and act in a “socially responsible and ethical manner” (Seeger, 1997, p. 9). Corporate and industry discourses may “seek to establish public frames of reference for interpreting information concerning issues deemed important.” As such, these efforts “not only reflect the society of which they are part, they also help create and recreate it” (Cheney & Dionisopoulos, 1989, p. 144).

Perelman and Olbrechts-Tyteca (1969) reveal that argumentation is capable of establishing a structure of reality by “resort to the particular case” (p. 350). By employing an argument from model and anti-model, an organization might choose to use their capacity to influence perceptions to restore credibility and support for their purposes. For example, Sellnow and Brand (2001) explored the effectiveness of

Nike's use of model argument to restructure public perceptions about their athletic shoe products in response to protests and boycotts in 1999. Brand (2007) also revealed how Merrill Lynch used model argumentation to restore investor confidence after civil and criminal accusations in its banking and investment divisions.

The public discourses surrounding the John Besh case and others that have been associated with the #MeToo movement, possess the potential to elevate discussions beyond attacking the individuals responsible for their actions and to make room for productive symbolic and actual organizational and cultural changes. Argument criticism has the capacity to advance the study of crises such as this one for the purpose of doing more than "understand any given reality. There is a need to transform it, to advance the cause of social protest, action, and change" (Denzin & Giardina, 2012, p. 18).

CHEF BESH, SEXUAL MISCONDUCT, AND HOSPITALITY INDUSTRY RESPONSES

In the midst of the swirl of accusations against celebrities, broadcasters, politicians, and other public figures in 2017, the results of an eight-month investigation by *The Times-Picayune* identified 25 current and former Besh Group employees who reported "that they were victims of sexual harassment while working at BRG or at a number of its restaurants" (Anderson, 2017, October 21). Accusations were directed towards John Besh, as well as his business partner Octavio Mantilla, and other members of the organization's management and leadership. Nine women agreed to have their names revealed in the report. Two women filed complaints with the federal Equal Employment Opportunity Commission (EEOC). Complaints and accusations in the article and the EEOC reports identified inappropriate touching, suggestive comments, efforts to coerce women for sex, and retaliatory actions for those who complained; as examples of conditions working for John Besh and in restaurants owned by the company. Additional federal discrimination complaints were filed against John Besh's restaurant group in December of 2017, echoing similar complaints found in the October investigative report and other EEOC filings (Anderson, 2017, December 28).

The accusations against Besh were not very different from the complaints filed against other targets of the #MeToo campaign; individuals with accusations from multiple victims with reports that supported and reflected repeated bad behaviors. The scope and number of complaints showed patterns of sexual harassment and assaults against women and have fueled the movement's efforts to address the larger issues that are revealed by these revelations. These accusations may be conceptually defined and categorized as efforts to: identify specific offensive and illegal actions on the part of John Besh and others targeted by victims of the #MeToo campaign; to reveal institutional and organizational norms and behaviors that have created the conditions leading to these offensive behaviors and actions; and finally, these accusations help to identify the characteristics of responses needed to address these crises.

The importance of the #MeToo movement and cases, like the John Besh accusations, is that they have helped to define and operationalize what accusers and victims mean by sexual harassment in the workplace. These accusations are conceptually difficult to understand until they are spelled out by the accusers and the frequency and similarity of the statements can be compared and compiled. Actions of physical and psychological abuse; work cultural norms and behaviors that reinforce these harmful conditions; the exercise of power and privilege over employees; and other revelations serve to create conditions that can allow scholarship to evaluate the adequacy and appropriateness of organizational responses and to recommend correction to existing organizational cultures and practices.

Application of Model and Anti-Model Argument

The use of model and anti-model argumentation presents a person or case to be either imitated or rejected based on its association to the values of the organization they reflect. Warnick and Kline (1992) explain that interest in “the model (antipathy for the anti-model) is converted into favorable or unfavorable orientation towards the model’s behavior” (p. 9). This argument scheme functions through use of a rhetorical process identified as dissociation, “whereby a unitary idea is bifurcated into two rival ideas” (Hearit, 1995, p. 121). Through dissociation, “one remodels the audience’s concept of reality and resolves incompatibilities (Schiappa, 1985, p. 10). Through dissociation, an organization or corporation can “claim that the wrongdoing is in no way reflective of how it generally does business” (Hearit, 1994, p. 121). Use of dissociation and model argument allows an organization to respond to a crisis and “regain its model status by shunning unacceptable practices. As such, an organization can reemerge as a model by stressing its unwillingness to conform to standards that are not acceptable” (Sellnow and Brand, 2001, p. 283).

As an academic practice, the evaluation of argumentation through model and anti-model argument reveals how organizations can define and represent themselves in situations where the actions or behaviors of the organizations are in opposition to their expressed values and mission. Arguments of this type conceptually identify the foundation of an organization and allows them to depict themselves as they advocate for an interpretation as aspiring to or meeting their objectives. To identify the application of model and anti-model discourses by organizations means to reveal what the organization accepts as model and anti-model performances by their members, leaders, or the organization as a whole.

Accusations of Sexual Misconduct against John Besh and his Organization

The case of John Besh, like that of Harvey Weinstein and the growing list of other accused harassers and abusers, is bigger than the accused. They represent abuses of power and authority that celebrities, owners, leaders, and public figures have wielded to harm women, minorities, and other vulnerable people. The accusations against John Besh and his associates in 2017 underscore the nature of complaints about powerful leaders, bosses, and celebrities and their treatment of others as part of the #MeToo movement. Consideration of their replies to these accusations should be assessed with not only the immediate context but the larger activity on the national stage.

The early responses by John Besh and his organization demonstrate an effort by the company to reply to some of the accusations without confirming the extent and seriousness of the investigative report by the media. At first, responses focused on ways to downplay the seriousness and scope of the accusations. John Besh offered that he had been in “consensual relationship with one member of my team” while married and that he is “entirely responsible for my moral failings. This is not the way the head of a company like ours should have acted, let alone a husband and father” (Anderson, 2017, October 26). In an earlier interview, Besh explained that he “would not characterize the values of this company in the way you just described” in the investigative report (Anderson, 2017, October 21). Besh later stepped down in his role as leader of the company and withdrew from visible management of the organization after publication of the investigation (Burton, 2017a).

Raymond Landry, general counsel for the Besh Restaurant Group, wrote that they “have learned recently that a number of women in our company feel that we have not had a clear mechanism in place to allow them to voice concerns about receiving the respect they deserve on the job” (Anderson, 2017, October 26). The 12-year old company, with multiple restaurants and more than 1,000 employees, did

not have a human resources department to process complaints or accusations until their first director started the job on October 11, 2017.

Business partner, Octovio Mantilla, argued that the accusations represented only a small number of the thousands of employees over the years who have not filed accusations, attempting to minimize the scope of the problem. The general counsel's statement also minimized the extent of the problem and made conciliatory gestures to show an appropriate response so that "the clear procedures that are now in place to safeguard against anyone feeling that his or her concerns will not be heard and addressed free from retaliation" will protect people who speak out against abuses in the future (Anderson, 2017, October 21). All of these statements represented the initial response to the investigations into the Besh Restaurant Group's treatment of employees.

The details of *The Times-Picayune* investigative report and responses by Besh added him to the list of persons accused of sexual misconduct that has been growing since 2017. Those complaints have formed the basis for new efforts to report and respond to sexual harassment allegations. *Time Magazine*, in the "Person of the Year 2017" edition, reported on the "Silence Breakers" who came forward to change "the way people view women who come forward" (Zacharek, et. al., 2017). Polls taken at that time also indicated that because of these cases women were more likely to speak out about harassment and be believed by other women (Zacharek, et.al., 2017). Although this accusation-making stage of the #MeToo movement has made progress in how people see the issues concerning treatment of women, minorities, and other vulnerable groups by persons in positions of power; further advancement is necessary. In another time, the initial responses by Besh and his organization might have been sufficient. The progress of the #MeToo movement, however, has generated the need for more extensive action and response.

After the initial revelations about the Besh Restaurant Group and John Besh stepped down, the organization restructured itself and announced the appointment of Shannon White as CEO. As the new CEO, White has been navigating the challenges of running the organization, even while Besh is reportedly still owner and having say over major business decisions concerning the company. Interviews and statements by members of the organization show the effort to design new model behaviors, policies, and procedures for the organization. In her initial letter to employees and members of the BRG team, new CEO Shannon White updated the members of initial plans to make institutional change happen. Included in her letter were statements about conducting an outside review and investigation, creation of an employee advisory committee, finalizing a sexual harassment policy and code of conduct, an employee assistance program, human resources training and education, among others. She committed the organization to be at "the forefront of a change in the hospitality industry and we will all be stronger and better on the other side" (Burton, 2017b).

By January, 2018, the parent company of John Besh's restaurants continued to advance changes. They changed their name from Besh Restaurant Group to BRG Hospitality (Carter, 2018). This was advertised as a way to recognize the new legal entity and coordination planned for the units in the company. They continue to work to adapt to the new reality concerning their businesses and finding ways to change their culture and industry. The organization, like many hospitality groups, has begun building the infrastructure necessary to develop a model of change and safety from past sexual harassment and assault issues. Changes including an employee hotline, new training, employee handbook, corporate code of conduct, employee advisory committee for feedback, an employee assistance program, and a complete internal investigation to identify other potential cases and problems not identified by the media's investigative report (Severson, 2018).

By adopting a strategy of model and anti-model advocacy, rather than just a reputational repair strategy, BGR Hospitality has moved to distance itself from the specific crises created by Chef Besh, and has sought to reform and transform its organization in ways it can to protect its employees, restaurants, and its future as an organization.

SOLUTIONS AND RECOMMENDATIONS

Expanding outward from the immediate leadership of BRG Hospitality, the discourses about the Besh accusations and restaurant culture start to take on new approaches and reforms. They became less about personal attacks and criticisms, and are more focused on the conditions that contributed to these cases and how to develop models for organizations and the industry to follow to avoid more of the specific anti-model behaviors reflected by chefs like John Besh and members of the hospitality industry.

In addition to the sexual harassment scandal surrounding John Besh, at least three other high-profile hospitality groups have been damaged by the sexual harassment and assault revelations and in the same vein of other #MeToo charges. Charlie Hallowell, in Oakland, California; Ken Friedman and Mario Batali in New York; have all been accused of sexual harassment and related charges, all have released apologies, and have been removed from daily operations or oversight for the restaurant groups they have helped create. As a whole, the restaurant industry has more sexual harassment claims filed against it than any other industry. Estimates as high as 90 percent of women and 70 percent of men are the victims of some form of harassment in their workplace by managers, coworkers, customers, and vendors (Reedy, 2019).

The actions advocated and taken by these hospitality organizations demonstrate the application of model argumentation that propose to alter the reality of their restaurants and the work environments to prevent and protect from the anti-model behaviors of their owners, founders and others. These cases reveal common problems that contributed to the conditions that led to work environments that employees have identified as reinforcing the anti-model conditions of sexual harassment and assault on employees. The advocacy efforts to correct these problems are proof of change and the expectation they will contribute to a new reality for the organization and industry.

One common variable for some restaurant groups facing these challenges is that they have not traditionally invested in human resource departments and management who could receive and listen to harassment complaints. Celeste Cooper, one of those reporting Charlie Hallowell for sexual harassment explained that without a mechanism to complain about behaviors they couldn't react. "I didn't think that it would be taken seriously, because he did that to everyone" (Duggan, 2017). BRG Hospitality, Charlie Hallowell's restaurant group, Ken Friedman's organization, and Batali & Bastianich Hospitality Groups have all announced changes in human resource areas; centralizing employee services and creating mechanisms for complaints and investigations (Severson, 2018; Duggan, 2017). In most cases, these organizations did not have centralized human resource resources or robust use of them. The restaurants often functioned independently without HR oversight. The absence of this type of corporate resource is generally considered problematic for larger organizations and even for small companies, the need for a human resources structure has become necessary in this industry in light of conditions that have led to sexual harassment and assault charges (Brasted, 2017). The addition of these changes presents one example in favor of a new model for the management of these organizations and a positive move for them. These new mechanisms do not address the specific charges against the celebrity chefs, but they do allow the organizations to dissociate themselves from past behaviors and indicate commitments to new conditions and treatments of workers to prevent the recurrence of past problems.

The restaurant groups who are related to the chefs accused of harassment and other misbehaviors have not only had to contend with changing their own internal structures and cultures, they have had to deal with the loss of partnerships and business opportunities that the accusations have endangered. Harrah's Casino in New Orleans dropped the Besh name from its restaurant Besh Steak after the accusations went public, attempting to distance themselves from the public perceptions of the culture of the restaurants owned or managed by the Besh Restaurant group. The South Beach Wine & Food Festival had promoted a dinner event co-hosted with John Besh who was then replaced with Amanda Freitag, a judge on the Food Network's *Chopped* show. (Carter, 2017). Other business ventures have also been cancelled or held up.

Mario Batali's organization, B&B Hospitality Group, announced that three of its Las Vegas restaurants would close on July 27, 2018. The partner in those businesses, Las Vegas Sands Corp., chose to end its relationship with B&B and close all three properties. These announcements came shortly after a *60 Minutes* report expanding on accusations against Batali for sexual harassment and assault (Mancini, 2018). Batali was the subject of investigations concerning sexual assault in two states, New York and Massachusetts. The investigations in New York were closed when the police could not find enough evidence for an arrest (Southall and Moskin, 2019, January 8). Although he was reported to have been exploring ways to making a comeback in the business in April 2018, plans to divest him from his restaurants continues with B&B Hospitality (Plagianos, 2018). Other business relationships have also been revised or altered since the accusations were made public against the chef.

Like other professions and industries faced with the accusations of sexual harassment and assaults, the restaurant industry's leadership and membership are called to reply to this situation and to reinforce proposed changes that may help alter perceptions of its culture. The late Anthony Bourdain, who was also supportive of other victims in the #MeToo movement, tweeted in response to the report on John Besh, "The beginning of the end of institutionalized Meathead Culture in the restaurant business" (Rainey 2017). Chef Jose Andres in Manhattan, NY also responded, "Need to make sure Restaurant industry is actively leading the way, respect, dignity, humanity is non negotiable. Specially protecting women" (Rainey, 2017). Although some chefs, restaurant owners, food journalists did speak against Besh as an anti-model of behavior and standards, the immediate reaction was not deafening. This point was made by restaurant owner and author Jen Agg who commented, "It's worth noting FAR MORE journalists and non restaurant people seem to be talking about Besh than the restaurant people who should be" (Rainey, 2017).

Celebrity chefs who have been accused of sexual harassment and assaults also experienced backlash from colleagues. As this cascade of cases including Besh, Batali, Friedman, and others have played out; other chefs have replied with their concerns about their industry and how male chefs are going to need to change their behaviors. Chef Tom Colicchio, in an open letter to chefs and the restaurant industry, wrote candidly about the need to reform the culture and expectations that have led to these abusive conditions. "I'm betting we can reinvent our industry as a place where people of all genders feel safe and prepared to lead" (Colicchio, 2017). Colicchio's letter was not only an attack on a culture that has contributed to the current crisis, but also one that has made it difficult to advance women and minorities within the industry as a whole and has endangered the success of the restaurant industry overall. "Can we finally redefine, in our collective minds' eye, what the race, gender or sexual identity of a top chef might be, and take the steps to make that happen?" (Colicchio, 2017). Colicchio's letter came at a time when the restaurant industry and chef culture is facing multiple challenges, and these harassment cases have only made it more difficult for the industry to thrive. At the same time that working conditions for women and minorities are being challenged; low unemployment, the crackdown on illegal immigration, and

alternative choices for cooks and chefs beyond traditional restaurants are leading to shortages and staffing problems for the industry (Maynard, 2017, November 10). Colicchio's advocacy for change reflects his support for reforms broadly, "It's going on everywhere. It's pretty clear that this isn't an issue for just the restaurant industry. It's a problem with our culture" (Andrews, 2017).

Model and anti-model arguments within the industry and from related groups and organizations are contributing to the voices advocating for a renewed industry that can address its challenges; not simply attack those who have abused others and have damaged the reputation of the industry. After the accusations against Chef Besh were revealed, a number of television cooking shows and networks cut his ties to him and cancelled appearances and shows, even reruns. PBS station WYES announced that it would no longer air productions featuring Besh, explaining that "WYES would not want any viewers to think that broadcast of those programs represented condonation of actions of the type alleged" (Sayer, 2017). Broadcast outlets represent an important revenue stream for celebrity chefs, but they are sensitive to allegations of sexual harassment and other inappropriate behaviors. Public television stations have a code of integrity that influences not only what is shown on their channels but also the behaviors of those hired to produce content. One example of the code states they "Expect employees to uphold public media's integrity in their personal as well as their professional lives, understanding that employee actions, even when 'off the clock,' affect trust, integrity, credibility and impartiality" (Maynard, 2017, October 24). A Bravo network show edited John Besh out of an episode of "Top Chef," a show he had guest judged on for years (Andrews, 2017). Other food related programs have also removed, delayed, or cancelled productions associated with celebrity chefs accused of harassment. Mario Batali was asked to leave co-host role in the ABC series "The Chew," and a planned production of a revival of his "Molto Mario" show for the Food Network has also been placed "on hold" (Bartiromo, 2017).

Restaurants and chefs have benefitted from the publicity that television has given them, and for expanding the celebrity culture of many chefs and restaurants. As such, their voices and production decisions are now capable of reinforcing change and models of industry behavior that should not negatively harm their financial interests. The harassment charges against Besh and other celebrity chefs continues to spill over into other businesses and the public's perception of them. Reactions by broadcasters and others also utilizing model and anti-model discourses are also helping to advance transformation in their organizations or risk losing their standing and opportunities in business.

The restaurant industry recognizes its best through a variety of awards, rankings, and honors. The Beard Foundation's, James Beard Awards, are one of the highest honors for a chef to receive. The award confers a level of excellence that leads to greater financial and social recognitions for its recipients. Many of the celebrity chefs accused of harassment and assault have been past winners of the award. Besh was a two-time winner and a Who's Who inductee. Batali won five Beard awards, Ken Friedman won the Outstanding Restaurateur award in 2016 (Canavan, 2017). In its instructions to judges for 2018 it asked judges to incorporate issues of behavior including these allegations and others in their nominations criteria. "The Restaurant & Chef awards honor professionals who serve as industry leaders. More than ever, we are thinking about respect and integrity when making recommendations for the semifinalists. As judges we ask you to do the same." (Canavan, 2018). The Beard Foundation, like other organizations working within the restaurant industry has been understandably impacted by the actions of their celebrity award winners. As such, their arguments and responses to this crisis count and have the power to influence public perceptions and the industry's pathway to changing its behaviors.

The overall impact of the accusations against John Besh and his organization have extended well past it into the restaurant industry as a whole. The profession and organizations that participate in this indus-

try have begun to identify its best and worst practices, established a dialogue and ways to communicate about them, and as a result recommend changes in their organizational culture, practices, and leadership.

FUTURE RESEARCH DIRECTIONS

The growing wave of accusations and accounts of sexual harassment, assault, and abuse, revealed in the wake of the #MeToo movement and by other victims, are themselves worthy of documentation, discussion, understanding, and outrage. The recording of these events and identification of these behaviors is a necessary step that have revealed hundreds of celebrities, public figures, and leaders for their harmful behaviors towards women and other vulnerable persons. These cases are also likely to reveal more as well as complaints against many others in their industries regardless of fame or celebrity. This study of accusations against John Besh and the further cycles of discourses about chef culture and actions by other members of the hospitality industry has demonstrated that the evolution of this movement must go beyond shaming, out casting, labeling, and accusing its unworthy role models and leaders. Academic scholarship, applying an understanding of argument schemes like model and anti-model argument, should participate in “giving people a language and a set of pedagogical practices that endeavors to turn oppression into freedom, despair into hope, hatred into love, doubt into trust” (Denzin & Giardina, 2012, p. 21). The advocacy approach represented in model and anti-model argument suggests rich potential for further research to advance understanding the #MeToo movement and other industry-wide crises that address sexual harassment cases and other industry challenges.

The argument schemes identified by Perelman and Olbrechts-Tyteca represent “distinct, culturally-held beliefs about the ways we form new beliefs from already accepted premises” (Warnick and Kline, 1992, p. 3). Model and anti-model argument schemes have the potential to shape the “structure of reality” understood by the audience to create “new audience perceptions” (Warnick and Kline, 1992, p. 3). Like Denzin and Giardina’s (2012) call for a scholarship that transforms society, the application of the model and anti-model scheme represents a rhetorical strategy that establishes in “the realm of conduct, particular behavior may serve, not only to establish or illustrate a general rule, but also to incite to an action inspired by it” (Perelman and Olbrechts-Tyteca, 1969, p. 362). Further research to explore the discursive power represented by model and anti-model argument may be able to not only identify its application but also successes in transforming the members of an organization in significant ways.

Finally, this chapter has helped to define and explain the concept of model and anti-model argument and to apply it to organizations and industries that need to do more than just repair their reputation or image. This research program allows for the consideration of efforts to effectively communicate during a crises and to move beyond the moment to enact change and transformation. Although research into reputational repair and organizational learning has frequently focused on repairing the public’s attitudes towards an embattled person or organization, this research represents an opportunity for additional consideration of strategies that seek to transform and change organizations, to help them learn to adopt new values and behaviors appropriate to their mission and public perceptions of their role in society.

CONCLUSION

This chapter has established the importance of evaluating the chef John Besh accusations, and those of others in the hospitality industry, by exploring model and anti-model arguments used to define and respond

to the controversies revealed and amplified by the #MeToo movement. They extend beyond any single industry or organization to the larger cultural system that has contributed to sexual harassment and abuse by those persons of power and authority. Viewing these accusations in this manner has demonstrated that the perceptions of reality and the capacity to guide and change those beliefs and actions can begin, only if a discourse that demonstrates the alternative model to current anti-model behavior can take place.

The hospitality groups once led by the accused, other partner organizations, celebrity chefs, industry associations and representatives, all have employed a rhetoric of model and anti-model argumentation that creates conditions to limit and isolate the actions of some of its membership from the rest of the industry. They are using “the act/essence dissociation to claim that the wrongdoing is in no way reflective of how it generally does business” (Hearit, 1995, p. 121). These acts of corporate and organizational discourses demonstrate that “public relations statements and issue management campaigns not only reflect the society of which they are part, they also help create and recreate it” (Cheney and Dionisopoulos, 1989, p. 144).

Although the #MeToo movement and initial advocacy concerning it is relatively new, this chapter has explored how revealing the harmful, anti-model values and actions in the hospitality industry might be a step towards reform if the counterweight of model argument is offered, and the expectation for transformations of perception, behavior, and action take place. As such, this chapter provides a method for organizational change and learning for a variety of industries. A strategy rooted in model and anti-model argument and advocacy can assist an organization to respond effectively to a crisis; to dissociate the crisis from the rest of the organization; and to recommend the changes necessary to transform the organization from a position of failure to uphold expected values and behaviors to one where the organization can now succeed and become a role model for its stakeholders and community.

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KEY TERMS AND DEFINITIONS

#MeToo Movement: A movement responsible for revealing sexual harassment and abuses against women and other disadvantaged individuals by persons in power and influence. The movement has advocated for change in many industries and fields, both in the United States and worldwide.

Anti-Model Argument: An argument identifying unacceptable behavior or messages the advocate wishes to discuss.

Dissociation: An argumentation process that separates one set of actions or behaviors from another.

Hospitality Industry: An industry encompassing food and drink venues, entertainment sources, travel and tourism, lodging and recreation services.

John Besh: A celebrity chef and restaurateur accused of inappropriate sexual harassment and abuses by employees.

Model Argument: An argument identifying the accepted behavior or messages that the advocate wishes to promote.

Organizational Crisis: Any event that threatens an organization's reputation or credibility due to actions by employees or leadership of the organization.

Section 11

Knowledge Management

Useful Organizational Knowledge via Knowledge Elicitation and Management

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INTRODUCTION

Currently, and with almost light speed, new advances in both human-centered and technology-driven efforts have led to new methods in obtaining and using organizational knowledge. For the purposes of this Chapter, Organizational Knowledge will be seen as the different knowledge and skill sets that the employees of a large company or organization have, and how these can be used and shared to make the organization more effective. The emphasis will be on how to elicit those knowledges and how to evaluate their usage. As examples, Organizational Knowledge can be used in analyses of the structure, techniques and functioning of an organization. Organizational Knowledge can also play in identifying the areas where research is needed, what new knowledge is needed for possible re-organization...and be part of any decision-making that impacts the organization. The author's goal is to explicate a new model for eliciting and using Organizational Knowledge. This Chapter will build a model composed of both old techniques and technological advances in human knowledge elicitation, then using and evaluating the human knowledge gained, plus elements of knowledge management and Pareto analysis. This new paradigm uses all of the components above in a blended Delphi. Advantages of using the components listed are that they are all content-area neutral and, in a real sense, generic in application.

BACKGROUND

The Delphi method was developed by the now USAF's Project RAND during the 1950-1960s. and derived its name from a contraction of the term research and development (**R**esearch **A**nd **D**evelopment). The Delphi technique has long been used for eliciting knowledge from subject matter experts (SMEs) and has become a common methodology/methodologies for eliciting analyses, expert opinions and evaluations on a variety of topics. Delphi techniques, a subset of CE/KE, have a goal at arriving at something closer to expert consensus. The Delphi method has been widely adapted to work problems and is still in use today. It has changed over the years from SME anonymity to allowing face-to-face groups (estimate-talk-estimate; ETE) of SMEs. Meister (1985) noted "The (Delphi) methodology is by no means fixed...[it] is still evolving and being researched." This is as true now as it was when Meister stated it. In point of fact, with the leaps in communication methods and related computer technology, this is even more true today as Delphi techniques have recently begun to look at and attempt to take full advantage of these advances.

One also finds that an expansion in the the field called cognitive/knowledge engineering (CE/KE) has occurred and is still in progress. KE was defined in 1983 by Edward Feigenbaum and Pamela McCorduck as follows: "KE is an engineering discipline that involves integrating knowledge into computer systems in order to solve complex problems normally requiring a high level of human expertise." For a

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more complete overview and discussion on KE, differing views and uses, the reader is referred to Studer, Benjamins and Fensel (1998).

There is a new emphasis on a related discipline: knowledge management (KM). The field of KE has recently expanded to encompass KM as a subset. KM has been defined as “...the practice of selectively applying knowledge from previous experiences....with the express purpose of improving the organization’s effectiveness.” (Jannex, 2014). For works on KM, Amazon’s web site has 50 or more, including the ubiquitous *The Complete Idiot’s Guide to Knowledge Management* (Rumizen, 2001).

Pareto Analysis has a long history of being used processes to focus on selecting the best course of action for dealing with issues/problems. Pareto analysis is a formal technique useful where many courses of action are possible. In essence, an estimate or criticality rating is done that allows for selection of effective action (s) that deliver a total benefit to an organization or other entity. Pareto analysis is a creative way of looking at causes/”cures” of organizational problems as it helps stimulate thinking and organize thoughts

The newest sub-set/direction of knowledge elicitation and management is knowledge management success, KMS. KMS is “...a multidimensional concept defined by capturing the right knowledge, getting the right knowledge to the right user and using this knowledge to improve organizational and/or individual performance...” (Jennex, 2012 citing himself, Smolinik and Croasdell, 2009). Thus, KMS evaluates the success of the processes and knowledge generated as the organization develops and uses knowledge about itself. KMS today places emphasis on the success of using a KM process in organization-wide endeavors.

Collectively, all of the above could be used in a paradigm for developing organizational knowledge for such processes as decision-making, reorganizations and future research needed, all on an organizational level

The author is here attempting to show how a Small Group Delphi Paradigm (SGDP)/Estimate-Talk-Estimate (ETE) amalgam with a modified Real Time Delphi (RTD) could be used on some specific problems, as well as adding in the use of a mini-Pareto as a start point. And, evaluated as KMS. Finally, this Chapter will outline a blueprint/framework for the processes for using this new paradigm, in real time. All being done in the hopes that such efforts might be of some interest to current and future researchers in developing, using and evaluating Organizational Knowledge. This Chapter will begin with the development of the Small Group Delphi Paradigm, SGDP (Lofaro, R.J. 1992) in 1985/6.

The Small Group Delphi Paradigm: Origin

As the SGDP lies at the heart of the model to be explicated, we begin here. However, space requirements preclude all but a bare bones treatment. For a much more complete exposition, please email the author; lofaro@msn.com.

The SGDP was somewhat controversial yet was actually the first iteration of the now accepted ECE Delphi. It began with a specific problem and task: to develop for the U.S. Army Aviation Command an computerized aviator candidate selection test that also showed which of the current rotorcraft would be the optimum operational aircraft placement for the candidate upon completion of initial training. In short, Army Aviation wanted to initially train pilots **and** immediately afterward put them in transition training for one of then then operational rotorcraft, based solely on a test. Historically, there were several articles that voiced strong objections to a Delphi not being anonymous. A major one being that having participants see and interact with each other would at best, dilute results, and at worst, negate them. As an example, Pill (1970) had said that this may dilute the opinions of the real expert. These the objections seemed to the author to be somewhat bizarre. First, the subject matter experts (SMEs) selected ARE the

real experts. Not only that, the reality (based on the author's having conducted several workshops using SME's to focus on and solve problems) was this: The other SMEs recognize, welcome and use another SME's expertise—as their goal is the best result/product possible.

Another objection was that the group dynamics may force ratings and analyses towards a mean or middle ground that does not fully reflect all the SMEs' views. In response, true SMEs will not allow that to happen for personal reasons and pride. They will not “go along to get along.”

The instruction in group dynamics and group processes, the trained facilitator and the iterative methodology to be used were designed to ensure such prior objections could be met. The objections to a new, face-to-face Delphi could not only be overcome but the use of group dynamics coupled with traditional Delphi processes could add robustness and a completeness, as it were, to results obtained from this coupling. In this new Delphi process, the abilities approach of Fleishmann was used. In their book, *Taxonomies of Human Performance*, Fleishmann and Quaintance (1984, revised 2000) state that “specific tasks are said to require certain ability profiles if performance is to be maximized. Abilities provide a natural basis for describing and classifying tasks in terms of human performance requirements.” Fleishmann and Quaintance defined ability as “an innate enduring attribute.” As such, abilities are indicators and predictors of later skill development. Put another way, the ability requirements theory/approach is away of describing and classifying human tasks. Once a set of tasks is identified, a human performance taxonomy can be developed from it. Taxonomy, as used here, denotes a system that classifies and describes human tasks according to a particular focus, such as the abilities seen as essential to specific task performance.

The process used in 1985/6 was face-to-face, small groups (five and ten) of Army aviators, who were recognized by their peers as exceptional pilots in their particular rotorcraft from all Army posts worldwide, functioning as SME's. These SME's were given a 30 page read-ahead package. After some weeks, these SME's were brought to Ft. Rucker where they would have group function/dynamics training, and begin facilitated group work to achieve consensus on the objectives specified in the read-ahead. This endeavor came to be called the small group Delphi paradigm (SGDP). Thus, the SGDP took the Delphi process in another direction by modifying it via merger with elements of group dynamics in order to have interactive (face-to-face) Delphi workshops. These modifications resulted in a paradigm for using small groups of subject matter experts (SMEs) in a workshop setting.

The basic categories the author and associates looked at in the original 1986 SGDP were psychomotor (hand/eye coordination as an example); cognitive; personality characteristics. Thus, we were establishing what would be called today an ontological scheme to reduce complexity and structure the data. A KE/KM ontology compartmentalizes the variables needed for some set of computations and establishes the relationships between them; thus, an ontology is used to limit complexity and to organize and structure information. After the SME's identified the skill sets this completed the ontological taxonomy for each helicopter. Sub-tests were then chosen (or modified from existing ones) to provide measures on skill sets found in the workshops. Finally, a unified test and scoring algorithms were developed. The use of multivariate discriminant analyses resulted in a “profile” of the (weighted) factors that made for success for pilots, but in only three of the four rotorcraft. It was found that that each centroid contained the same set of what we called basic rotorcraft piloting skills, common across all centroids and second sets of skills, particular to only one rotorcraft. It was determined that this common set of skills were those needed to pilot the UH-1 Iroquois (called the “Huey”), at that time the basic Army operational rotorcraft. This finding was both vital and important. It showed what we had thought and what, informally, the SME's had brought up: there was a set of basic pilot skills needed for all rotorcraft. This also boded well for the selection aspect of the test. Secondly, each rotorcraft has a secondary set of skills specific

to that rotorcraft; this boded well for the placement aspect of the test. And a real serendipity: when the Army was going to go over to new training system, they were going to stop using the then initial training rotorcraft, the TH-55, a piston-engined relic. The UH-1, which was as were all Army operational rotorcraft, jet engined, was to now be the initial training rotorcraft. The skills common across all three centroids were extracted and formed a fourth centroid; the UH-1 skill set centroid.

Thereupon, The U.S. Army Aviation Center made the test battery and set of algorithms (now called Multitrack, as was the new training system) operational. It was successfully used in selecting rotorcraft aviator candidates for initial rotorcraft training and later, placement in their operational rotorcraft for more than five years

At this point we must mention validity. The original concern was neither with internal nor with external validity. i.e., if the results of a study are generalizable or transferable...most discussions of external validity focus solely on generalizability (Campbell and Stanley, 1966.). [Aside: However, our work was both generalizable **and** transferable]. The researchers' main concern in 1986 was with predictive validity: the degree to which the test battery can predict (or correlate with) with success of the construct in operational use. Of import are both the high "pass" (success) rate when the pilots were placed for transition training in the operational rotorcraft Multitrack indicated versus the high "fail" rates when, for some bureaucratic reason, the pilots were not placed in the optimum first choice or even the second choice rotorcraft. In sum, The SGDP accomplished what had never been done before. It delivered an operational, computerized set of tests with scoring algorithms that not only selected the best aviator candidates for initial pilot training but also showed which of the four then-existing rotorcraft types these candidates should be placed for transition training upon completion of initial training.

NOTE: Complete statistics on the extremely high predictive validity are available (Lofaro, Intano & House, 1990). This initial SGDP R&D effort has been extensively presented (Intano, Howse & Lofaro, 1991; Intano & Lofaro, 1990; Intano & Lofaro, 1989; Lofaro & Intano, 1989).

The Small Group Delphi Paradigm: Past Uses

In 1986, the author did not realize the potential of the SGDP in other venues, areas, problems. But, from 1987 through 2003, the SGDP was adapted and successfully used in a broad spectrum of tasks. In 1987-1988, the SGDP was used to develop a training syllabus to achieve an optimum performance level; In a Federal Aviation Administration-sponsored project that developed a computerized air traffic control specialist (ATCS) selection test battery (Gibb and Lofaro, 1993); in identifying airline baggage x-ray screener abilities and developing a prototype test for both selection and evaluation of aircarrier baggage screeners (Lofaro, Gibb and Garland, 1994; Gibb and Lofaro, 1994) [Note: In this endeavor, Lofaro gave training to Gibb and associates in doing the SGDP as he was not able to facilitate the Delphi's himself. Lofaro also provided Gibb with a written precise of the SGDP technique. Gibb and associates did the actual SGDP workshops themselves at various locations. The successful use of SGDP techniques by others indicate that the techniques are not dependent on who administers them; rather, they not only are effective across venues but also with different personnel directing/facilitating the SGDP workshops.] To resume: The SGDP was used in developing sets of specific managerial and employee core competencies (Lofaro, 1998, 1999) and lastly from selection through to useability testing (Lofaro & Maliko-Abraham, 2002; Maliko-Abraham & Lofaro, 2001, 2003).

In Sum: As said above, these successful adaptations, modifications, implementations, across many venues, showed that the SGDP is both transferable and generalizable.

The SGDP: Technological Innovations

Some twenty-five years after the SGDP was devised, used and appeared in multiple publications, it has been re-discovered, as it were, and is now recognized as an acceptable Knowledge Elicitation method. The use of face-to-face groups in a Delphi is now a fact and is termed Estimate-Talk-Estimate (ETE). New communication capabilities and technologies seem to have driven the development of what are generically referred to as a mini-Delphi or ETE, with many variants. There is also the Real Time Delphi (RTD) that maintains anonymity but uses computer linking for a high level of instantaneity (Gordon, T. J., & Pease, A., 2006). While the SGDP structure and processes are still relevant, they can be and are in real need of some level of integration with ETE/RTD techniques and current advances in computer and communication abilities and techniques. The author's belief is that the result of an integration would be a revised Delphi that will produce the same level, if not a higher level, of accurate information in many venues. In modifying the SGDP for use with today's technology and advances in KE/KM, any problems to be investigated would require, as a first step, the building a model of a knowledge domain, defining the terms inside that domain and the relationships among them...developing an ontology. We will return to this later.

A MODEL OF A BLENDED SGDP/ETE/RTD

Before we look at expanding the SGDP to bring it into today's era, let us state the core components of the SGDP, the ones that must be at the heart of all new work with it. Again, for a more complete SGDP write-up, email the author; lofaro@msn.com. The core SGDP structures to be maintained are: the careful selection of a limited number of SMEs (however, there can be many small(er) SME groups functioning at one time); the preparation of an extensive and comprehensive set of SGDP objectives; the use of an explanatory read-ahead package for the SGDP members, one which contains the objectives and the use of group dynamics and finally, before the initiation of the SGDP, the use of some facilitation and group dynamics instruction in face-to-face sessions. On to the blended model. One example of a difference in an ETE or RTD (a computer-based Delphi with anonymity) versus either a traditional or SGDP Delphi: the iteration structure used in the traditional or SGDP Delphi, which is divided into three or more discrete rounds, can be replaced by a process of continuous (roundless) interaction, enabling SMEs to change their evaluations at any time. A new ETE/RTD/SGDP model would be computer-based. The reader is referred to the work of Turoff and Hiltz (1996) on computer-based Delphis.

Integration of the SGDP with a ETE/RTD (*sans* anonymity) approach can be achieved thusly: all participants can be logged on simultaneously, each participant can briefly state their name and credentials, the group dynamics instruction can be done by the facilitator to all simultaneously (aside: it would seem that a linked network of all SMEs is possible and even *de rigueur*). The SGDP face-to-face group meetings would now be done on-line. This will allow for instantaneous feedback by any SME during a session, as well as discussions). The iteration structure used in SGDP, which is divided into as many discrete rounds as needed for consensus, can be replaced by a process of continuous (roundless) on-line interaction, enabling SMEs to change their evaluations at any time and give a rationale with ensuing discussion in real-time. Finally, the statistical group(s) response(s) can be updated in real-time and shown whenever a SME, or a group, provides a new evaluation. It is clear that "face-to-face" discussion will be virtual. This is, to the author, a real and significant loss. But, the speed, multiple iterations, real-time, access to a large number of SMEs and other aspects to be gained cannot be ignored. Another possible modification

is a multi-tiered SGDP/ETE/RTD where the use of two or more groups working different problems can be convened and given objectives based on their expertise. As these groups come to consensus on their objectives, these new data can be integrated, built into a new re-ahead package and made available to a new set of participants with new or prior SME's.

A second modification would be use of only specific elements of a Pareto Analysis as the first step after the group dynamics instruction. This is because such a step would identify problems, then, sharpen (focus in on the ones that are amenable to resolution) while, at the same time, providing an ordering of which should be worked on via criticality ratings. The elements of the Pareto Analysis would be the first three steps in such an analytic technique. Step 1: Identify and list problems to be examined. Or, if and only if one problem/issue exists, a break-out of the sub-problems could be done. Step 2: identify causal factors inherent in each problem. Step 3: Score (in this case, criticality rate) the problems, resulting is a somewhat rough ontology. The Pareto, done in the context of a SGDP/ETE/RTD could also allow for many possible solutions to be evaluated by many types of SMEs with differing areas of expertise but in areas germane to the problem. This would result in a winnowing down of courses of action to those that were realistic and possible of success. The advantages of using a Pareto, core SGDP structure and ETE/RTD (all computer/Internet driven) are that they are all content-area neutral and, in a real sense, generic in application.

A SPECIFIC EXAMPLE OF POSSIBLE PARADIGM USE

This paper will only deal with one current commercial aviation issue. The author's 26 years of experience in aviation; United States Air Force, Army Aviation Command, and the Federal Aviation Administration (FAA), simplified that choice. There is a significant amount of controversy over upset training; training pilots to recover the airplane from unusual (unstable; dangerous; rarely encountered) attitudes thereby not having potentially fatal accidents. The Air France Flight 447 accident, for example: A series of errors by pilots and a failure to react effectively led to the crash of Flight 447. The plane went into a sustained stall, signaled by a warning message and strong buffeting of the aircraft. Despite these persistent symptoms, the crew never understood they were in a stall situation and, therefore, never undertook correct recovery maneuvers. In other words, a high altitude, high speed stall was a situation the crew was unable to recognize much less had ever trained for. The Colgan Air crash outside of Buffalo, NY is another fatal accident where the U.S. National Transportation Safety Board (NTSB) determined that the probable cause of this accident was the Captain's inappropriate response to the activation of the stick "shaker" (the airplane's main control device actually shakes/vibrates in the pilot's hand if the plane is in danger of stalling/spinning) which led to an aerodynamic stall from which the airplane did not recover. To further cloud the issue, the American Airlines upset prevention and recovery training (UPRT) ground school with flight simulator (FS) training, called advance aircraft maneuvering program (AAMP), was seen by the NTSB as possibly a contributing factor in the American Airlines flight 587 crash in 2001 (Croft, John. 2014a). The FAA, while not yet issuing an Advisory Circular or a Federal Aviation Regulation issued a document called Airline Upset Recovery Training Aid, version 2. The current issues seem to be use of a full motion FS, that will be part of an expected FAA pilot training rule by 2018 (Croft, John. 2014b), versus in-aircraft training (or some combination) and swept wing jet aircraft specialized training. It is believed that a modified SGDP/ETE/RTD, using senior pilots as SME's can point a way to types/procedures and applicability for upset training.

This SGDP/ECE/RTD would proceed thusly: A multi-tiered effort, beginning with the Pareto described above to identify 2 or 3 issues that most need solutions (a quasi-ontology) from the issues cited above: use of a full motion FS and/or in-aircraft training and/or swept wing jet aircraft specialized training. Next, as always, multi-tiered, identify the sub-issues involved. Here, as with the remainder of the SGDP/ETE/RTD, the data needed for all tiers/sub-tiers would come from SGDP/ETE/RTD's consisting of 5 to 9 (senior) pilots from as many aircarriers as possible. Possibly, each interested carrier initially could do such efforts. In this way, each carrier would have results based on their mission and objectives for possible upset recovery training. Since the multiple sub-tiers would only be dealing, at first, with one specific arena, the results could be used grist for another round(s) where consensus, via criticality ratings and discussion, is worked on. This multi-tiered approach can be used for all the issues listed above-simultaneously or sequentially. In a second, or as an extension of the first SGDP/ETE/RTD, the SME pilots can identify and sort these upset recovery maneuvers into taxonomies for those which are primary and necessary for what can be called an air carrier's "basic training" for aircrew, then for transition training and for yearly recurrent training. Again, in a tiered series of SGDP/ETE/RTDs.

The use of a FS (What type? What recovery techniques can be taught in FS and which require in-plane training? And for which planes?). What are the performance standards for each maneuver? Answers to these all would be results from such an effort. It may be possible that the large amounts of data being developed ("soft data" as they are the results of opinions and/or criticality ratings) could be handled by data & knowledge engineering (DKE) methods. Finally, these SGDP/ETE/RTD techniques can be used for many tasks requiring generating and use of specific knowledge sets.

EVALUATING THE PARADIGM IN TERMS OF KM SUCCESS

Only a few years back, a model was developed (The Jennex and Olfman KM Success Model; Jennex, 2013) that would allow, among other things, evaluating the Organizational Knowledge elicited and its use by the organization. Put another way, much of KMS work today has a focus on the knowledge elicited being of use in/to an organization. Using the KMS model can allow a measure, actually several measures, of the use-value to an organization of knowledge elicited and developed about the organization. The author sees using the KMS model as necessary in evaluating work done in knowledge management/organizational knowledge. It can also be used, retroactively, on prior KM/organizational knowledge efforts to find where and why such efforts were successful...or not. Perhaps pointing the way to additional efforts that would have more...or a chance of...successful outcomes.

As some examples: one KM Success Model measure of success is internal and external success of the knowledge being useful and used. Was the organizational knowledge set the organization generating the knowledge about itself successfully used? Was the organizational knowledge elicited in agreement with (useful to?) the objectives it was elicited for?

Another measure of KMS is knowledge quality as shown by organizational knowledge generated being accurate/correct and inclusive, being optimum...i.e., optimum being a performance-based word. In the KMS model one measure is system quality: Was the organizational knowledge generated stored, able to be retrieved and applied?.

Lastly, yet another KMS measure is service quality as shown by the performance impact of the the organization making operational the knowledge generated about itself.

It is to be hoped that, if the paradigm were used in/on real life organizational issues and problems, one could reasonably expect the Organizational Knowledge gained to be successful in many ways. Us-

ing the Jannex KMS model to evaluate any real life use of the model presented would provide data that could well be instructive and helpful to any future efforts/research,

SOLUTIONS AND RECOMENDATIONS

Of necessity, this Section of the Chapter will be rather short. Mayhap it should have been rolled into the final two Sections. Plainly put, this Chapter does not present findings, rather it shows how a new paradigm was developed from one begun in 1986 and used for many years. The Chapter delineates new components, due in the main to new technology but also to the incorporation of an older technique. It does give an example of how this new model could be used on a real life problem, in real time. At this point, the final two Sections come into play and there may be some redundancy.

FUTURE RESEARCH DIRECTIONS

As said, this Chapter is not a report on the results of prior experimentation, rather it is an attempt to meld old and new techniques with advances in technology ...in a new discipline. It is an attempt to indicate the structure of a new paradigm that can be useful in developing and using organizational knowledge. More importantly, it is also a call for research efforts to try the new procedures and validate (or not) them. Another future research task would be to see how/if using the new paradigm was a KM with KMS endeavor. Thus, this chapter provides a rough template for possibly important future research.

CONCLUSIONS

The broad spectrum of Knowledge Engineering has immensely benefitted from the new/newer technologies of the last 10-15 years. Let us begin with Knowledge Elicitation and the Delphi technique. What was a real change in Delphi techniques, the SGDP of the late 1980s into the early 2000s, has become not only accepted and used, but has a name; The ETE Delphi. Advances in computer speed, memory capacity, in communication speed not only led to the ETE but now to the ability to do a Delphi or concurrent ones in real time ..the RTD

A new arena, knowledge management has strongly impacted the knowledge elicited by its focus on organizational effectiveness. There is now a new emphasis on selectively applying knowledge from previous experiences with the express purpose of improving the organization's effectiveness. Next is Organizational Knowledge. This term has had some differing definitions; the author prefers a compilation of different knowledges and skills possessed by the employees of a large company or organization. Organizational Knowledge can identify, compile and organize these differing knowledges/skill so as to enable them to be codified and used. This effort leads back to knowledge engineering/elicitation and knowledge management.

And, in the newest step forward, one has knowledge management success..a new discipline which attempts to show how/measure the Organizational Knowledge elicited impacts the function and effectiveness of a/the organization. In point of fact we have the Jennex and Olfman KM Success Model (Jennex, 2013), At this point, one can see not only the connection of these disciplines but their interconnectivity.

Again, it must be strongly noted that the Chapter is not a report on the results of prior experimentation, rather it is an attempt to meld a modified Delphi procedure with today's KE/KM efforts and today's technology for use in developing and using Organizational Knowledge. It provides a start-point template with an example of using that template..

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KEY TERMS AND DEFINITIONS

Consensus: Consensus is the state achieved when, if any group participant is asked, alone and outside of the group's hearing, about the consensus/results achieved by the group: their response is that they can support the consensus arrived at, no reservations.

Facilitator: A person that helps to bring about an outcome (as learning, productivity, or communication) by providing indirect or unobtrusive assistance, guidance, or supervision. At times, the facilitator can provide initial instruction and, at times again, be more proactive as to direction.

Flight Simulator: A flight simulator (FS) is a system designed to “imitate” the functions of another system (an airplane) in a real operational environment; to be a realistic substitute that responds realistically to flight crew inputs. A FS is a training device whose primary functions are 1. To present information like that which the real system would present, for the purpose of training and, 2. To provide a practice environment that facilitates and enhances the skills and knowledge of the pilot, and thus provides learning which enhances performance in the real system, the airplane. There are several types of flight simulators.

Group Dynamics: The interactions that influence the attitudes and behavior of people when they are grouped with others through either choice or accidental circumstances. Social psychologist Kurt Lewin coined the term *group dynamics* to describe the positive and negative forces within groups of people.

Ontology: A term that comes from philosophy. In KE/KM, an ontology is a formal naming and definition of the types, properties, and interrelationships of the entities that really or fundamentally exist for a particular domain of discourse. It is thus a practical application of philosophical ontology, with a taxonomy. A KE/KM ontology compartmentalizes the variables needed for some set of computations and establishes the relationships between them; thus, an ontology is used to limit complexity and to organize and structure information.

Real-Time Delphi (RTD): An advanced form of the Delphi method. The advanced method “is a consultative process that uses computer technology” to increase efficiency of the Delphi process.

Subject Matter Expert (SME): An individual who exhibits the highest level of expertise in performing a specialized job, task, or skill within the organization.

United States Federal Aviation Administration (FAA): Is the national aviation authority of the United States. As an agency of the United States Department of Transportation, it has authority to regulate and oversee all aspects of American civil aviation.

United States Federal Aviation Administration (FAA) Advisory Circulars (AC): The FAA normally publishes these which are designed to provide assistance and guidelines in complying with FARs; they serve as a “how to” template. The AC’s are titled and numbered and are not legally binding as are the FAR’s.

United States Federal Aviation Administration (FAA) Regulations (FAR): All are in the Combined Federal Regulations (CFR), Title 14, Aeronautics and Space; each a descriptive title and number; they are legally binding.

United States National Transportation Safety Board (NTSB): An independent Federal agency charged by Congress with investigating every civil aviation accident in the United States and significant accidents in other modes of transportation – railroad, highway, marine and pipeline. The NTSB determines the probable cause of the accidents and issues safety recommendations aimed at preventing future accidents.

State of the Art in Semantic Organizational Knowledge

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INTRODUCTION

Semantic organizational knowledge refers to the Semantic Web and Linked Data technologies that are applied to the principles and procedures of organizational knowledge. The aim of this chapter is to present the state of the art research in *semantic organizational knowledge*. Originally, organizational knowledge is the ability of employees of an organization to perform tasks given the collective understanding of a particular context. As human knowledge comes in many forms and shapes, previous research conducted by Nonaka (2007, chapter 3), Choo (1996) and Spender (1993), has identified the existence of several types of knowledge in organized contexts including *explicit* knowledge, *tacit* knowledge, *cultural* knowledge and *embedded* knowledge. Explicit knowledge is intuitive, based on experience, intractable and refers to knowledge known as “know-how”. It was originally defined by Polanyi (1958). The popular view of this type of knowledge is a form of knowledge encoded in organizational practices, procedures and routines. It is also transmittable in formal language as clear facts, propositions and symbols. Tacit knowledge known as “know-what”, is easy to identify, store, retrieve and disseminate. Cultural knowledge refers to being familiar with various cultural characteristics, including history, moral values, belief systems, history, and social norms. In contrast, embedded knowledge, a substantial part of organizational knowledge, is formal or informal knowledge that is locked in archives, processes and internal practices waiting to be extracted. The essence of this knowledge, either individual or collective, is often perceived as a dynamic array of experiences, values, contextual information and expert insights. When it is individual, knowledge shows an individual’s ability to demonstrate judgment in a particular situation. In contrast, collective knowledge initiatives in an organization consist of creating and sharing knowledge for improving business and increasing productivity. These initiatives may also expand externally over time and include partners and customers. From this perspective, knowledge becomes an organizational asset that can be managed, shared with partners or provided as a service to others. According to recent research, the **Semantic Web**, an extension of the current Web (Berners-Lee, 1999; May 2001), (Decker, 2000) and its related **Linked Data** concepts and techniques appear to be appropriate for solving issues of knowledge acquisition, documentation, transfer and sharing/distribution in an organizational context. In fact, these concepts rely heavily on Resource Description Framework (RDF) and Ontology. 1) The popular RDF model and syntax is a World Wide Web Consortium (W3C) recommendation in February 1999 (Heflin, 2001). An ontology provides an agreed understanding of an organization domain knowledge that rests on a common vocabulary. More precisely, an ontology defines the meaning of the terms in that vocabulary together with their inner relationships (De Araújo, 2015; Chandrasekaran et al., January 1999). It plays a central role in enabling the processing and sharing of knowledge within an accepted domain. Originally, the concept of ontology was created in the branch of philosophy that studies being or existence, the kind of things that exist. Then, the term was co-opted by Artificial Intelligence researchers to represent computational models for automated reasoning. A widely accepted and

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interesting technical definition of an ontology that still stands in computer science is that “*an ontology is an explicit specification of a conceptualization*” (Gruber, 1993, p. 1).

The main purpose of this chapter is to present a state of the art survey of research and development in semantic Web and Linked Data applied to the management of organizational knowledge. The applications of these technologies can have a direct impact on people, internal processes and support the distribution of knowledge throughout and outside of the organization. However, these advances are not without social and cultural issues and technical challenges. To this end, a tentative structure¹ of this contribution is the following: The first section is an **Introduction** to the main topic in the Semantic Web context. A **Background** section provides details on the real nature of organizational knowledge, the Semantic Web and Linked Data. The **Focus of the Article** section presents results of our state of the art survey on R&D in semantic organizational knowledge. This survey focuses on current issues and challenges in knowledge management that could be solved using Semantic Web or Linked Data technologies. Then, some known solutions to current challenges are suggested in the **Solutions and Recommendations** section. Last, a number of research ideas are presented along the lines of our discussions in a **Future Research Direction** section. A short summary of contributions concludes the chapter.

BACKGROUND

Types of Knowledge

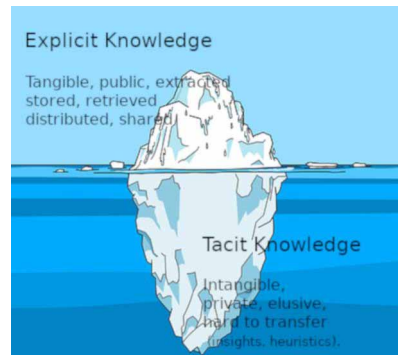
This section introduces the concepts of *organizational knowledge* and presents the *Semantic Web* and *Linked Data* as enabling technologies. In the modern economy, many organizations implement initiatives for the management of *organizational knowledge* for improving process performance, raising product/service quality, engaging customers and laying the ground for innovation. To reach these goals, large organizations have been investing time, energy and funds into the capture, storage, sharing and dissemination of existing collective knowledge and the creation of new one. The vast, previously unexplored, human knowledge across these large organizations, is helping them build competitive advantage on the marketplace. Polanyi (1958) was the first to explain the term “tacit knowledge” in his pioneering work in the mid 50s. The main principle of Wiig’s knowledge management model (1993) requires knowledge to be organized according to its applications. Practical dimensions of this model are completeness (relevant knowledge), connectedness (relations between knowledge objects), congruency (facts, concepts, values between the objects are consistent), and perspective and purpose (Dalkir, 2011). Then, Koenig and Srikantaiah (2000), Nonaka (1994, 1998) and Cvusgil et al. (2003) laid the foundations of the most accepted depiction of knowledge with its *tacit*, *explicit* and *implicit* dimensions (see Figure 1).

Explicit knowledge is easy to identify, capture and represent in formal languages. Examples explicit knowledge include corporate publications, internal business messages and records, intranet, relational and knowledge bases. This type of knowledge can be extracted, edited, managed, stored, retrieved and distributed within the organization. Managing explicit knowledge means creating, acquiring, sharing and disseminating it with the support of information and communication technologies (ICT).

Tacit knowledge in contrast to explicit knowledge, is inherently elusive and cannot be articulated because it rests in individuals’ mind in the form of experience gathered as insights, heuristics, intuitions, and skills difficult to share with others in formal terms (Stenmark, 2001). Tacit knowledge is hard to codify and transfer from one individual to another or to an organization. Since this form of knowledge lays the ground of intellectual capital in organizations according to Koenig and Srikantaiah (2000), it

Figure 1. The Knowledge Management iceberg

Retrieved and adapted from <https://www.k4health.org/toolkits/km/about-km>.

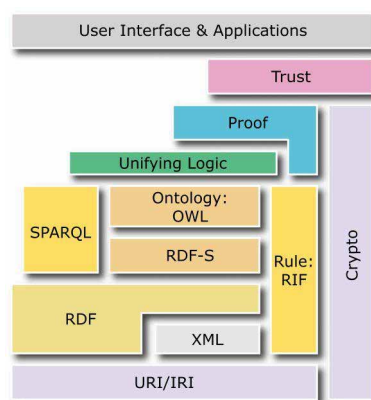


must be represented and managed as well. Srikantaiah and Nonaka (1991) suggest that explicit and tacit knowledge are strongly interrelated in that each contributes to the understanding and support of the other. In addition, they are part of an effective organizational knowledge management.

Semantic Web and Linked Data

In the early 2000, a new vision of the Web of data called the **Semantic Web** was proposed in the form of an extension of the current Web of Hypertext Markup Language (HTML) documents. Its objective would be to facilitate human-computer collaboration. Berners-Lee explained the term Semantic Web in 2006 as: “*The Semantic Web isn’t just about putting data on the web. It is about making links, so that a person or machine can explore the web of data. With linked data, when you have some of it, you can find other, related, data.*” (Berners-Lee, 2006) To support this new framework, an ensemble of technologies including the Resource Description Framework (RDF) based on XML syntax, its related RDF schema, the Darpa Agent Modeling Language (DAML), the Ontology Web Language (OWL), (W3C, February 2004) the Simple Knowledge Organization Systems (SKOS), are developed by the World Wide Web Consortium headed by Berners-Lee. An illustration of the Semantic Web technology stack is displayed in Figure 2 below.

Figure 2. The layered Semantic Web technology stack



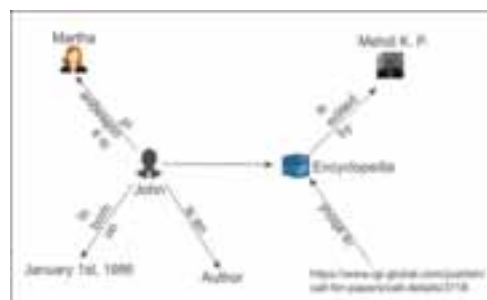
In the traditional document Web, hyperlinks relate only two HTML documents and leave out the fine-grain relationships between specific entities included (Savage, June 2017). To make up for this lack of expressiveness of the HTML language, the Consortium introduced the concept of *Linked Data* (Bizer, 2009). It refers to a collection of interrelated data sets that rests on the known HyperText Transfer Protocol (HTTP) technology (Fielding et al., 1999) and the (Berners-Lee et al., 2005).

To turn the Web of data into reality, the current Web extends into a global space where related data, previously isolated, becomes connected. In computing, Linked Data is a method of publishing structured data as interlinked entities in RDF format and the Uniform Resource Locators (URIs). Its purpose is to serve Web pages for human reading and more importantly for computers automatic processing. Here data is represented in the form of RDF triples as (*subject, predicate, object*). The *subject* (source of the relationship) and *object* appear as URI references that represent resources. The *predicate* (known as property), also represented as a URI reference, is the element that tells us how the subject and object are related. A predicate is also a *first-class object* because it may be used as subject or object in another statement. It is good to know that the subject and the predicate of a statement must be resources whereas the object has the option of being a resource or a literal (Decker, 2000). The representation of the many layers of information as a collection of triples, generates a data model where relationships between elements appear as arcs labeled with properties names in a directed graph. This particular graph is in turn parsed by the **Sparql Protocol And RDF Query Language (SPARQL)**, a powerful query language and widely used Application Programmer Interface (API) for accessing linked data collections online.

The following example directly related to the publication of this encyclopedia could help visualize this model more clearly. In order to specify the link between an author named *John* and the book editor named *Mehdi Khosrow-Pour*, conventional relational databases must contain tables that describe these two persons and their related primary/secondary key identifications. However, this link does not provide any description of the actual semantics of this relationship of data. The database knows natively that the two elements are related but has no clue of how they are link. With the help of the RDF data model, this link can be annotated with semantic meaning which relates the elements through the triple <John><is published by><Mehdi Khosrow-Pour>. Details are provided in **Figure 3** and below.

```
<John> <is an> <author>.
<John> <is a colleague of> <Martha>.
<John> <is born on> <January 1st, 1986>.
<John> <published in> <Ency. of Organizational Knowledge, Admin., and Tech.>.
<Encyclopedia of Organizational Knowledge, Admin., and Tech.> <is edited by>
<Mehdi Khosrow-Pour>.
```

Figure 3. Connected graph of the triples example



<the Web page 'GI Global Call for Chapters - E.O.K.A.T.'> <is about> <Ency. of Organizational Knowledge, Admin., and Tech.> <John><published in><Ency. of Organizational Knowledge, Admin., and Tech.>

Linked Data is at the heart of the Semantic Web in terms of large scale integration and reasoning on the Web of data. Berners-Lee (2006) outlined a set of guidelines known as the “*Linked Data Principles*”, for publishing and relating data on the Web as part of a single global data space. Given its distributed nature, Linked Data technology offers a strong support for the integration and management of internal or shared enterprise data (Baldassare et al. 2010). It fosters enterprise cooperation in data sharing with little coordination. There exist a number of experimental methods for capturing and expressing tacit knowledge within a Linked Data set (Di Iorio, 2019).

ISSUES IN KNOWLEDGE MANAGEMENT

This section explore key issues in organizational knowledge representation and management. In spite of the impressive amount of theoretical and conceptual work, the knowledge management research community must rethink some fundamentals including the theoretical aspect of knowledge itself and knowledge management processes (CEN, 2004; Heisig, 2009). One of the challenges of current organizational knowledge systems is to identify and integrate vast amount of structured or unstructured data from heterogeneous sources. Data sets in corporate knowledge must be reachable and editable from different perspectives and users within the organization. On the other hand, the existence of multiple computer systems creates heavy costs for:

- storing redundant data;
- automating data transfer between systems;
- updating or replacing obsolete software and related applications;
- organizing and reformatting data moved from one system to another.

In addition, the planning systems of organizational resources have an inherent limitation in processing the meaning of concepts in knowledge bases. This is where the Semantic Web comes into play by providing new methods of data management and representation of meaning through ontologies (Fridman, 1997).

Knowledge Creation Issues

The idea of a hybrid knowledge environments (Davenport, 1998) including humans and computing resources, could support knowledge creation in an enterprise. It also helps overcome inherent technological challenges and take into account the enterprise business needs. However, the discussion around enterprise system failures does not appear to consider the fact that modern enterprise systems go through a trial or evaluation period before their definitive adoption in an enterprise. That is to say, an enterprise system no longer imposes its own logic on a company's strategy, organization, and culture. In the concept of Core Organizational Knowledge Entities (COKE), an ontology, expressed through disjunctive logical programming, helps capture the evolution of business processes. This concept described by **Gualtieri and Ruffolo** (2005) includes 2 distinctive levels of ontologies: 1) the top level ontology which refers to concepts characterizing organizational background and 2) the lower level ontology designed for the

COKE. A similar approach that exists, considers a layered set of ontologies of a relevant sub-domain (Ammann, E. et al., 2011). These ontologies describe the real life domain knowledge ontology together with the logic for reasoning. and support interoperability (Swartout 1999; Gualtieri 2005).

Knowledge Sharing and Dissemination Issues

Over the last two decades, the issue of knowledge sharing in organization has been the focal point of much research and debate. Knowledge is created and transferred by individuals (Minbaeva, 2004; Nonaka & Takeuchi, 1995). Organizational culture, access to appropriate technology and its integration appear to have substantial impact on organization success (Raja, 2011). Research also found that solving issues around culture and employees behavior is a prerequisite to any technical implementation within the organization. Given this information, several researchers proposed innovative techniques, tools and approaches based on the Semantic Web and Linked Data for an efficient KM. During this long journey, the focus of semantics in KM has evolved from knowledge containers in textual form to the application of Semantic Web technologies. More precisely, these technologies refer to ontologies originally introduced in artificial intelligence, to support knowledge sharing and re-use. This shift in perspective paved the way for better KM solutions including knowledge elements of varying granularity. According to **Fensel** (2003), this whole new perspective in KM created a number of issues including:

- 1) *knowledge integration*: The development of KM applications in organizations requires a seamless integration of interrelated knowledge into a coherent corpus. This helps avoid development overhead.
- 2) *knowledge categorization*: User interactions, patterns of behavior and context suggest new semantic categories and relations.
- 3) *knowledge personalization*: It refers to user experience and expectations in order to avoid information overload and for delivering the right knowledge. With the support of Semantic Web with ontologies, it is possible to provide semantic information about a user's interests and
- 4) *knowledge access*: For some time, fields including genomics, astrophysics and biochemistry generated large amount of data with virtually no semantic means.

Kings et al., (2007) advocates in his models of knowledge sharing, the use of ontologies for the improvement of knowledge management in organizations where social and technical context are taken into account. **Nonaka** and **Takeuchi** contended that the sharing and dissemination of knowledge in organizations is a prerequisite to its use (Nonaka & Takeuchi, 1995). However, this aspect of knowledge management relies very much on the organizational culture and the existence of technology capable of processing explicit knowledge. According to **Pasquariella** (2003), knowledge sharing and dissemination is essential to organizations in that it generates new knowledge leading to competitive advantage. In (**Mentzas** et al, 2007), the reader discovers new approaches that appear as a substitute to traditional knowledge sharing techniques and practices in organizations. In their contribution, the authors focused knowledge exchanges that treat knowledge assets with Semantic Web capabilities as tradable goods. **Stojanovic** et al. (2007), proposed a framework for managing organizational knowledge on the Semantic Web where differently formatted knowledge can be collected from various sources, stored in known formalism (**Mentzas** et al, 2007) and processed (**Staab**, 2001).

Knowledge Acquisition Issues

In contrast to the traditional perception of an organization where knowledge is acquired through procedures, training and rules; the “learning organization” empowers individuals and turns technology into a facilitator. Sicilia (2005) suggested that learning styles can be included within ontologies and semantic methods may support the sharing of knowledge and experiences. More specifically, Semantic Web technologies provide the necessary infrastructure to support organizational learning mechanisms. Here ontologies refer to descriptions of learning objects, organization fundamentals and resources. He also proposed the concept of “semantic learning organization” as an entity where semantic-mediated learning acts as a catalyst to move the organization to a desired state. The implementation of this vision where the Semantic Web plays an essential role is not without serious challenges. Sicilia insists that “the creation and maintenance of large, shared conceptualizations is a problem in itself” and the implementation of specific languages requires advanced tools and the need to align an organization and its individual members’ needs and satisfaction. A number of studies show that organizational knowledge acquisition benefits substantially from emerging techniques. However, according to Zolhavarieha (2007), a number of issues including the quality, relevance and reliability of the extracted knowledge, still persists. These studies also mention that as knowledge acquisition becomes more complex, so does its semantics. In addition, they also note two knowledge-acquisition issues that can be addressed by Semantic Web technologies: data format and content heterogeneity and the lack of semantic analysis.

SOLUTIONS AND RECOMMENDATIONS

The Semantic Web and Linked Data technologies can provide the appropriate supporting framework for connecting heterogeneous data sets within an organization. These technologies not only help structure and uncover the meaning of this data but they also contribute in solving the known issues related to distributed and heterogeneous data. The recommended approach in implementing a Semantic Web and Linked Data is highlighted in the following steps: the raw data is transformed into the Resource Description Format (RDF) knowledge base of triples (*subject, predicate, object*). That is to say, statements about resources are formalized for better processing. As stated in the “Semantic Web and Linked data” sub-section, subject, predicate and object are materialized as URI references or literals. Central to the implementation of the Semantic Web in organizational settings, are ontologies. Their main purpose is to solve the inter-operation juggernaut in large organization systems. In this perspective, explicit knowledge is ascribed metadata extracted from the domain/topic of interest to create a relevant ontology. With this shared ontology, systems with different syntax, structure and format can engage in a productive exchange, search and retrieval of information process. By its nature, an ontology includes multiple different views and vocabularies. As part of the applications of semantic Web services, an ontology also raises knowledge structures to higher levels including intelligence. Therefore, semantic techniques together with ontologies could help in managing integration in organization knowledge.

Another interesting solution is the **Simple Knowledge Organization System** (SKOS), an element of the Semantic Web family of standards (World Wide Web Consortium, 2009) and part of the Linked Data ecosystem. It is conceived with thesauri, classification schemes, taxonomies, and structured vocabulary. Its objective is to enable easy publication of these vocabularies as linked data. Several initiatives are exploring SKOS for the management of knowledge in organizations. The implementation of SKOS in organizational knowledge allows multiple actions including:

- a) identification of concepts using URIs,
- b) labeling with lexical strings in natural languages,
- c) assigning notations (lexical codes),
- d) linking to other concepts and organizing into informal hierarchies,
- e) aggregating into concept schemes and ordered collections,
- f) mapping to concepts in other schemes.

FUTURE RESEARCH DIRECTION

Over time, KM as a multidisciplinary science, has benefited from a variety of academic contributions and an extensive set of organisational practice from industry and society. As a result, KM research needs critical research perspectives that take into account themes related to individuals, communities and industries. These themes will bring balance and a whole new perspective in the KM landscape. Future research on Semantic Organizational Knowledge should naturally go along the lines of advances in the fields of Semantic Web and Linked Data. That is to say, future research agenda in this field could be influenced by the evolution of Linked Data in connection with Artificial Intelligence including Big Data, Machine Learning and Deep Learning. For example, recent surveys on Linked Data research (Bizier, 2009; Heath 2011) show an increased interest in building deep learning data sets, architecture search and compressing neural networks. These approaches are paving the way for the future of Deep Learning. In addition, future research in Machine Learning is currently heading towards two directions illustrated in the following questions: 1) how is it possible to generalize a concept from studying a small sample set? 2) how should we apply knowledge gained from experience to new or dynamic contexts? Besides, the Semantic Grid, defined as an extension of the current Grid with information and services clearly identified (Geldof, 2004), is converging with the Semantic Web to explore the advancement of Semantic Organizational Knowledge.

CONCLUSION

This chapter presented the state of the art survey on semantic Web and Linked Data technologies for solving issues related to organizational knowledge. The concepts of organizational knowledge, Semantic Web and Linked Data are presented. Then, a description about the Semantic Web and Linked Data underlying technologies including RDF, RDF schema, DAML, OWL and the SKOS are given. A comprehensive survey on R&D in semantic organizational knowledge is proposed. Here Knowledge is clearly considered through its explicit and tacit dimensions to highlight applications domains of Semantic Web and Linked Data technologies. That is to say, this chapter demonstrated how these technologies have been used to effectively support all aspects of knowledge acquisition, creation, sharing and dissemination.

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KEY TERMS AND DEFINITIONS

Explicit Knowledge: Explicit knowledge is knowledge that can be verbalized, stored, accessed, and shared with others. Explicit knowledge is often seen as complementary to tacit knowledge in that you need both to draw a complete picture of organizational knowledge.

Linked Data: It is about using the Web to connect related data that wasn't previously linked, or using the Web to lower the barriers to linking data currently linked using other methods. More specifically, Linked Data is the set of recommended best practice for exposing, sharing, and connecting data, information, and knowledge on the Semantic Web using Uniform Resource Identifier (URI) and Resource Description Framework (RDF).

Organizational Knowledge (OK): It refers to the collective knowledge and skills possessed by employees of an organization. This knowledge exists in the form of intangible company asset that needs to be shared and processed in order to provide competitive advantage.

Semantic Organizational Knowledge (SOK): This concept refers to technologies of the Semantic Web and Linked Data applied to the principles and procedures of organizational knowledge.

SPARQL Protocol and RDF Query Language (SPARQL): It is a powerful query language and widely used Application Programmer Interface (API) for accessing linked data collections online.

Tacit Knowledge: This is knowledge acquired through personal experience that is difficult to express. It is also known as the individual know-how, techniques, processes, and expertise that is considered embedded in the organization's knowledge base.

Uniform Resource Identifier (URI): It is a string of characters that uniquely identifies a particular resource (virtual or physical) that is part of a computer network. Two types of URIs exist: the Uniform Resource Locator (URLs) and Uniform Resource Names (URNs) which follow known syntax and protocols to. The first expresses an address whereas the second defines a name space for persistent object names.

Influential Factors on Reverse Knowledge Transfers in Multinational Organizations

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INTRODUCTION

Knowledge plays a pivotal role in the competitiveness of firms as both a resource in itself – which is rare, firm-specific, and difficult to imitate or substitute – and an integrating factor that makes other intangible resources and capabilities unique, especially in dynamic environments.

Knowledge has also a social dimension within firms. Hence it is important that firms develop a positive culture so that the utilization of individual's knowledge can be used and thereby makes firms compete favorably in the market. As such, firms need not only to develop a better knowledge base, but also need to manage knowledge better. For that, firms need to develop a teamwork effort so that the utilization of knowledge is useful for the firm (Omerzel & Gulev, 2011).

Globalization has turned organizations into highly complex and competitive environments where information and knowledge are the main sources of sustainable competitive advantage (Nonaka & Takeuchi, 1995; Teece, Pisano, & Shuen, 1997). With the globalization of the economy, the internationalization of the firms has become an increasingly important activity for their growth and survival (Dicken, 2015; Moreira, 2009). Although there are numerous theories that explain how firms internationalize, knowledge is almost taken for granted in most of them (Ribau, Moreira, & Raposo, 2015). Moreover, very few scholars address the importance of knowledge as a competitive advantage for multinationals to compete (Moreira, 2009; Ribau et al., 2015).

Multinational organizations need to be seen as global knowledge transfer systems where multiple knowledge flows happen simultaneously every minute between headquarters and local clusters, headquarter and subsidiaries and also among subsidiaries. Furthermore, in order to improve international positioning, these organizations must deal with and try to take advantage from different temporal, cultural, linguistic and spatial contexts (Demarest, 1997; Spender & Grant, 1996). Knowledge transfer involves sharing, filtering and presenting knowledge. This process is successful when the knowledge receiver changes its behaviour or performance, due to the knowledge sender's transfer (Argote & Ingram, 2000).

On one hand, headquarters (thereby written HQs) are irreplaceable sources of new knowledge for the subsidiaries, since they possess valuable intangible assets and capabilities, which might be used by the subsidiaries in their local markets. However, on the other hand, the local knowledge created and transferred from the foreign subsidiaries to the headquarters has proved to be very beneficial to the

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productivity and local performance of the multinational, improving the formulation of global strategies, facilitating the access to external resources and supporting both research and development (R&D) and new products development activities leading to productivity gains to the multinational (Ghoshal, 1986; Ishihara & Zolkiewski, 2017).

Subsidiaries can contribute to the overall multinational knowledge with local expertise and market intelligence. The expertise concerns input, productivity and output processes. Whereas market and business intelligence refer to information about clients, competitors and suppliers, representing the most valuable knowledge to the firm but least transferred one (Ambos, Ambos, & Schlegelmilch, 2006; Gupta & Govindarajan, 1991). Although there are numerous researches on the importance of several types of knowledge flows within multinationals (e.g. Crespo, Griffith, & Lages, 2014; Yang, Mudambi, & Meyer, 2008), the aim of this chapter is to deepen the literature specifically on reverse knowledge transfers in which knowledge flows from the subsidiary (the sender) to the HQs (the receiver) that receives, absorbs and applies it to obtain and exploit global competitive advantage.

This chapter seeks to explore the main key success factors that influence Reverse Knowledge Transfers (RKTs) within multinational corporations (hence referred as MNCs). The chapter categorizes those knowledge transfers within four main groups: subsidiary's characteristics; knowledge characteristics; relationships between HQs and subsidiary; and the central outcomes of these knowledge flows to the organization.

This chapter is divided in four sections. After this introduction that comprises the first section, background information is presented in section two. Section three addresses the main focus of the chapter: the four main groups of RKT. Section four presents the solutions and recommendations. Section five addresses the future research directions. Finally, section six presents the main conclusions.

BACKGROUND

As stated before, knowledge is considered the main source of companies' competitive advantage (Nonaka & Takeuchi, 1995; Teece et al., 1997). Since MNCs are divided into several agencies, they must handle knowledge transfers in different directions, such as conventional or vertical transfers (from HQs to subsidiaries), lateral or horizontal transfers (between subsidiaries) and reverse transfers or RKT (from subsidiaries to HQs). The latter, while being extremely valuable in transferring knowledge and underpinning the MNC's strategy, faces several obstacles to succeed.

This chapter's contribution can be divided in terms of RKT factors into four main groups: characteristics of subsidiaries, characteristics of knowledge, characteristics of the relationship between HQs and subsidiaries, and outcomes of RKT. The first group, which is one of the most explored topics in literature, is the subsidiaries' characteristics, namely the influence subsidiaries have under the strategy development, the internal and external embeddedness of these divisions, the subsidiary's country of origin, as well as the entry mode chosen to initiate the commercial relations in the given country.

The characteristics of the knowledge itself are very relevant to explain the RKT, specifically in terms of relevance, explicitness and complexity (Crespo et al., 2014; Ishihara & Zolkiewski, 2017; Yang et al., 2008).

The relationship between subsidiary and HQs is an extremely interesting area, although difficult to exploit and sometimes achieving contradictory results. It explores aspects such as the ability to disseminate and absorb knowledge, human resources practices and the control and coordination mechanisms adopted in each subsidiary.

In spite of being very scarce, information was also gathered on the research carried out on the results of RKT in terms of performance or productivity gains to the MNC, based on the work of Ambos et al. (2006) and Driffield, Love, and Yang (2016).

FOCUS OF THE ARTICLE

The main focus of this section is to address RKTs based on the main groups referred in the introduction.

Subsidiaries' Characteristics

This subsection analyzes the subsidiaries' characteristics, bringing into focus the subsidiary's elements that influence the success of RKT such as autonomy, capacity and willingness, age, influence, strategic role, entry modes, location and embeddedness.

Autonomy

The autonomy of a subsidiary determines the degree to which it has the power to decide on MNC's strategic issues. As autonomous subsidiaries can exploit their business and local market opportunities by taking advantage of external sources of knowledge, they normally engage in more RKTs vis-à-vis less autonomous subsidiaries (Silveira, Sbragia, Lopez-Vega, & Tell, 2017). Regarding the use of coordination mechanisms, Rabbiosi (2011) demonstrated that when subsidiaries are more autonomous, choosing technological coordination mechanisms is a better option.

Capability and Willingness

In order to understand the subsidiary's capability to transfer new knowledge, HQs' managers should evaluate the adequacy of training routines and performance appraisals, the degree of the subsidiaries' formal integration, and the frequency of communication between subsidiaries and HQs (McGuinness, Demirbag, & Bandara, 2013), as the perceived capability of the subsidiary has a significant positive impact on RKT (Nair, Demirbag, & Mellahi, 2016).

The motivation or willingness of the subsidiary's employees to transfer knowledge has a positive impact on RKT. This motivation depends on: good human resource management practices (particularly compensation and promotion systems); the degree of informal integration of the subsidiary, the frequency of communications between HQs and subsidiaries (McGuinness et al., 2013); the extent of external embeddedness; and shared values between HQs and subsidiaries (Najafi-Tavani, Giroud, & Sinkovics, 2012).

Additionally, RKT may benefit more from subsidiaries with corporate language proficiency (Pelto-korpi, 2015).

Age

Generally, older subsidiaries transfer more strategic knowledge to the MNC when compared to the younger ones (Rabbiosi & Santangelo, 2013; Silveira et al., 2017), as older subsidiaries have more information, resources, R&D skills, experience, as well as better integration with the HQs. However, sometimes the participation in RKT is higher for younger subsidiaries, since they adapt faster to the demands of the

markets and to the organizational contingencies of the MNC (Silveira et al., 2017). Moreover, the positive link between age and knowledge relevance depends on the entry mode of the MNC, which means that acquired subsidiaries and/or majority-owned joint ventures are better off than Greenfield subsidiaries in RKT (Rabbiosi & Santangelo, 2013).

In addition, for young subsidiaries it is important to adopt socialization mechanisms to improve especially internal embeddedness (Najafi-Tavani et al., 2012). Moreover, in old subsidiaries there is a positive relationship between internal and external embeddedness and RKT (Najafi-Tavani et al., 2012).

Internal and External Embeddedness

As subsidiaries are normally created to explore and develop knowledge and competences on foreign markets, external or local embeddedness with suppliers and customers, as well as internal embeddedness between the subsidiaries and the HQs, are essential for both the development of MNCs' strategic knowledge MNCs and successful RKTs (Najafi-Tavani, Zaefarian, Naudé, & Giroud, 2015; Silveira et al., 2017). Thus, the information about local market collected by the subsidiaries has a positive impact on mechanisms of formalization, integration and socialization (Jeong, Park, & Chae, 2017).

Influence

Studies have shown that transferring more knowledge contributes to the subsidiaries' influential power on the MNC's strategic future. The increase in the power of subsidiaries is important, since they become more autonomous, maintain a relationship of trust with HQs and get more attention from the parent company. Enhancing subsidiaries' influence is also fundamental to HQs, because it is easier to obtain specific and local knowledge from the subsidiaries (Najafi-Tavani et al., 2015). The subsidiary's ability to exert influence on corporate strategic decisions strongly depends on its contribution to the HQs' knowledge base. Furthermore, the relationship between internal and external embeddedness and influence is mediated by the knowledge developed by the subsidiary and RKTs (Najafi-Tavani, Giroud, & Andersson, 2014).

Location

As most developed countries have infrastructural conditions, business support institutions and legal environments favorable to internationalization, it is understandable that subsidiaries located in developed countries create and transfer more knowledge compared to subsidiaries in developing countries (Ambos et al., 2006; Rabbiosi, 2011; Silveira et al., 2017). In the same vein, RKTs are most beneficial when the country of the knowledge sender has more competitive strength than the country of the knowledge recipient (Ambos et al., 2006). Conversely, the location of the subsidiary may have a negative effect on the relationship between knowledge relevance and RKT market (Yang et al., 2008).

According to Gupta and Govindarajan (2000), the economic level of a country affects the perception of value that the HQs have of knowledge accumulated and created by the subsidiaries of that country (Li, Barner-Rasmussen, & Björkman, 2007). With this in mind, subsidiaries located in more developed countries transfer more knowledge to other corporate units compared to the knowledge transferred by subsidiaries of less developed countries. Moreover, social interaction, trust and shared vision are more prominent in subsidiaries in less developed countries (Li et al., 2007). However, the relationship between

the social interaction and the location of the subsidiary is not relevant, because social interactions do not necessarily lead to a greater learning capacity, as was the case of Chinese subsidiaries (Li et al., 2007).

In addition, the level of a country's economic development and the strength of its institutional structures have a positive effect on the MNC's performance, through RKT, especially in countries where there is a prominent protection of intellectual property rights (Driffield et al., 2016).

Entry Modes

Concerning the entry modes, the subsidiaries' productivity effect on the parent company's performance is greater in acquired subsidiaries, particularly when there are similarities in the industry they are operating. The only case in which subsidiaries upstream of the HQs' supply chain generated significant productivity effects on the parent company are those subsidiaries specialized in R&D activities (Driffield et al., 2016).

In order to compare the subsidiary's innovation capacity and entry mode, it should be borne in mind that for low levels of innovative capacity, Greenfield subsidiaries transfer more knowledge than acquired subsidiaries. This is explained by the fact the language, culture, routines and organizational characteristics of newly created subsidiaries are compatible with those of the HQs. This contrasts with the behavior of acquired subsidiaries, which still need to get integrated into the internal network of the MNC to overcome the incompatibilities that may exist. On the other hand, as acquired subsidiaries are already incorporated in the local network, they can transfer more knowledge than the Greenfield subsidiaries, which still need to invest time and money in the development of a local network (Mudambi, Piscitello, & Rabbiosi, 2014).

Strategic Roles

Subsidiaries can assume one of four strategic roles, regarding the behaviors and patterns of knowledge flows (Gupta & Govindarajan, 1991): Global Innovators; Players; Local Innovators; and Implementers.

Subsidiaries behave as Global Innovators when they are the main source of knowledge for the other organizational units. When subsidiaries create knowledge, but are not self-sufficient in terms of their creation, they behave as Players. Implementers are those subsidiaries that invest little in the creation of knowledge and strongly depend on knowledge transfers from HQs or other subsidiaries. Finally, Local Innovators are subsidiaries that are responsible for generating almost all their local know-how (Gupta & Govindarajan, 1991). Generally, Players tend to transfer more beneficial knowledge to HQs than the other subsidiaries (Gupta & Govindarajan, 1991; McGuinness et al., 2013).

Conversely, in order to draw conclusions about the subsidiaries that transferred more knowledge to HQs Rabbiosi (2011) relied on the three roles of the subsidiaries, identified in Ghoshal's (1986) doctoral thesis: Implementer; Contributor; and Innovator. Implementer subsidiaries are units that adapt products to local market needs. Contributor subsidiaries usually take advantage of MNC's knowledge. Finally, Innovator subsidiaries are normally established to increase or create new technological skills for the whole MNC. Rabbiosi (2011) concluded that Contributors and Innovators subsidiaries transfer more knowledge to HQs than Implementers.

Knowledge Characteristics

This subsection addresses the content that is being transferred in terms of its complexity, relevance and explicitness, which is also essential to understand how RKT happens.

Complexity

As a result of the increasing specialization and sophistication of R&D activities, companies need to acquire and relate knowledge of very different areas to develop new products according to the different variety of markets, which makes knowledge more complex. Nevertheless, studies involving Brazilian MNCs have shown that the complexity of knowledge has a positive impact on RKT, because in spite of complex knowledge transmission involving more costs and barriers, RKT will be transferred anyway as it is the most valuable type of knowledge for HQs (Silveira et al., 2017).

Relevance

Knowledge relevance has a positive impact on RKT (Driffield et al., 2016; McGuinness et al., 2013; Nair et al., 2016). The relevance of knowledge transferred may be influenced by the subsidiary's country, as developed countries tend to transfer more strategic relevant knowledge to the HQs (Yang et al., 2008). The degree of firm's centralization (McGuinness, Demirbag, & Bandara, 2013) and the use of formalization integration and socialization mechanisms affect positively the relevance of knowledge created (Jeong et al., 2017; McGuinness et al., 2013). Consequently, if the knowledge transferred by subsidiaries is seen as of added value to the HQs, the subsidiaries' capability will be recognized (Nair et al., 2016) and take advantage of the market knowledge acquired by the subsidiaries (Jeong et al., 2017).

Explicit and Tacit

As tacit knowledge is more abstract and contextualized, it is more difficult to articulate and transfer (Crespo et al., 2014), which can weaken RKT (Ishihara & Zolkiewski, 2017). Although tacit knowledge cannot generally be taught, it may nevertheless be easily transferred through job rotation, training, storytelling, and forums (Rollett, 2003). As a result, MNCs need to invest to make tacit knowledge explicit as it is vital to the success of RKT, especially when cultural distance is small (Crespo et al., 2014).

Relationship Between HQs and Subsidiaries

Studies have generally paid more attention to the HQs side when investigating RKT. However, in order to complement this knowledge, it is pertinent to study the relationship between the two actors participating in these knowledge transfers. This section addresses not only how the HQs control and manage the subsidiaries, in the matter of coordination or control mechanisms and RH practices, but also the capacity of each part to absorb and disseminate knowledge, as well as the distance between the parties.

Absorptive and Disseminative Capacities

The success of RKT is positively related to the parent's absorptive capacity (Ambos, Ambos, & Schlegelmilch, 2006; Nair, Demirbag, & Mellahi, 2016), which depends on the establishment of a positive learning environment, a technical knowledge infrastructure (Nair et al., 2016) and the use of formalization, integration and socialization mechanisms (Jeong et al., 2017). This is important for the competitive wellbeing of MNCs as previous knowledge affects the degree of receiver's absorptive capacity (Ambos et al., 2006; McGuinness et al., 2013).

In a complementary perspective, Ishihara & Zolkiewski (2017) revealed the importance of heeding capacity – i.e. HQs' ability to overcome cultural and linguistic barriers through willingness and active listening – vis-à-vis disseminative capacity for the reverse knowledge transfer, especially when the subsidiary's disseminative capacity is weak – namely, when they are not proficient in English, for example (Ishihara & Zolkiewski, 2017).

In addition, the commitment of HQs can moderate the relationship between communication media richness and the RKT itself (Peltokorpi, 2015). There is also evidence to confirm the positive relationship between the HQs' absorptive capacity and the market knowledge application (Jeong et al., 2017).

Beyond absorptive and disseminative capacities, other characteristics of receivers and senders need to be highlighted, namely their communication competencies, the personal relationships they established, knowledge previously acquired and individual learning styles as they influence success of RKT (Rollett, 2003).

Distance

Distance has been studied to explain the knowledge transfer process in a multinational context. This construct can be divided into four categories: cultural, linguistic, economic, geographical and relational distance.

Cultural, linguistic and geographical distances affect the use of personal mechanisms of coordination, because they may involve people from different cultural backgrounds. On the contrary, the technological mechanisms and their code nature do not influence the knowledge transfer effectiveness between distant multinational units, since when the content is codified and transferred by computers, context is not really relevant (Ambos & Ambos, 2009).

Although there is evidence that economic and physical distances reduce the positive impact the subsidiary's performance has on the parent company (Driffield, Love, & Yang, 2016), the geographical distance does not have a clear impact on the effectiveness of RKT and does not represent a constraint to social and organizational relationship building between the two corporate units, thus, not influencing the cultural and relational distance (Jasimuddin, Li, & Perdakis, 2015).

In spite of being evidence proving that the greater the cultural distance, the lower the RKT (Crespo et al., 2014; Jasimuddin et al., 2015), other studies could not validate this relationship (e.g. Ambos et al., 2006). Complementarily, the relational distance between HQs and subsidiaries also negatively affect knowledge transfers (Jasimuddin et al., 2015).

Expatriates

There is no doubt that expatriation (also known as corporate expatriation) and repatriation involve transferring an executive from HQs or a subsidiary to another subsidiary of the company, located in a different country (Dobrai, Farkas, Karoliny, & Poór, 2012). The latter involves the inverse process of expatriation as it corresponds to the first job of an individual/manager after returning from an international assignment, that normally does not last more than two years – which can play a crucial role in the RKT process.

Expatriation can be short- or long-termed. The capability to transfer knowledge is higher if the expatriation program is short-termed (less than a year, one to two weeks, or involving frequent trips). These short experiences allow employees to acquire more knowledge and global competencies, making then better teachers/trainers. However, motivation and will is higher when the expatriation program is long-termed, as long periods of time at a foreign subsidiary allow expatriates to have more autonomy

and accountability in terms of performance and to show more commitment and willingness to perform a better job (Minbaeva & Michailova, 2004).

The knowledge transfer depends on the expatriates' ability and motivation, disseminative capacity, technological and management competencies (Dobrai et al., 2012). However, the knowledge characteristics, the receivers' absorptive capacity and the relationship between sender and receiver are also important (Dobrai et al., 2012). From another angle, the RKT of repatriates is also positively influenced by their disseminative capacity, which is related to the level of acquired knowledge and the company's whole international assignments policy. However, the firm's help and support during the expatriation and/or repatriation processes does not affect knowledge transfer (Sanchez-Vidal, Sanz-Valle, & Barba-Aragon, 2016).

Frequency of Communication

As the communication between organizational units become more frequent, the higher the ability to process information crucial to innovation processes and, consequently, the better the knowledge transfer (Crespo et al., 2014; Gupta & Govindarajan, 1991; McGuinness et al., 2013).

Coordination Mechanisms

The relationship between subsidiaries and HQs can be easier should they use coordination mechanisms, which can be personal or electronic. The personal coordination may involve the participation of subsidiaries' management within international teams or projects, staff transfer and the organization of committees and meetings (Rabbiosi, 2011). These are crucial to the routine coordination of all operational units (Ambos & Ambos, 2009). The electronic mechanisms allow all employees to codify, store and access knowledge. Their main purpose is to maximize resources that are incorporated in a unit's network separated by time and space. The electronic mechanisms use infrastructures that include tools such as business intelligence, coordination software, organizational learning and knowledge mapping (Ambos & Ambos, 2009). According to Ghoshal (1986), subsidiaries characterized as 'contributors' and 'innovators' transfer more knowledge to the HQs. As such, more personal mechanisms of coordination should be implemented in innovator and contributor subsidiaries. The electronic mechanisms should be used especially in contributor subsidiaries, which experience less autonomy than the others (Rabbiosi, 2011).

Taking into account Bartlett and Ghoshal's (1990) typology, when MNCs resort to innovations generated by their subsidiaries, MNCs tend to use resources and capabilities of their geographically dispersed units, which contribute to the developments of the MNC's competitive position. As such, knowledge involves a world-wide scientific and technological expertise in geographically dispersed units that needs to be coordinated.

Finally, the extent of shared values between the subsidiaries and HQs (Najafi-Tavani et al., 2012) and the communication media richness (Peltokorpi, 2015) affect RKT. The implementation of socialization mechanisms improves the relationship between a subsidiary and its parent company, the amount of shared values for both young and old subsidiaries, and also the extent of RKT themselves (Najafi-Tavani et al., 2012). Parent companies can benefit more from RKT if they use socialization mechanisms with older subsidiaries (Rabbiosi & Santangelo, 2013). The use of socialization mechanisms may improve the extent of internal embeddedness for both acquired and Greenfield subsidiaries (Najafi-Tavani et al., 2012).

Control Mechanisms

According to Ghoshal and Bartlett (1990), managing the interorganizational network within the MNC is a very complex task as there are different networks within the MNC. Moreover, there are also different control mechanisms and levels of formalization.

Centralization is a control mechanism of the HQs on the subsidiaries, which restricts the decision-taking to the HQs. Formalization allows the HQs to implement decision-taking power using strict routines, rules and procedures (Gupta & Govindarajan, 1991).

When these types of mechanisms are used, the communications between HQs and subsidiaries are more frequent (Crespo et al., 2014) and very important when RKTs are at stake especially involving different degrees of innovative activities among hierarchies (Bartlett & Ghoshal, 1990).

Human Resources Practices

Human resources (HR) play an important role in knowledge management. The most important HR practices related to knowledge management are the ability to assure personal credibility (such as achievement of goals and communication competencies), the change of management capacities/competencies and the appropriate business knowledge HR possess (Dobrai et al., 2012). As such, it is not usual to rely on external service providers to provide HR's functions related to knowledge management in MNCs as those functions depend on the ability and motivation of the person to transfer knowledge as well as on his/her communication skills. As a result, the training and local development (provided in the subsidiary) and informal workplace learning are the most effective learning methods (Dobrai et al., 2012).

It should be highlighted that the more similar the practices used both within HQs and subsidiaries, the greater the effectiveness of the knowledge transfer (Ambos & Ambos, 2009).

Outcomes

Benefits to the MNC's Knowledge Base

There are several benefits in transferring knowledge across the MNC. The knowledge most frequently transferred is marketing know-how, followed by the distribution and technological know-how. However, the most valuable knowledge to HQs is the customers and competitors' market-related information, which is less transferred (Ambos et al., 2006), perhaps because it is based on tacit knowledge. However, R&D and marketing knowledge can be also considered as the one that brings more benefits to the parent company (Rabbiosi & Santangelo, 2013).

Knowledge itself influences the RKT within the MNC as this influences the degree of innovation, the level of multinationality, and the social capital, especially the internal social capital, of the MNC (Jiménez-Jiménez, Martínez-Costa, & Sanz-Valle, 2014). As such, it is more important to study the benefits of knowledge transfer than just the knowledge flows (Ambos et al., 2006).

Performance and Productivity

Another way to check the positive results of RKT is looking at the MNC's results/outcomes, for example total factor productivity, turnover, capital and employability, among other factors. By doing this, Driffield et al. (2016) concluded that the subsidiary's productivity has a positive impact on the HQs' performance.

SOLUTIONS AND RECOMMENDATIONS

MNCs compete in broad resource and product/service markets and stretch out through various countries, involving people and different ways of doing business. Knowledge is an important intangible competitive advantage that MNCs need to manage properly across the countries where they have subsidiaries. Moreover, as subsidiaries play different roles, and as countries have different factor endowments HQs have to manage not only knowledge within the corporation, but also the reverse knowledge transfer from subsidiaries to HQs.

The literature presented in this article unveils some issues and problems in the RKT processes, such as the subsidiary's age, location and entry mode and distance between corporate units in many above-mentioned dimensions.

With this in mind, this section puts forward some recommendations directed to MNC's management.

Early-created subsidiaries should receive training, so they can be quickly embedded within the MNC's modus operandi, which needs to be a continuous organizational learning culture. All subsidiaries, specially the older ones need to foster knowledge transfer capabilities and should be ready to welcome and transmit their knowledge to the new employees.

In addition, a knowledge management system should be officially created to manage the knowledge transfers, assure the frequency of communication, increase internal embeddedness, develop knowledge performance indicators and monitor them. This knowledge management system must include control, coordination and socialization mechanisms, of both personal and technological natures. Periodic electronic reports, development of communities of practice and annual summits would help subsidiaries and their key stakeholders be on the same page, thereby benefiting the MNC's overall success. The experiences' exchange between old subsidiaries, young subsidiaries and the HQs can be fruitful for the establishment of relationships and competition pertaining cultural, economic and relational distances.

The development of 'glocal' HR practices must be included, increasing the disseminative capacity of all subsidiaries and enhancing the knowledge's quantity and relevance, promoting the RKT from subsidiaries located in developing countries and increasing the market application of transferred knowledge.

Finally, expatriates must be encouraged to share their lively experiences, since they have more ability to transfer knowledge in a short-term basis. When returning, active training and experience exchange should be done, so that the MNC can take advantage of the relevance and uniqueness of the expatriates' knowledge and the expatriates' willingness to transfer knowledge.

FUTURE RESEARCH DIRECTIONS

RKT is crucial to build relevant organizational knowledge and its adequate management will certainly help MNCs to succeed overseas. Knowledge comes from all the people involved within the MNC and technologies (including social networks) can help HQs and subsidiaries to monitor what is new in which subsidiary. This would allow the development of a market, competitive and resource intelligence knowledge repositories that would enable the MNC to deal with a global mindset and an evolving-oriented culture.

Although Kogut & Mello (2017) refer that the studies using quantitative methodologies have a pre-dominant presence in this research area, due to the cultural and individual differences that may influence the results, the adoption of qualitative methodologies, such as multiple case studies and in-depth interviews, may be a sign of detailed, substantial and context-specific descriptions about knowledge transfer practices and processes, thus increasing the understanding of reverse knowledge transfer.

Finally, as knowledge and knowledge management have a pervasive effect on competitive advantage, it would be advisable to extend research on RKT and MNCs beyond the confinement of the business, management and economics arena including studies on HR management (Dobrai et al., 2012; Minbaeva & Michailova, 2004), computer science, and information management.

CONCLUSION

Within the MNCs, RKT research is becoming more and more important. Knowledge is the best source of continuous competitive advantage and subsidiaries need to be seen as centers of unique strategic knowledge, crucial for the MNC to be competitive worldwide.

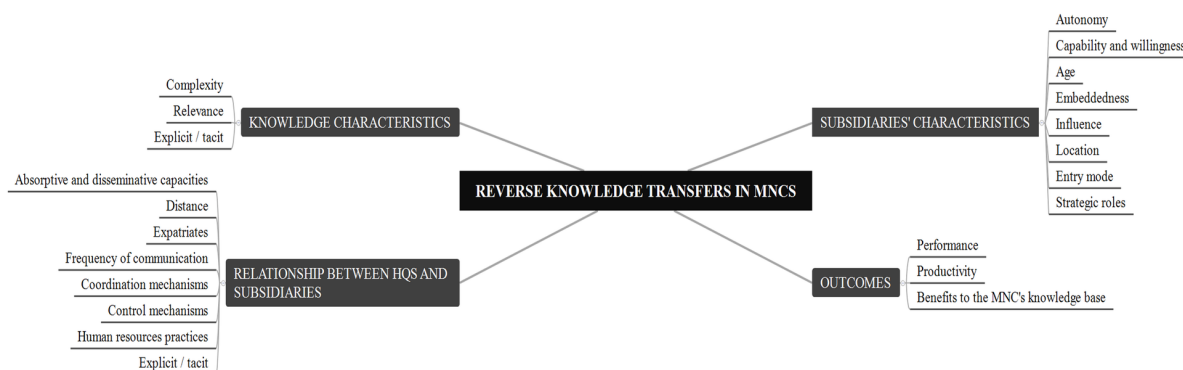
Several subsidiaries' characteristics are important when studying RKTs. Subsidiaries that have more autonomy and participate actively in strategic decision making are naturally more willing and capable to transfer knowledge to the HQs. The entry mode chosen by the HQs to penetrate foreign markets may also dictate the success of RKTs, as acquired and Greenfield subsidiaries contribute to the multinational knowledge in different manners.

Generally, the larger the subsidiaries, the more knowledge they transfer. Moreover, larger subsidiaries also transfer knowledge more frequently than other types of subsidiaries. Location is a relevant fact, since it has been proven that subsidiaries from developed countries tend to take part in knowledge transfer process.

In addition, the type of subsidiary is important as not all subsidiaries behave alike in transferring knowledge. For example, regarding the degree of knowledge creation, Contributors and Innovators are among the subsidiaries that reversely transfer more knowledge. The subsidiary's external (with the market) and internal (with the HQs) embeddedness is also an important factor of influence.

Concerning the relationship between HQs and subsidiaries, the HQs' absorptive and heeding capacities, as well as the subsidiary's disseminative capacity should be improved so that the likelihood of RKT is successful. As cultural, geographical, economic and organizational distances create a barrier to overseas communication, MNCs need to deploy the use of personal and technological coordination mechanisms. However, results relating distance are not coherent, thus it is important to highlight the need to understand and explain the situational and geographical context and its implications. A good example is the research paper of Li et al. (2007), in which two different countries are compared: Finland and China. HQs may

Figure 1.



implement expatriation programs and control mechanisms (formalization and centralization) to increase, for example, the frequency of communication, which represents a positive effect on RKT. The adoption of 'glocal' HR practices might be an option for MNCs to establish an organizational learning culture globally. The practices would be similar for all the operational units. At the same time, MNCs need to respect the local learning methods in order to develop broad, plural competencies.

In spite of being more complex and tough to transfer, tacit knowledge might be more strategically relevant than explicit knowledge. With this in mind, MNCs should try to find ways to explicit the tacit knowledge. However, explicit knowledge is also beneficial to RKT.

Finally, as Ambos et al. (2006) stated, the benefits of RKTs should be highlighted, since these are the reasons MNCs perform RKT in the first place.

Figure 1 summarizes the main factors that impact RKTs within MNCs, as shown in this chapter.

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KEY TERMS AND DEFINITIONS

Absorptive Capacity: An ability of a person who recognizes the value of knowledge already acquired and link that to new information and its usefulness.

Corporate Language Proficiency: Degree to which a person can speak, write, and understand the most used language within the business (mostly English).

Cultural Distance: Represents differences between people from diverse cultural backgrounds and the way it affects their relationship. Language, religion, racial or ethnic origin and traditional costumes and values are examples of factors.

Disseminative Capacity: An ability of a person who can spread the information in the best way possible for the receiver to understand it, through face to face and/or through a technological device or network.

Explicit Knowledge: A type of knowledge that is formal and systematic. It consists of the description of facts, concepts, and relationships. It is easily communicated and shared through documents, procedures, and software.

Glocal Human Resource Management: A MNC's ability to focus on the characteristics of a global organization, and also to adapt human resource practices to the local markets and/or cultural characteristics of the subsidiaries.

Heeding Capacity: HQs' ability to overcome cultural and linguistic barriers through willingness and active listening.

Multinationality: It is normally associated to firms that produce and sell goods in different countries. A degree that evaluates in how many different countries (and cities within those countries) a multinational organization establishes business relationships.

Relational Distance: Lack of personal or trust bonds between the employees within one or between two corporate units of an organization.

Tacit Knowledge: A set of as skills, ideas, and experiences that people have but are not codified. It is the type of knowledge that is complex, diffused, ingrained in the people of the organization. It is related to technical skills and know-how, but also to mental models, beliefs and perspectives.

Knowledge Harvesting Concept Paves Way for Open Innovation Initiatives

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INTRODUCTION

The basic functions such as production, marketing and finance continue to be the same from the day world has moved from agriculture economy to industrial economy. Business processes, procedures, methods, strategy, management thinking and approach related to basic functions have been changing. Any change such as adding to the new features to the existing products, designing a new product, changing the business processes, business models and other activities in the basic functions in an organization has to be carried out. This assignment is given to research and development department. The role of a research and development in an organization is to think of a new approach for the above activities. In case there is no research and development department in an organization, a group of executives at the instruction of the management will form as a group to carry out innovation initiative for the above activities. Their innovative approach will be based on the professional experience and knowledge (Anderson N & Costa A C, 2010). Their innovative approach will aim to be competitive in the market. In the present business scenario, it is not enough for enterprises to be competitive, but it is required to be acceptable as suppliers or service providers. Now it has become a necessary for every enterprise to think differently and follow a new approach to manage their business goals. Now critical business needs decide the type of innovation initiative is to be adopted.

In recent times open innovation initiative is gaining importance for the strategic management purposes. Now enterprises have started opening up their open innovation process and adapt their business models to benefit not only from internal but also from external ideas and knowledge. An important aspect of open innovation is that enterprises can capitalize on expanding the research and development activities by using external ideas as well as internal ideas for expanding their domestic and global markets. The open innovation approach forces enterprises to cross boundaries to get ideas from the various stakeholders (Arora, 2015).

Essence of Open Innovation

Open innovation project is knowledge intensive. It has become an imperative to collaborate in learning and sharing knowledge from inter organization networks (Denning & Dunham, 2012). The challenge of these networks is to manage and develop interpretations of the internal and external environments of enterprises. Personal contacts take place in the organizations' networks. Social groups are formed through their interactions. Creative individuals share their knowledge within the group. This leads to open innovation initiatives (Kasemsap K, 2014). Ultimately it can be said that open innovation in the business landscape is the solution to face rapid changes that are taking place in domestic and global economy.

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Perception of Open Innovation

Open innovation concept has already been in existence in the corporate world for a long time. Many companies have been making use of this concept without it being referred as “Open Innovation”. Brain storming sessions are the classic examples for getting ideas. It may be noted that all the employees in the organizations are the participants to these sessions. In these sessions, gist of the business issue/problem is written on the board, where this session is held. Even silly ideas expressed at this session are discussed. After analyzing all the suggestions expressed at the session, the best workable solution will be accepted for solving the business issue/problem. Some enterprises follow “Suggestion Boxes” method. In this method “Suggestion Boxes” are kept at the important places in an organization. Employees are invited to write their ideas or suggestions in relevance to their business on a paper and drop it in the “Suggestion Box”. It is a general feeling that employees who are directly associated with the business processes or activities will have a better ideas to suggest (Schein & Schein, 2017).

The above two methods can be considered as an open innovation initiative. The participants under the two methods are the employees of the same organization. The employees are the main internal stake holders. In the present business scenario external stake holders are also invited to share their experience and knowledge for solving business issues of an organization. The concept of open innovation has received much importance due to the participation of external stakeholders in an organization’s business issues. Now open innovation initiatives are crossing the boundaries of an organization.

Back Ground

Many business enterprises rush into generating ideas to become more innovative before clearly identifying the problem in their enterprise. If the enterprises expect their employees to come up with ideas that would work, the employees need to know the business problems faced by their organization. The employees must have access to the information pertaining to the problems of their organization. It is the practice of many enterprises that their organization’s information is considered to be important and secret. It is meant for the top management’s view only. The environment in enterprises must be friendly instead of closed. Then only the employees will associate themselves with their organization. This would facilitate them to integrate creativity and strategic thinking. Creativity is certainly a part of innovation but innovation is much more (Tocci C L, Chesbrough H, & Piller F, 2016).

It is observed executives in enterprises are under the impression that innovation is associated with new products, new technology, and research development activity. This view is too narrow in the present business scenario. Innovation can be applied broadly across all aspects of an enterprise. They are such as existing products, services, business processes and business models (Knot, 2017).

Peter Drucker in his article on the discipline of innovation says that innovation is real work. It should be managed like any other corporate function. Further he explains that it does not mean the same as other business activities. He stresses that innovation is the work of knowing rather than doing. He argues innovative business ideas come from methodically analyzing seven areas of an opportunity. The areas are 1) Unexpected occurrences 2) In Congruities 3) Process Needs 4) Industry and Market Changes 5) Demographic Changes 6) Changes in Perception and 7) New knowledge. He groups the above areas of opportunity are under within a company or industry and outside a company in its social and intellectual environment. The first four areas fall under the group one and the balance three fall under group two. The glass is half full and the glass is half empty are the descriptions of some phenomena, but have vastly

different meanings. Changing a manager's perception of a glass is from half full to half empty opens up big innovative opportunities.

Globalization has created new trends such as market consolidation, Vertical market strategies and mergers in the business world. These trends have forced many business enterprises to adapt themselves to these new phenomena (Estrim J, 2009).

History of Innovation

Innovation has always been part of mankind. Since the discovery of fire by rubbing two stones together, human beings have been innovating. Innovation is probably the oldest known process. In other words innovation is an extension of a person's creativity. Human beings have been using their inner skills to create many new things to help mankind.

Historical Background of Knowledge Management

The concept of knowledge management is not new. The focus and approach has been changing over a period of time. One may observe from the literature on the history of information and knowledge that the basic patterns of behavior remained constant over a period of centuries concerning the role of information and knowledge (Tores, Ibarra & Arena, 2015). History provides many examples. Emperors in the olden days always surrounded themselves with advisors who were scholars first and politicians second. Roman emperors like the ancient Greeks consulted educated priests to gain an insight into the possible future. Indian Kings seemed to be concerned with creation of knowledge among people by allocating places for schools and libraries. Julius Ceaser used innovative construction methods and advancements in ammunitions to achieve military success. Napoleon made use of the advancements in artillery to defeat his opponents. Cornelius Vander Bilt had taken advantage of the advancements in rail road wheels and brakes to create vast commercial empire. J.P.Morgan made a huge fortune and revolutionized the financial system by developing modern investment banking practices. Tipu Sultan used war rocket in some of the battles he fought against the British soldiers. This earned universal fame as "Innovator of the World's first war Rocket". It was his victories against the British forces that ranked Tipu Sultan among the few Indian rulers who have defeated the British.

In the pre industrial era agriculture was the basis of nation's economy then the concentration was to learn more about farming. In the post industrial era manufacturing became the basis of nation's economy then the concentration was to learn more about manufacturing techniques. In the present globalization scenario the focus is towards adapting innovation and process speed in business enterprises. Knowledge base in a business enterprise is an extension of knowledge sharing systems. Business success lies in converting the information into knowledge. In today's business scenario the use of sophisticated knowledge base depends on the skill with which executives in business enterprises arrive at their findings from their analysis for framing strategy for their organization. Further business executives can draw insights from the large information stored in their systems. Conclusions drawn from these analyses will help the business executives to involve in innovation.

Indian and Chinese Thinking

Jugard is a colloquial Hindi word that roughly translates as "Innovative Fix" (Radjou N, Prabhu J & Ahuja S, 2012). It is an improvised solution born from ingenuity and cleverness. Jugard is quite simple. It is a

unique way of thinking and acting in response to challenges. It is the gusty art of spotting opportunities in the most adverse circumstances. Further it is making use of available resources fully improvising solutions by simple means.

Juggard is practiced by almost all Indians in their daily lives to make the most of what they have. Juggard applications include finding new uses for everyday objects such as empty soft drink or pickle bottles reused as containers for water, spices or lentils. When a truck cannot be repaired, diesel engine is removed and used as a cart. Juggard happens in an emergency situation. It is not a planned activity. Chinese believe in today's world the primary resource is knowledge and innovation. This resource comes from one's brain. If one's brain retires, then there is no more life (Sunted, 2011). The level of innovative thought will be one of the major economic drivers for China. Many global organizations have already established offices in China to capture both the creative kinds of its people and the tremendous market share.

Trends in Management Concepts

One can find from the analysis of trends in management in every decade. New concepts have been emerging. The moment it emerges, it is considered as "Next Big Thing" or "Next Important Concept". In 1950's "Brain Storming" Concept has become popular. It was considered to be a very important factor in involving the employees in business enterprises to generate new ideas. In 1960's and 1970's, sensitivity groups have played an important role in business enterprises. The group leaders of this group have been considered to be "Gurus". They would lead group managers. Then it has been practice, "Gurus" would make brief opening remarks and they would wait for response from the group managers. Then the "Gurus" would facilitate them to express and try to clarify. It was a hope that "Inner Manager" would emerge. It was expected that more research would follow on their deliberations. The era 80's was considered as the age of quality management. During this period quality control, quality circles, six sigma and other related approaches were followed for enhancing workers performance. The quality related approaches have been continuing for a long time. In the recent past, the need for knowledge management has been felt very much to face globalization secenario. In the present era the concept of "Innovation" is becoming ultimate goal of enterprises to face the complex global economy (Vint V K, 2009).

Invention, Innovation and Creativity

The terms invention and innovation are used interchangeably. Actually these are separate and distinct concepts. Invention means designing and creating something which has never been made before. The classic examples are invention of light bulb by Thomas Edison, and Invention of telephones by Alexander Graham Bell. Louis Pasteur came up with vaccines. Innovation deals with bringing in new methods and ideas resulting in required changes in an enterprise. In the present business context, innovation is taking interesting ideas and transforming them into usable solutions (Vangundy B, 2008).

Creativity can be defined as discovery of a new idea or connection (Mathur, Singh, & Ashutosh, 2013). Many ideas already exist somewhere in the World. Creativity is to identify these ideas and connect them in a new way. But innovation is much more than just identifying and connecting these creative ideas. It is about strategy and action bringing values to the enterprise through the implementation of these creative and strategic ideas. Innovation can therefore be interpreted as the profitable implementation of strategic creativity (Goel, 2016).

Example for Invention and Innovation

John Shepherd Barron reached his bank a little late and thought that why there could not be a system to get cash on the lines of chocolate vending machine. This thought gave him an idea to invent the first automatic cash dispensing machine now known as ATM. John had also thought of the four digits PIN Number. Creation of ATM can be considered as a classic example for invention and innovation. Many more features are being added to ATM by other people. Invention of ATM has given a scope for adding additional features in ATM. The enhancement of additional features can be considered as innovation (Gerard & Costa, 2013).

Types of Innovation

Innovation can be applied broadly across all aspects of an enterprise such as existing product, services, processes and business models (Prahalad C K, & Masshelkar, 2011). Innovation can be classified under three categories. They are 1) Efficiency Innovation 2) Evolutionary Innovation and 3) Revolutionary Innovation.

Efficiency Innovation

Efficiency Innovation talks about the changes in the existing processes in enterprises. The management is generally happy for small changes made in the existing processes and procedures in their organization. This approach is usually to cut costs, reduce cycle time or designing a simple format of a report to the top management of an enterprise.

Evolutionary Innovation

Evolutionary Innovation concentrates on ideas that represent something distinctly new and better. An example under this category is the introduction of internet banking. This has changed banking business from the fixed hours to banking at any hour. The other example under this type is advertisement in tabloids. Advertisements make the publishers of tabloids possible to distribute news free of charge with the revenue from the advertisements. The business models such as B2C, B2B, and B2G have been providing a scope to innovate improvements and expansion in enterprises.

Revolutionary Innovation

Revolutionary Innovation focuses on something radically new. This may change the existing structure of an enterprise and market place. McDonalds approach to fast foods changed the restaurant business. Disney's unique characters and interactive theme parks changed the entertainment business. Internet has brought a change in business scenario. It will continue to change in the industry sectors also.

Need for Innovation

The innovative spirit among the inventors is responsible for inventing the car, the telephone, television, and the internet. The world is benefited from manifestations of the innovative spirit. One may wonder what makes the need for innovation different in the present day context (Chesbrough H, 2011). Business

world is in the middle of significant transition. Three factors are playing important role in the present transition period. The three factors are information technology, the expanding world, and demanding customers.

Need for Clear Focus

The important aspect that is required in an enterprise is the type of innovation it wants to pursue (Dastur P A, Sawant S & Bawa B, 2012). There will be conflicting views among the executives in enterprises. Many times ideas suggested by the employees are not encouraged for fear of the unknown once they are presented. Enterprises generally support very small impact of efficiency innovation. It is very important at the beginning of any project to discuss the type of innovation the enterprise is expecting. Decision has to be taken in light of the available resources such as the core competencies and culture of the enterprise. Innovation momentum for an enterprise is like a snow ball. Snow ball gains in size and power as it rolls down the hills. Similarly an enterprise gains power as more and more employees adopt an innovative attitude and succeed in finding distinctly new and better ideas.

Enterprises cannot afford to depend on one person or one department to focus on the future. They need to have every employee in every area of an enterprise to be on the lookout of innovative ideas. It is the tendency of the employees to continue old and comfortable way of doing things. Sometimes it is a tough proposition for the employees to drop their emotional attachment to the way they are presently working. Enterprises need an innovation road map and detailed action plans. Innovation road map is required to enable enterprises in the creation of innovation centric organization. Innovation road map should address knowledge and skills of employees for innovation environment of an enterprise (Dyer J, Halgregeresen, & Christensen C M, 2011).

Knowledge Harvesting

The concept of knowledge harvesting is the key element in an open innovation. Knowledge harvesting is an integrated set of processes that allow the often hidden insight of human expertise in business enterprises to be captured. Then it is converted into a specific actionable know-how that can be transferred to others. The actionable know-how will be stored in an information system which will help thereby to create organizational value and enhance in decision making processes, record facts about critical decisions. Further it will facilitate to create meta knowledge about actual working adapted to changes (Lester R K, & Piore M J, 2010).

The word “Harvesting” generally applies to agriculture. It refers to the practice of increasing the yield of cultivable land. In the same way organizational databases are considered as equivalent to cultivable land. In the context of organizational environment, the employees “Wisdom” can be considered as “Manure”.

The employees’ wisdom will help the data in the system to be converted into useable information.

Case Illustration-1

3G textile mill is one of the leading textile mills in India. This textile mill has been in the business over five decades. The unique aspect of this mill is that is being managed by a management consisting of president, senior president, and vice president who belong to three different generations. Their approach and decisions are based on their experiences, business insight and education. All the three in the top management team keep updating themselves new technologies in their textile business besides keeping

them aware of new trends in information technology and market trends. They are assisted by a team of executives who have rich experience in the respective field of textile industry.

3G textile mill has been manufacturing cloth material for western and eastern counties' ladies requirements. They also manufacture shirting, and suiting materials besides producing readymade garments for men and women. They enjoyed major global market share for their products till the globalization policy followed by many countries. It is because of changing scenario in the global market, their market share is affected. Consequently their profits have been fluctuating. The top management along with their team of executives have analyzed that they have cost advantage over their competitors. They have edge over in the process technology and size of business enterprise. They have come to the conclusion, after the analysis that their weak link is in the fashion technology. They hired the services of domain experts in the field of textiles who are familiar with the tastes of people in European and Eastern counties. They expected that their guidance will help them to improve their global market share. The domain experts have their offices in Paris and Singapore.

Cloth Material

Cloth material is designed by the domain experts from their experience based on the needs of the consumer requirements such as color combination of dyes with the cotton mix. The domain experts have made use of the virtual reality concept in designing the cloth material according to the latest trends in the European and Eastern countries.

Readymade Garments

The domain experts have taken into consideration the latest trends in the fashion in the European and Eastern Countries. The domain experts designed and created garments on the basis of real world requirements of the two countries (Gallo C, 2012). Simulated versions of readymade garments are carried out in the computer systems under the cloud computing environment. The concept of virtual reality helped them to look from the real world situation. Resources in cloud computing environment have made it possible for the domain experts to create designs for the requirements of 3G textile mill.

Management Team of 3G Textile Mill

The management team along with their technical executives in India is able to view the design of cloth material and design of readymade garments on their system. They have suggested the changes wherever they felt they are required.

Social Media and 3G Textile Mill

The management team at 3G Textile Mill has realized that the market place is about brands and consumers speaking to each other. Further brands have been losing control over the kind of conversation that is taking place about the brand. The internet has moved the control of brands into consumers' hands and that is posing new challenges for brand owners. It has become a necessity for brand owners either need to have more people speaking positively about the brands or have fewer people speaking negatively. Social media plays a crucial role in both the cases. They have realized the need for exclusive social media sites for business activities.

Marketing Wing

The management team has felt that the concept of social media is to be made use of for their business. A sample cloth material and garments have been designed by the domain experts with their experience, knowledge and also with the inputs from the executives of the 3G Textiles. The concepts of virtual reality and multimedia are applied in creating a material with the different combination of colors. While designing the cloth material, the types of dyes available in the market are also kept in mind.

The marketing department of the mills has created an exclusive social media channel for the prospective customers to express their opinions of the proposed design of a cloth material and garments. The proposed design of their products is uploaded in the site. Vendors of dyes have been informed to visit the social media site to get an idea the types of dyes are to be supplied once the proposed design is finalized.

Interactions with the prospective customers on the social media site have facilitated them to understand their needs and tastes. This has helped the mills to design a cloth material and garments from the data and information from the social media site created exclusively by the marketing department (Chang W, & Taylor S A, 2016).

. This Case Illustration gives an overview of the approach followed by the textile mill to design a cloth material for ladies making use of the concepts such as virtual reality and multimedia. The feedback from the prospective customers on the social media channel facilitated them to finalize the design of the cloth for production. Further vendors who supply dyes and raw cotton are able to get the required information for supplying the materials as per the requirements of a new design. Customers' tastes are becoming more homogeneous around the globe. The feedback on social media channel facilitates to innovative approach (Chiporni D, Chiesa V, & Frattini F, 2011).

Innovative Approach

It is clear from 3G textile mill's innovative approach that new products can be designed and developed by the domain experts who are away from the Indian soil. This is because the domain experts' involvement of the process of continuous exchange of ideas among the members of virtual team dispersed across the globe. This process helps in generating alternative ideas by taking inputs from different sources and structuring through virtual reality applications. This model provides an idea for the creation of global innovative approach. It facilitates to structure the work flow by visualizing the various phases of the development of a product.

In today's knowledge rich environment, 3G textile mill has proved that enterprises can no longer afford to rely entirely on their ideas to advance their business. It may be noted that they have not restricted their innovative approach to a single path market. As a result the traditional model of innovation which has been largely internally focused or a "Closed One" has become obsolete. Emerging in its place is a new paradigm "open Innovation". This strategically leverages internal and external sources of ideas and takes them to market through multiple paths. Global enterprises can take advantage of unique knowledge and resources wherever they are located. Information and communication technology has created virtualization in activities and ways of working. The approach of 3G textile mill explains in adopting innovative approach. Further it applies the concept of "Mind Invoking" (Govindarajan, & Christrimble, 2011).

Approach in Case Illustration-1

3G textiles felt for the need for innovation. They have a clear focus in their innovative approach. They have applied revolutionary innovation method in designing and developing a product. They have involved their executives along with the domain experts in the innovative approach followed by them. They have made use of the concepts such as virtual reality, cloud computing and knowledge harvesting in their product designs. It is interesting to note that the management team consists of three different generation people. They are ready to adopt innovative approach to face the challenges in the present globalization scenario. It is apt to note the observations of Linda A H, Greg B, Emily T, & Kent L, (2014) in their book that though each of our leaders and their firms differed in key ways all leaders paid particular attention to making sure their organizations were able to collaborate, engage in discovery driven learning, and make integrative decisions. In the case of 3G Textiles the top management team, executives in their organizations, domain experts, vendors, and the prospective customers worked as a team to apply revolutionary innovation approach (Gupta P, 2009).

Case Illustration -2

Consumable products such as tooth brushes, tooth pastes, shaving brushes, and shaving creams are being manufactured by different small scale units in South India. Their products are more competitive in the rural market in South India. It is because of pricing and the features of the products are produced basically to the local needs of the people. Each unit supplies to various distributors for marketing their products. These manufacturers feel that their distributors give more importance to the reputed brands of similar products. Direct marketing to the retailers is not financially feasible to them.

Small scale manufacturing unit owners are members in a local social club. They know each other member in the club. They meet and have formal talk among themselves. They never discuss about their business. A member of the club asked the tooth brush manufacturer why his products are not available in the market. To avoid the endorsement he said that he would find out from his office. The manufacturers of the other consumable products who overheard the conversation of the tooth brush manufacturer with his friend felt that they too have similar issue. One of the small scale unit manufacturers has taken an initiative to call for an informal meeting to discuss about the issues pertaining to their products distribution.

During the informal meeting they discussed about their products and channels of distribution. Hiring a consultant to assess the market potential for their products and alternative method of distribution of their products is not financially feasible. They have realized that they do not have a database of the markets and related information about the competitor's products.

They have decided to form as a team and work together for their products. They are not competitive to each other product. Their products can be termed as family consumer products. They have decided to form as a team and work together for their products.

The team formed by them is given the responsibility of creating a database maintaining and updating it. All the units have agreed to share the cost of information and communication technology infrastructure. Their data base will contain the details of all distributors' network channels in the rural areas in South India. The team is able to collect the other competitor's product details. Their competitor's products are classified as two groups. One group is known as reputed brands and other one as less well known brands. The database will contain the details such as pricing, packing, discounts, credit limits offered by their competitors. They have decided to meet weekly once to review the progress and frame market strategy for their products. Their database will contain all the views, ideas, discussions, and decisions

at their weekly meetings. They have identified a common distributor for marketing their products. At frequent intervals by rotation each team member should visit the retailers and distributors for all their products. This approach will help them in the reduction in the marketing expenditure. Sales reports are to be updated in the common data base maintained by the team. All the units will come to know the movement of their products.

After understanding the importance of the common data base, it has been decided to change the name of the database as knowledge harvesting system for family consumer products. The team has expressed that their knowledge harvesting system will provide an opportunity for an open innovative initiative thinking.

Open Innovative Marketing Initiative

Frequent updating of information into the knowledge harvesting system has made the team members to browse the system. Their browsing the system has enabled them to analyze the data from the business and marketing perspective. They felt they have the required knowledge to innovate new ways of marketing.

They have come to know that the tooth brush for children is not manufactured by the tooth brush manufacturer. There is a good potential for this segment. Tooth paste and shaving creams are not available in an economy package. Production of the above products does not need any additional investment. The present infrastructure can be made use for the above production.

They have introduced a scheme offering their products together. Their offer such as one tooth brush is free for every purchase of a shaving brush. They have family pack containing all their products useful to a family. They have also other schemes of offering with the combination of different products. They have organized special road shows for their products in the rural parts of South India. The joint efforts of the small scale units helped them to increase their sales. After seeing the success of their innovative marketing approach has given them confidence to start joint venture among them for the production of the other related consumable products.

They have decided to use the unutilized floor space in their units for the joint venture of their business. Their units are located in the close proximity to each other unit. Different stages of production can be carried out in their units. They have already established the distributional channel of their existing products. It has become easy to make use of the existing market channels for their new products. Open innovative marketing initiative has led them to venture into the new business areas related their product group.

Approach in Case Illustration-2

A casual meeting at social club has paved a way for forming a business team. Exchange of views relating to their business issues has helped them to create a common knowledge harvesting system for their marketing issues. This system facilitated them to think in open innovative way for marketing their products jointly. The open innovative approach has given them an opportunity to get into new business ventures.

Case Illustration-3

An automobile manufacturer in India initially was manufacturing all the components required for the production of their cars. Due to the growth of their business and industrial activities, the demand for passenger cars has been increasing. The management of the automobile manufacturer has decided some

of the components required for their cars are to be outsourced. The automobile manufacturer has identified the small scale units who have the required infrastructure and technical knowledge to manufacture the components as per their specification for their cars. The small scale units have agreed to produce the components provided they are assured by the automobile manufacturer that later would provide the procurement schedule and delivery dates. Further the small scale units have to send delivery receipts along with the components sent to the automobile manufacturer. An invoice for the supplies made during a calendar month would be sent to the automobile manufacturer on the first day of the succeeding month for the payment. The procedure at the automobile manufacturer is to receive the components as per the delivery receipts and recorded in the materials inward register. The components will be tested for the quality by the quality inspection department. The components approved by the quality inspection department are taken into the stock. The rejected components with the rejection slips are given to the suppliers at the end of the month. Due to various components received from the different suppliers, the quality inspection department use to take their time for quality inspection and deciding about the approved quantity

Most of the small scale units are solely dependent on the automobile unit for the payments towards their supplies made to them. The automobile manufacturer pays for the components approved by their quality inspection department. Small scale units would find in very difficult to manage their finance. It is because the amounts received by them less than their invoice amount. This has resulted in some small scale units finding it extremely difficult to maintain their production schedule. Consequent to this the automobile manufacturer's production is affected. There used to be frequent meetings between the purchase department of the automobile manufacturer and the owners of the small scale units. There has not been any meaningful outcome from these meetings.

Solution to the Above Case Illustration

A group of executives from the departments of purchase, production, quality inspection and finance at the automobile manufacturer formed as a core team to study and find a solution for receiving the components as per their standard. Further they wanted to find a way that the small scale units would not struggle for the flow of money for their business.

They have discussed among themselves the various aspects related to the issue. After a lot of deliberations they have decided to change the procedure followed by them in their company. They have agreed to create a separate group in the quality inspection department to test the quality of the components received from the small scale units. They need to send the accepted quantity information through e-mail to the concerned small scale unit. The small scale unit could raise an invoice for the accepted quantity on the basis of the e-mail advice. The quality inspection department would send a goods accepted note to the finance department. This will be in a printed form. The idea behind a printed form is to help the finance department for relating with the copy of invoice received by them. In this process the small scale units have an option either to rectify the rejected components or to produce the additional components. This procedure has solved the issue of the small scale units. Further it has helped the automobile manufacturer to solve the bottle necks in their production schedule.

OBSERVATION

The deliberations among the stake holders of the automobile manufacturer have resulted in acceptable and working solution to the both parties. The automobile manufacturer is able to maintain their production schedule. Small scale units have also succeeded in managing their finance and also improved their quality procedures.

Generally executives in any organization confined themselves to their functional activities. Experience leads many executives to think within their functional boundaries. The core group at the automobile a manufacturer unit started thinking “Outside the Box” and forgot their functional boundaries. The core group has been triggered to rethink the way they followed the procedure in their company. This has helped them to come up within new ideas. The purpose of open innovation is to find break through solutions to the process issues.

Important Observation

The above three case illustrations facilitate executives in business enterprises to understand the importance of knowledge harvesting and open innovation initiatives in the present business scenario.

Future Trends

The future of open innovation is very bright. Adopting new methods and designing products or services will ultimately be overtaken by an open innovative approach. A new approach developed through open innovation initiative can be referred as designing or developing a new approach (DNA). DNA leads to form new strategies by enterprises for making open innovation effective in the modern business (Dwiedi, 2016).

CONCLUSION

The boundaries of the business are no longer clear. Expansion is happening in multiple new areas simultaneously. This expansion is leading to uncertainty in business, new threats from unexpected quarters and new competitions (Christensen C M, Bartman T, & Vanbeer D, 2016 September).

Effectiveness of open innovation comes from selecting specific open innovation project. There should be a clear understanding of what an enterprise wants to achieve in business and which opportunity the enterprise wishes to pursue (Rangaraju & Kennedy, 2013). Turning out lots of innovative ideas and products without a vision saps precious resources. Opportunities for enterprises come from recognizing and solving business issues that no one else has identified. But opportunities themselves are getting harder to spot and more complex to understand and exploit. There is no definite statement of the problem. Each solution reveals new aspects of the problem. Knowledge is more than book learning. But knowledge solely in a specific discipline is insufficient to bring an idea to the market place. Knowledge from many disciplines will be required. The innovator need not be a master of all things. The innovator needs to be totally aware of the knowledge associated with purposeful and effective in open innovation approach. Organizations have different priorities in developing business models under open innovation initiative. The approaches by enterprises will vary. All the management concepts when closely observed one can find open innovation element is hidden in the concept. It may be noted that every concept begins with an idea.

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KEY TERMS AND DEFINITIONS

Core Team: A team consists of domain experts to perform multiple disciplinary activities.

Globalization: The process by which business starts operating on a global scale.

Innovation: This deals with bringing in new methods and ideas resulting in required changes in an enterprise.

Invention: Innovation means designing and creating something has never been made before.

Knowledge Harvesting: Knowledge harvesting is an integrated set of processes that allow the often-hidden insight of human expertise to be captured. Then it is converted into a specific actionable know-how that can be transferred to others.

Social Media: Social media use web technology to quickly disseminate knowledge and information to huge number of users. Face book, Twitter, Blog, and other similar social networking site are collectively referred to social media.

Virtual Reality: A system in which images that look like real three-dimensional objects are created by a computer system.

Information Overload

11

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INTRODUCTION

Even though the complex phenomenon of information overload (IO) often remains unrecognized (Badke, 2010) and is qualified to be a modern-day myth (Tidline, 1999), it is a major impediment to efficiently using information in the business world, academia and the professions both in the case of print and online (digital) documents, IO is one of the perhaps best known ‘information pathologies’ (Bawden & Robinson, 2009), thus it signalizes the existence of a dark side of information. Nonetheless, the technological and social approaches to mitigating its syndromes, i.e. the ‘bright side’ of information is also worth of attention (Koltay, 2017). This encyclopedia entry will examine both sides by describing the history, the diversity of concepts, types and sources of the multifaceted phenomenon of information overload and the ways of coping with it.

BACKGROUND: THE CONCEPT OF INFORMATION OVERLOAD

Information overload can be defined as a state in which not all inputs can be processed and utilized for varied reasons (Nelson, 1994). In other words, it occurs when potentially useful information received by someone becomes a hindrance (Bawden & Robinson, 2009), be it persons or organizations (Jackson & Farzaneh, 2012). Appearing in academia, the business word and everyday life, it affects both individuals and systems (Nelson, 1994). Information overload situations appear in activities, related to information retrieval and the organization of information, in decision and communication processes (Eppler & Mengis, 2004).

The main factors of IO are the following ones:

- The volume of information supply (the quantity of information);
- Information processing capacity;
- Information-processing requirements;
- Time requirements for processing information (available versus invested time);
- Subjective (personal) factors.

Some definitions also mention dysfunctional consequences of being overloaded that may be qualified as symptoms (effects), which are mainly related to the loss of control over information, frequently leading to suboptimal decisions, and higher time requirements for information handling, causing time delays (Eppler & Mengis, 2004). It is also associated with the feeling of being overwhelmed. In some cases, these effects can lead to a loss of job satisfaction and even damages to personal relationships or someone’s own health (Bawden & Robinson, 2009). Results of an empirical examination show that the perception of IO exist among varied age groups (Benselin & Ragsdell, 2016).

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However, though paradoxically, information overload can provide satisfaction, because mastering it gives to many people the feeling that they are in control of something (David Johnson, 2014).

THE HISTORY OF INFORMATION OVERLOAD

While complaints about an overabundance of books date back at least as far as the sixteenth century, Ecclesiastes, one of books of the Tanakh (Hebrew Bible) originally written c. 450-180 BCE, might be the first writing to comment on the “proliferation of information as a detriment to effectiveness and efficiency” (Bawden & Robinson, 2009, p. 183).

George Simmel, a turn-of-the-century sociologist has been identified as the first commentator, who recognized the concept in its modern sense (Wurman, 2001). About the first writers mentioning information overload, there are contradictory opinions, whether it was Richard L. Meier, an American urban scholar in 1962, or the social scientist Bertram M. Gross (also from the United States) in 1964. In any case, the concept itself became a generally accepted problem in the late 1950s and early 1960s (Bawden & Robinson, 2009). In the 1970s and 1980s the focus was on IO related to the quantity of journal articles and consumer choice. Later attention shifted to email overload. Attention to IO has increased with the appearance of the Internet and World Wide Web, then with wiki systems, weblogs and mobile communications (Benselin & Ragsdell, 2016).

THE TYPES AND NATURE OF INFORMATION OVERLOAD

We can experience information overload

- in academia, impacting researchers, faculty and students;
- in business environments, impacting decision makers and other employees, as well as customers;
- in everyday life, impacting the general public (Butcher, 1998).

We can differentiate between objective and subjective IO, where the former is based on the characteristics of information, such as its amount and complexity that influence processing time. Subjective IO refers to feelings that individuals have, when confronted with information (Ji, Ha, & Sypher, 2014).

It is also necessary to tell apart the macro level of IO from its micro level. The macro level is of quantitative nature, i.e. is related to the limits of physical storage and processing capacities that present an obstacle to information access. IO at the micro level mainly depends not on the quantity of information, but is determined by its characteristics is a qualitative phenomenon. This kind of overload is essentially a failure to filter information, (Davis, 2011). Due to its qualitative nature, it also can be termed *cognitive*, *sensory*, *communication*, or *knowledge* overload (Eppler & Mengis, 2004). Some of these will appear in this encyclopedia entry in order to illustrate the diverse approaches to IO. Diversity and novelty also characterizes *data overload* that appeared in answer to the growing interest in different kinds of data and their importance, reflecting the excess of data and the similarity between data and information.

If speaking about information overload (including data overload) as an issue for professionals, we can see that it concerns varied fields. A review of literature, using the Web of Science database for the period from 1990 to 2017 found 2,469 publications on IO. The leading subject area of these publications was computer science with 56%, while the literature in engineering produced 20.5%. Other areas

present were (in descending order) business economics, information science and library science, and telecommunications (Virkus, Mandre, & Pals, 2018).

THE SOURCES OF INFORMATION OVERLOAD

The concept of information overload is associated with the notion of excess, but this is not a sufficient condition for being overloaded. Therefore, overload should be seen in comparison to some norms, which regulate what is an appropriate amount of information and which piece of information is undesirable (Himma, 2007).

Several earlier studies attributed IO to the prevalence of e-mail messages. Even a recent survey and interview study sixty one percent of 82 students from Tallinn University felt that they checked their e-mails or mobile phone messages too frequently (Virkus, Mandre, & Pals, 2018).

A case study of five organizations from the hotel industry within the hospitality sector shows that employees struggle with the excessive amount of information and data, especially in the context of digital data. Feeling overwhelmed is particularly salient if the data available is unstructured and available through third-party Internet platforms (Saxena & Lamest, 2018).

While the effect of excessive information quantity, predominately called TMI (Too Much Information) is real and undeniable, it is not the only cause of IO (Bawden & Robinson, 2009). Moreover, Neylon (2011) underlines that in an information-driven society we simply cannot have too much information. This means that besides TMI, we can name a mix of varied causes that may contribute to IO. Some of these ones are innate qualities of the information to be processed, or determined by the given task or process (that also define information processing requirements) (Eppler & Mengis, 2004).

It also makes a considerable difference if we request the given piece of information ('pull') or it was provided without being asked for ('push') (Jackson & Farzaneh, 2012). Even though search engines usually present a selection of information that is overwhelming, they do it only at the users' desire (Benselin & Ragsdell, 2016). This means that – despite of the quantity of information – it makes a difference, when information does not arrive constantly without being under the user's control (Bawden & Robinson, 2009).

A growing complexity, materializing in diverse and abundant information choices in almost all fields (Morville, 2005) is also a source of IO. The variety of networked information comes among others from a greater diversity of formats and types available, while it is delivered through a limited number of interfaces (Bawden & Robinson, 2009). Equivocality, i.e. the existence of multiple valid interpretations and variety (Bettis-Outland, 2012) and tendency to change quickly and in an unpredictable way, i.e. the volatility of information, i.e. (Davis, 2012b) also must be mentioned as sources of IO. The novelty, complexity, ambiguity and uncertainty of information, its debatable usefulness, questionable relevance or validity also may increase IO (Jackson & Farzaneh, 2012).

Besides the nature and quality of information, the cognitive style, attitudes, qualifications, and experience of information users play substantial role. They comprise not only people's capacity to process information, but refer to limited skills, or lack of motivation (Eppler & Mengis, 2004).

Information processing requirements may largely contradict to the person's processing capacity and time available negatively influence performance. Interruptions in processing and the need for multi-tasking further aggravate the situation (Jackson & Farzaneh, 2012).

The occurrence of IO can also be related to the organizational design of a company, the changes that create the need for more intensive communication and coordination, even though better organization and coordination may diminish overload. As to the influence of the tasks and processes, it can be said that

they exert more pressure on the individual if they go beyond recurring routines and when various tasks must be managed in a parallel way (Eppler & Mengis, 2004). Most of the above factors are coupled with people's general inefficiency in performing a given task (Davis, 2012a).

By its increasing complexity, the constantly evolving information landscape requires the application of *metacognitive strategies* (Walton, Pickard, & Dodd, 2018).

Metacognitive strategies are used to monitor or control our cognition and selecting the most appropriate cognitive strategy for the task we are undertaking (Quigley, Muijs, & Stringer, 2018). In a broad sense, metacognition is thinking about thinking. It can be divided into metacognitive knowledge, which is our understanding of cognition; metacognitive monitoring that takes, when we evaluate the current state of our cognition, and metacognitive control, meaning the adjustment of our cognition to the actual needs (Devers, Devers, & Oke, 2018). As demonstrated by Sannomiya and Ohtani (2015), cognitive overload inhibits metacognitive activities, though impairment is selective. Research on individual's use of metacognitive strategies during information searching underscores that planning, monitoring, and evaluating skills is of high value, because it improves search outcomes, thereby reducing the occurrence of irrelevant materials (Blummer & Kenton, 2014).

The prevalence of smartphones, social media, and online shopping induced new areas of information overload. In the present day information environment, in particular in the case of social media, the problem of quantity is aggravated by the lack of incentives to remove outdated, unused or forgotten information from the net (Brown, 2010). An example of heavy use of social media services that can be identified as source of IO can be found in responses of the Tallinn University study (Virkus, Mandre, & Pals, 2018).

The users of social media services feel boredom and fatigue as they become overwhelmed by the excessive number of sites, contacts and content (Bright, Kleiser, & Grau, 2015). One of the main reasons for this is that users cannot control their use of social media sites, due to the quick pace of information exchange (Benselin & Ragsdell, 2016) and the "always connected" communication environment (Lee, Son, & Kim, 2016). These circumstances explain, why we can say that information overload is one of the main antecedents of the social network fatigue syndrome (Shokouyar, Siadat, & Razavi, 2018). Therefore, it is not by accident that IO also can be termed *information fatigue* (Virkus, Mandre, & Pals, 2018).

In the case of online shopping, consumers experience information overload, when:

- Information, provided by online vendors is characterized by complexity and ambiguity;
- Vendors provide a number of brand alternatives;
- Consumers perceive system interface issues, related to the number of advertisements, software upgrade, requests, complex procedures, security concerns or slow access (Li, 2017).

Mobile information overload, having the basically the same causes that were described by earlier general research on information overload, is a prevalent phenomenon among smartphone users, involving distraction and impatience, induced by the TMI feeling. On the other hand, the limitations of the phones, such as uncomfortable inputting methods and small screen sizes, can also be disturbing even if relatively small amounts of information have to be processed (Feng & Agosto, 2017).

SOLUTIONS AND RECOMMENDATIONS: COPING WITH INFORMATION OVERLOAD

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There are not only pro, but contra arguments for applying coping strategies, because we may say that our senses can not only handle a huge amount of input but enable the identification of significant patterns within it. On the other hand, we are ill-equipped to deal with the information delivered in the present-day information environment in multiple and complex forms (Bawden & Robinson, 2009).

Despite doubts, people usually are not passive when confronting IO (Eppler & Mengis, 2004), because they assume that being overloaded by information is not acceptable, neither on the individual, nor on the societal level. As a result, providers and consumers of information can apply various information management strategies to reduce information overload. This means that if IO can be positioned as a phenomenon on the dark side, while mitigating it can be qualified as an action to look on the bright side (Koltay, 2017).

Seen from a different angle, some of the strategies, applied in order to reduce IO are of technological nature, while others tackle social issues. Notwithstanding, in many cases they represent the two sides of the same coin. In this regard, it is also often discussed, whether technology is a main cause or a solution to IO. In most cases the conclusion is that it is not technology itself that causes IO but its use or misuse is responsible for it, therefore technologies are not efficient if users do not have adequate skills necessary for their use (Benselin & Ragsdell, 2016).

Technological solutions are mainly based on the idea that information overload is a result of a failure to create high quality information (Simpson & Prusak, 1995). Therefore, improving the quality of information via the proper presentation of information, materializing in its organization, selection, and format play key role in reducing IO (Jackson & Farzaneh, 2012, Blummer & Kenton, 2014). The reason for this is that the level of information processing capacity of the individual may increase, if we can improve the conciseness, consistency and comprehensibility of information on the input side of informing (Eppler & Mengis, 2004).

Among technological approaches that point to this direction, information architecture (IA) may play a distinguished role, as its main responsibility is designing, implementing and evaluating acceptable and usable information spaces (Dillon, 2002). IA is not only about surface architecture that concentrates on design issues, i.e. how information is presented and how users interact with the information system, but must be interested in content and in gaining deep understanding of information users (Brown, 2010).

For instance, slimming down website structures by removing obsolete links can not only enhance usability, but has the potential to reduce IO (Chen, 2018). Many problems, related to smartphones' limitations, mentioned above also can be solved by applying the tools of information architecture. While this is true, unfortunately, information architecture's power is generally limited, because information architects can discover IO only retrospectively and through indirect means (Davis, 2012a).

In contrast to technological solutions, social approaches offer a much broader repertoire of answers. This is especially true for the micro level of IO, propagated by people and caused by the lack of adequate filters to information or failure to apply them properly (Davis, 2011).

Most social approaches to combating IO are based on the belief that it can be mitigated by offering appropriate education, based on the critical assessment of information. Such assessment applies critical thinking, the backbone of which is the processes of analyzing, synthesizing, and evaluating information, necessary to understand and acquire knowledge (Radcliff & Wong, 2015). Reading information and assessing it critically should be applied both to information consumption and production. This requires

innovative thinking and problem solving, as well as self-management and cross-cultural interaction skills (Lee, 2013).

Pragmatic frameworks for such activities are offered by varied literacies. When speaking about them, it would be a legitimate concern to decide if there is a one-and only literacy that stands out from the multitude of new literacies, such as information literacy, data literacy, media literacy, and digital literacy. However, their development has shown different trajectories, characterized by the proliferation of concepts in this area, coupled to their complexity and change (Bawden, 2014).

The most widely known new literacy concept is *information literacy* that can be defined as the ability to think critically and make balanced judgements about any information we find and use (CILIP, 2018). This state-of-the-art understanding of the concept concerns all kinds of media.

We must refrain from explaining the similarities and differences between different literacies, except in the case of a relatively new type of literacy, i.e. *data literacy*. While in some cases appearing under different names, such as *data information literacy*, *science data literacy*, and *research data literacy*, data literacy has several close ties to information literacy. It can be defined as a set of skills and abilities related to accessing, understanding, interpreting, managing, critically evaluating and ethically using data (Koltay, 2015a).

Although not named ‘literacy’ or ‘critical approach’, managers’ behavior, found by Saxena and Lamest (2018) exemplifies possible coping strategies as it includes being selective about data sources, focusing more on qualitative data and engaging in summarizing unstructured data. This example is one of the numerous social approaches to mitigating IO that “revolve around the principle of taking control of one’s information environment” (Bawden & Robinson, 2009, p. 187). This feature is markedly present in the approach that underlines the importance of time management, because time constraints may profoundly obstruct decision making, especially if critical decisions have to be made (Hargittai, Neuman, & Curry, 2012).

Although seen from a slightly different angle, practicing slow information behavior is also connected to time. It means slowing down the pace of looking for information and consuming it. Such behavior is not only useful, but also shows characteristics of being critical against information. Slow information behavior is based on Slow Principles, exercised in many areas of life, originating in the Slow Movement. While not identical with doing something less rapidly but concerned with a carefully weighed way and a reflective attitude, as well as with judging the right speed for our behavior, this behavior is based on the belief that the present pace of information intake reduces our chances to make choices about what to consume (Poirier & Robinson, 2014).

From among the different approaches to mitigating IO, information architecture concentrates on the relationship between relatively well-defined actors, i.e. architects and their target audience, literacies operate on a more collective, societal level; applying slow principles pertains to a personal level, where the creator is less visible. No less is this true, for Personal Information Management (PIM), where the role and activities of individuals are emphasized. Focusing on the control of someone’s own environment, these individuals manage information, which is in their own possession.

Personal information management (PIM) is an activity in which an individual stores personal information items in order to retrieve them later (Bergman, 2013).

This fulfill this functions, mentioned in the above definition, PIM has to enable storing information, organizing and retrieving it using analogue and digital tools, usually by applying someone’s own, personal scheme and/or system. By origin, personal information items can be either public, or produced by people themselves, while both types can be present in the PIM environment of the same person (Jones & Maier, 2003).

Gathering personal information is accompanied by decisions to keep or discard a given piece of information. If it is judged to be useful, decisions need to be made in what format (print, electronic, or both) to keep it, where to keep it, how to structure or classify it, not forgetting about considering its relationship to other items. Positive decisions are followed by creating or organizing some sort of personal information space, where recognition and enabling retrieval should be cared for. In the case of researchers, PIM gains special weight, because most researchers ‘own’ more objects than they can remember (Bruce, Jones, & Dumais, 2004).

Keeping and discarding information, based on its critical assessment may be directed to cure the symptoms of IO.

PIM concerns both analog and digital forms of information. The analog form of PIM is still used, as people continue to take notes on paper in ordered form, usually on index cards. In the digital environment, there are other tools for organizing information. Retrieving information is possible by searching someone’s computer desktop, but in many cases it is difficult to find what someone is looking for, if it is not known or it is not a remembered object (Marshall, Bly, & Brun-Cottan, 2007). Varied citation management software products (e.g. EndNote, RefWorks or Zotero) also can be used for managing personal collections.

FURTHER RESEARCH DIRECTIONS

Since the first use of the term ‘information overload’ in the 1960s (Levy, 2008) up until the present day, neither definitions of the concept nor its effects have substantially changed. On the other hand, its causes have diversified over time with the advancement of technology. Fortunately, approaches to alleviating its symptoms also are developing constantly. This is especially true for literacies in general and for data literacy, in particular. Therefore, their development may open new ways to finding solutions to the problems of information overload, thus requires further examination.

Another objective of future research can be the investigation, directed towards understanding the relationship between multitasking and information overload (D’Arcy, Gupta, Tarafdar, & Turel, 2014).

In the areas, affected by IO, there is a considerable hype about Big Data. By its excessive volume, velocity and variety (De Mauro, Greco & Grimaldi, 2016), it may cause IO. Nonetheless, there seems to be no explicit discussion of its impact. One of the reasons for this lack can be that the Big Data phenomenon is often described in popular terms, without properly examining the complexity and expertise required for its analysis and interpretation (Borgman, 2012). Therefore, examining this aspect of IO also can be a new research direction.

CONCLUSION

Information overload remains an immense, global problem that requires solutions to reduce its effects. On the other hand, sources and frequency of IO, as well as some of the technological and social approaches, designed to reduce IO or alleviate its symptoms are present and they are evolving. From these approaches, IA activities and efforts, directed towards achieving findability serve the user, but usually are not performed by the user, will remain with us. Literacies, in contrast are a property of the individual but are based on societal qualities, will continue to offer a wide specter of solutions. Neither will not

lose its importance Personal Information Management, which is one of the conceivably most widespread approach to ease the burden of information overload.

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KEY TERMS AND DEFINITIONS

Critical Assessment: A critical approach towards information that comprises critical thinking about information and critical reading of it.

Data Literacy: A set of skills and abilities based on information literacy, designed to assess critically and handle all kinds of data, but focusing on research data.

Information Architecture: Concentrates on helping information users in effectively fulfilling their information needs by creating ways that make content findable and usable.

Information Literacy: A set of skills and abilities that concerns all kinds of media and enables recognizing information need, finding the needed information, critically evaluating and using it for different purposes.

Information Overload: A set of subjective and objective difficulties, mainly originating in the amount and complexity of information available and people's inability to handle such situations.

Personal Information Management: A set of skills, coupled with analogue and digital tools, applicable for collecting and maintaining a personal collection of documents, produced either by the given person or acquired from other sources.

Slow Information Behavior: A reflective and critical way of choosing the appropriate speed of consuming and producing information.

Big Data Analytics and Mining for Knowledge Discovery

11

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INTRODUCTION

Progresses in information science and technology have enabled the collection and generation of huge volumes of valuable data—such as streams of banking, financial, marketing, organizational, and transactional data—at a high velocity from a wide variety of rich data source in various real-life business, engineering, education, healthcare, hospitality and tourism, scientific, as well as social applications and services in government, organizations and society. These *big data* (Madden, 2012; Leung, 2015; Bellatreche et al., 2019) may be of different levels of veracities (e.g., precise data, imprecise and uncertain data) and/or of a variety of types or formats (e.g., structured data in relational databases; semi-structured data in extensible markup language (XML) or JavaScript object notation (JSON) format stored in document-oriented or graph databases; unstructured data in images, audios and videos). Embedded in the big data is implicit, previously unknown, and potentially useful information and knowledge. However, the big data come with volumes beyond the ability of commonly-used software to capture, manage, and process within a tolerable elapsed time. Hence, new forms of information science and technology—such as *big data analytics and mining for knowledge discovery*—are needed to process and analyze the big data so to as enable the enhanced decision making, insight, and process optimization. For instance, the discovery of organizational knowledge (e.g., common customer complaints, main causes of employee turnover, sets of popular merchandise items in shopping carts)—via techniques like big data analysis, statistics, and business analytics—helps reveal important patterns about an organization. This organizational knowledge helps executive and management teams of the organization to get a better understanding of the organization so that they could make better use of human resources and technology, focus more on education and growth, keep customers top of mind, and further improve quality of services and products. To a further extent, the discovery of organizational knowledge and its subsequent actions help the organization to meet goals, gain competitive advantage, and ultimately ensure sustainability, organizational growth and development.

Over the past two decades, algorithms have been proposed for various big data analytics, mining and knowledge discovery—including clustering (which groups similar data together), classification (which categorizes groups of similar data), outlier detection (which identifies anomalies), and frequent pattern mining (which discovers interesting knowledge in the forms of frequently occurring sets of merchandise items or events). Many of these algorithms use the *MapReduce* model—which mines the search space with distributed or parallel computing (Shim, 2012). Among different big data analytics and mining tasks, this chapter focuses on applying the MapReduce model to big (organizational) data for the discovery of frequent patterns.

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BACKGROUND

Since the introduction of the research problem of *frequent pattern mining* (Agrawal, Imieliński, & Swami, 1993), numerous algorithms have been proposed (Hipp, Güntzer, & Nakhaeizadeh, 2000; Ullman, 2000; Ceglar & Roddick, 2006; Aggarwal, Bhuiyan, & Al Hasan, 2014; Leung et al., 2017c). Notable ones include the classical Apriori algorithm (Agrawal & Srikant, 1994) and its variants such as the Partition algorithm (Savasere, Omiecinski, & Navathe, 1995). The Apriori algorithm uses a level-wise breadth-first bottom-up approach with a candidate generate-and-test paradigm to mine frequent patterns from transactional databases of precise data. The Partition algorithm divides the databases into several partitions and applies the Apriori algorithm to each partition to obtain patterns that are locally frequent in the partition. As being locally frequent is a necessary condition for a pattern to be globally frequent, these locally frequent patterns are tested to see if they are globally frequent in the databases. To avoid the candidate generate-and-test paradigm, the tree-based FP-growth algorithm (Han, Pei, & Yin, 2000) was proposed. It uses a depth-first pattern-growth (i.e., divide-and-conquer) approach to mine frequent patterns using a tree structure that captures the contents of the databases. Specifically, the algorithm recursively extracts appropriate tree paths to form projected databases containing relevant transactions and to discover frequent patterns from these projected databases.

In various real-life business, engineering, healthcare, scientific, and social applications and services in modern organizations and society, the available data are not necessarily *precise* but *imprecise or uncertain* (Leung, 2014; Leung, MacKinnon, & Tanbeer, 2014; Cheng et al., 2019; Rahman, Ahmed, & Leung, 2019; Titarenko et al., 2019). Examples include sensor data and privacy-preserving data (Leung et al., 2018; Chen et al., 2019; Leung, Braun, & Cuzzocrea, 2019; Li & Xu, 2019). Over the past decade, several algorithms have been proposed to mine and analyze these uncertain data. The tree-based UF-growth algorithm (Leung, Mateo, & Brajczuk, 2008) is an example.

With huge volumes of big data, it is not unusual for users to have some phenomenon in mind. For example, a manager in an organization is interested in some promotional items. Hence, it would be more desirable if data mining algorithms return only those patterns containing the promotional items rather than returning all frequent patterns, out of which many may be uninteresting to the manager. It leads to *constrained mining*, in which users can express their interests by specifying constraints and the mining algorithm can reduce the computational effort by focusing on mining those patterns that are interesting to the users.

Besides the aforementioned algorithms discover frequent patterns *in serial*, there are also *parallel and distributed* frequent pattern mining algorithms (Zaki, 1999). For example, the Count Distribution algorithm (Agrawal & Shafer, 1996) is a parallelization of the Apriori algorithm. It divides transactional databases of precise data and assigns them to parallel processors. Each processor counts the frequency of patterns assigned to it and exchanges this frequency information with other processors. This counting and information exchange process is repeated for each pass/database scan.

As we are moving into the new era of big data, more efficient mining algorithms are needed because these data are wide varieties of valuable data of different veracities with volumes beyond the ability of commonly-used algorithms for mining and analyzing within a tolerable elapsed time. To handle big data, researchers proposed the use of the *MapReduce programming model*.

BIG DATA ANALYTICS AND MINING FOR FREQUENT PATTERNS

The MapReduce Programming Model

MapReduce (Dean & Ghemawat, 2004, 2010) is a high-level programming model for processing huge volumes of data. It uses parallel and distributed computing on large clusters or grids of nodes (i.e., commodity machines), which consist of a master node and multiple worker nodes. As implied by its name, MapReduce involves two key functions:

1. the “map” function, and
2. the “reduce” function.

To solve a problem using MapReduce, the master node reads and divides input big data into several partitions (sub-problems), and then assigns them to different worker nodes. Each worker node executes the *map function* on each partition (sub-problem). The map function takes a pair of $\langle \text{key}, \text{value} \rangle$ and returns a list of $\langle \text{key}, \text{value} \rangle$ pairs as an intermediate result:

- map: $\langle \text{key}_1, \text{value}_1 \rangle \mapsto \text{list of } \langle \text{key}_2, \text{value}_2 \rangle$,

where:

1. key_1 & key_2 are keys in the same or different domains, and
2. value_1 & value_2 are the corresponding values in some domains.

The pairs in the list of $\langle \text{key}, \text{value} \rangle$ pairs for this intermediate result are then shuffled and sorted. Each worker node then executes the *reduce function* on:

1. a single key from this intermediate result, and
2. the list of all values that appear with this key in the intermediate result.

The reduce function “reduces”—by combining, aggregating, summarizing, filtering, and/or transforming—the list of values associated with a given key (for all k keys) in worker nodes and returns a single (aggregated or summarized) value:

- reduce: $\langle \text{key}_2, \text{list of value}_2 \rangle \mapsto \text{a single value}_3$,

where:

1. key_2 is a key in some domains, and
2. value_2 & value_3 are the corresponding values in some domains.

Besides a single value_3 , alternative output could be a list of $\langle \text{key}_3, \text{value}_3 \rangle$ -pairs or a list of value_3 (where key_3 is a key in some domains).

By using the MapReduce model, users only need to focus on (and specify) the map and reduce functions, without worrying about implementation details for partitioning the input data, scheduling and

executing the program across multiple machines, handling machine failures, or managing inter-machine communication.

Earlier works on MapReduce mainly focused on data processing in big databases (Dean & Ghemawat, 2004, 2010) or some big data mining tasks other than frequent pattern mining. Examples of big data processing with MapReduce include the construction of inverted indexes, the evaluation of queries involving joins or selection, the elimination of duplicates, text processing tasks (Lin & Dyer, 2010; Jiang & Leung, 2015) like the word counting of documents, and the processing of data cubes (Lee & Kim, 2016). Examples of big data mining with MapReduce include classification (Arias, Gámez, & Puerta, 2017), clustering and outlier detection (Ceccarello, Pietracaprina & Pucci, 2019).

Apriori-Based MapReduce Algorithms: SPC, FPC, and DPC

To mine frequent patterns from big databases of precise data with MapReduce, Lin, Lee, & Hsueh (2012) proposed three algorithms—namely, the Single Pass Counting (SPC), Fixed Passes Combined-counting (FPC), and Dynamic Passes Combined-counting (DPC) algorithms—based on both the Apriori and the Count Distribution algorithms. SPC first divides the databases into partitions, and then executes map and reduce functions in each pass k to generate candidate k -itemsets (i.e., candidate patterns each consisting of k items) and count their support/frequency. More specifically, SPC executes the following map and reduce functions in Pass 1:

- map: $\langle \text{ID of transaction } t_j \in \text{partition } P_i, \text{ contents of } t_j \rangle \mapsto \text{list of } \langle \text{item } x \in t_j, 1 \rangle$, and
- reduce: $\langle x, \text{list of 1's} \rangle \mapsto \text{list of } \langle \text{frequent 1-itemset } \{x\}, \text{sup}(\{x\}) = \text{sum of 1's in the list for } x \rangle$.

Here, the worker node corresponding to each partition P_i of the big databases executes the map function by outputting $\langle x, 1 \rangle$ (which represents the support of candidate 1-itemset $\{x\}$ in $t_j = 1$) for every item x in transaction $t_j \in P_i$. After grouping all the 1's for each x to form $\langle x, \text{list of 1's} \rangle$, the reduce function is then executed by summing all the 1's in the list for each x to compute its support $\text{sup}(\{x\})$, and outputting $\langle \{x\}, \text{sup}(\{x\}) \rangle$ (which represents a frequent 1-itemset $\{x\}$ and its frequency) if $\text{sup}(\{x\}) \geq$ a user-specific *minsup* threshold.

In each subsequent pass $k \geq 2$, SPC generates candidate k -itemsets from frequent $(k-1)$ -itemsets. The worker node corresponding to each partition P_i then outputs $\langle X, 1 \rangle$ for every candidate k -itemset X that exists in some transaction $t_j \in P_i$. Afterwards, the reduce function sums all the 1's for each X to compute its support $\text{sup}(X)$, and output $\langle X, \text{sup}(X) \rangle$ (which represents a frequent k -itemset X and its frequency) if $\text{sup}(X) \geq \text{minsup}$. In other words, SPC executes the following map and reduce functions in Pass k (for every $k \geq 2$):

- map: $\langle \text{ID of } t_j \in P_i, \text{ contents of } t_j \rangle \mapsto \text{list of } \langle \text{candidate } k\text{-itemset } X \subseteq t_j, 1 \rangle$, and
- reduce: $\langle X, \text{list of 1's} \rangle \mapsto \text{list of } \langle \text{frequent } k\text{-itemset } X, \text{sup}(X) = \text{sum of 1's in the list for } X \rangle$.

The three algorithms (SPC, FPC and DPC) are similar except that both FPC and DPC apply the *pass bundling* technique to reduce the number of passes/database scans in each P_i when generating candidate itemsets (for Pass $k \geq 3$). For instance, FPC statistically bundles a fixed number of passes (e.g., three passes) to generate all candidate k -, $(k+1)$ -, and $(k+2)$ -itemsets from frequent $(k-1)$ -itemsets. In contrast, DPC dynamically bundles several passes (depending on the number of generated candidates in these bundled passes).

Partition-Based MapReduce Algorithm

On the one hand, the use of the pass bundling technique reduces the number of passes/database scans in each partition P_i . On the other hand, the Apriori-based SPC, FPC and DPC algorithms still require multiple passes/database scans when mining frequent patterns from big data. In contrast, the MapReduce version of the Partition algorithm—presented by Leskovec, Rajaraman, & Ullman (2020)—requires only two passes/database scans. Hence, the Partition-based MapReduce algorithm uses two sets of “map” and “reduce” functions. Specifically, the master node reads and divides big databases of precise data into partitions. The worker node corresponding to each partition P_i then outputs $\langle X, 1 \rangle$ for every candidate pattern X (of any cardinality) that exists in some transaction $t_j \in P_i$. The reduce function then sums all the 1’s for each X to find patterns that are locally frequent in P_i . Taking the union of these locally frequent patterns forms global candidate patterns. To summarize, the first set of “map” and “reduce” functions can be expressed as follows:

- map: $\langle \text{ID of transaction } t_j \in P_i, \text{ contents of } t_j \rangle \mapsto \text{list of } \langle \text{itemset } X \subseteq t_j, 1 \rangle$, and
- reduce: $\langle X, \text{list of 1's} \rangle \mapsto \text{list of } \langle \text{locally frequent itemset } X, \text{NULL} \rangle$.

Afterwards, the worker node corresponding to each partition P_i outputs $\langle X, 1 \rangle$ for every global candidate pattern X that exists in some transaction $t_j \in P_i$. Then, the reduce function sums all the 1’s for each X to compute its support $\text{sup}(X)$, and outputs $\langle X, \text{sup}(X) \rangle$ (which represents a globally frequent pattern X and its frequency) if $\text{sup}(X) \geq \text{minsup}$. To summarize, the second set of “map” and “reduce” functions can be expressed as follows:

- map: $\langle \text{ID of } t_j \in P_i, \text{ contents of } t_j \rangle \mapsto \text{list of } \langle \text{global candidate pattern } X \subseteq t_j, 1 \rangle$, and
- reduce: $\langle X, \text{list of 1's} \rangle \mapsto \text{list of } \langle \text{globally frequent pattern } X, \text{sup}(X) \rangle$.

Tree-Based MapReduce Algorithm for Precise Data: PFP

Given that tree-based algorithms avoid the candidate generate-and-test paradigm of Apriori-based algorithms, Li et al. (2008) proposed the Parallel FP-growth (PFP) algorithm for query recommendation. PFP uses MapReduce to parallelize the tree-based FP-growth algorithm by first reading and dividing big databases of precise data into several partitions. The worker node corresponding to each partition P_i then outputs $\langle \{x\}, 1 \rangle$ for every item x in transaction $t_j \in P_i$. The reduce function then sums all the 1’s for each x to compute its support $\text{sup}(\{x\})$, and outputs $\langle \{x\}, \text{sup}(\{x\}) \rangle$ (which represents a frequent 1-itemset $\{x\}$ and its frequency) if $\text{sup}(\{x\}) \geq \text{minsup}$. In other words, PFP first executes the following set of “map” and “reduce” functions:

- map: $\langle \text{ID of transaction } t_j \in \text{database partition } P_i, \text{ contents of } t_j \rangle \mapsto \text{list of } \langle \text{item } x \in t_j, 1 \rangle$, and
- reduce: $\langle x, \text{list of 1's} \rangle \mapsto \text{list of } \langle \text{frequent 1-itemset } \{x\}, \text{sup}(\{x\}) = \text{sum of 1's in the list for } x \rangle$.

Afterwards, PFP reads the big databases a second time to form an $\{x\}$ -projected database (i.e., a collection of transactions containing x) for each item x in the list produced from the first reduce function (i.e., for each frequent 1-itemset $\{x\}$). The worker node corresponding to each projected database then performs the following:

1. builds appropriate local FP-trees (based on the projected database assigned to the node) to mine frequent k -itemsets (for $k \geq 2$), and
2. outputs $\langle X, \text{sup}(X) \rangle$ (which represents a frequent k -itemset X and its frequency) if $\text{sup}(X) \geq \text{minsup}$.

To summarize, PFP executes the second set of “map” and “reduce” functions as follows:

- map: $\langle \text{ID of transaction } t_j \in P_i, \text{ contents of } t_j \rangle \mapsto \text{list of } \langle \{x\}, \{x\}\text{-projected database} \rangle$, and
- reduce: $\langle \{x\}, \{x\}\text{-projected database} \rangle \mapsto \text{list of } \langle \text{frequent itemset } X, \text{sup}(X) \rangle$.

As PFP was designed for query recommendation, it usually takes a third set of “map” and “reduce” functions to aggregate and rank the list of frequent itemsets for the top-K frequent patterns to facilitate recommendations.

Tree-Based MapReduce Algorithm for Uncertain Data: MR-growth

Characteristics of big data can be described by at least 5Vs: volume, value, velocity, variety, and veracity. Among the 5Vs, veracity focuses on the quality of data (e.g., precision, uncertainty, messiness, or trustworthiness of data). In many real-life applications, available data can be *uncertain*. Uncertainty of the data may partially be caused by various factors such as imprecision or limitation of measuring instruments, as well as intentional blurring of data for privacy-preserving data. Hence, in these applications, users may be uncertain about the presence or absence of some merchandise items or events. For example, a manager may highly suspect (but cannot guarantee) that a customer is interested in certain products without explicitly asking the customer. The uncertainty of such suspicion can be expressed in terms of existential probability. Hence, to handle uncertain data, each item x in the transaction t_j is associated with an existential probability $P(x, t_j)$ expressing the likelihood of the presence of that item or event. With this notion, each item in a transactional database of precise data can be viewed as an item with a 100% likelihood of being present in the transaction.

When using probabilistic-based mining with the “possible world” interpretation (Leung, 2014), a pattern is considered *frequent* if its expected support is no less than the user-specified *minsup* threshold. When items within a pattern X are independent, the *expected support* of X in the database can be computed by summing (over all transactions) the product (of existential probabilities within X):

$$\text{expSup}(X) = \sum_{t_j} \left(\prod_{x \in X} P(x, t_j) \right), \text{ where } P(x, t_j) \text{ is the existential probability of item } x \text{ in transaction } t_j.$$

Leung & Hayduk (2013) presented the MR-growth algorithm, which uses MapReduce to mine frequent patterns from *uncertain* data in a tree-based pattern-growth fashion for big data mining. Again, MR-growth uses two sets of the “map” and “reduce” functions. Specifically, the master node reads and divides uncertain data into partitions. The worker node corresponding to each partition P_i then outputs $\langle \{x\}, P(x, t_j) \rangle$ for every item x in transaction $t_j \in P_i$. Note that, unlike the map functions for the aforementioned algorithms (which output $\langle \{x\}, 1 \rangle$ for representing the actual support of x in $t_j = 1$, i.e., x appears 1 time in t_j), the map function for MR-growth outputs $\langle \{x\}, P(x, t_j) \rangle$ (where $P(x, t_j)$ indicates the expected support of x in t_j , which means x has a probability of $P(x, t_j)$ to appear in t_j):

- map: $\langle \text{ID of transaction } t_j \in \text{database partition } P_i, \text{ contents of } t_j \rangle \mapsto \text{list of } \langle \text{item } x \in t_j, P(x, t_j) \rangle$.

Then, the reduce function sums all the $P(x, t_j)$'s for each x to compute its expected support $expSup(\{x\})$, and outputs $\langle \{x\}, expSup(\{x\}) \rangle$ (representing a frequent 1-itemset $\{x\}$ and its expected support) if $expSup(\{x\}) \geq minsup$:

- reduce: $\langle x, \text{list of } P(x, t_j)\text{'s} \rangle \mapsto \text{list of } \langle \text{frequent 1-itemset } \{x\}, expSup(\{x\}) \rangle$,

where $expSup(\{x\}) = \text{sum of } P(x, t_j) \text{ in the list for } x$. Notice that, when handling precise data, the actual support of $\{x\}$ is its frequency. In contrast, when handling uncertain data, the expected support of $\{x\}$ may not be the same as its frequency. For instance, consider an item b with existential probability of 0.9 that appears only in transaction t_1 . Its expected support may be higher than item c that appears seven times but with an existential probability of 0.1 in each appearance. Then, $expSup(\{b\}) = 0.9 > 0.7 = expSup(\{c\})$.

Afterwards, MR-growth rereads the big databases to form an $\{x\}$ -projected database (i.e., a collection of transactions containing x) for each item x in the list produced from the first reduce function (i.e., for each frequent 1-itemset x). The worker node corresponding to each projected database then performs the following:

1. builds appropriate local UF-trees (based on the projected database assigned to the node) to mine frequent k -itemsets (for $k \geq 2$), and
2. outputs $\langle X, expSup(X) \rangle$ (which represents a frequent k -itemset X and its expected support) if $expSup(X) \geq minsup$.

To summarize, MR-growth executes the second set of “map” and “reduce” functions as follows:

- map: $\langle \text{ID of transaction } t_j \in P_i, \text{contents of } t_j \rangle \mapsto \text{list of } \langle \{x\}, \{x\}\text{-projected database} \rangle$, and
- reduce: $\langle \{x\}, \{x\}\text{-projected database} \rangle \mapsto \text{list of } \langle \text{frequent itemset } X, expSup(X) \rangle$.

Constraint-Based MapReduce Algorithm: BigAnt and BigSAM

When mining and analyzing huge-volume big data, it is not uncommon that users may be interested in only some subsets of these big data in many real-life situations. This leads to *constraint-based mining* (Bonchi, 2009; Leung, 2009; Leung, 2018a), with which users can focus the mining on certain subsets of the big data by freely specifying some constraints to express their interest. For example, users can express their interests in finding a collection X of merchandise items having a total price of less than \$100 by specifying a constraint “ $\text{sum}(X.Price) < \$100$ ”. Similarly users can also express their interests in finding a set Y of branches with a minimum GPS coordinate (latitude) of 49°N by specifying a constraint “ $\text{min}(Y.GPSCoordinate) = 49^\circ\text{N}$ ”.

To handle these constraints and to focus the mining on those subsets of big data that are interesting to users, Leung & Jiang (2014) proposed the BigAnt algorithm to handle the user-specified anti-monotonic constraints by exploring the anti-monotonicity of the constraints, which states that “if a pattern satisfies an anti-monotonic constraint, then so do all its subsets”. In other words, if a pattern violates the anti-monotonic constraints, it can be pruned as any of its supersets is guaranteed to violate the constraints. For instance, if $\text{sum}(Z.Price) \geq \100 for some pattern Z , then $\text{sum}(Z'.Price) \geq \100 for any superset Z' of Z . So, the BigAnt algorithm also uses two sets of the “map” and “reduce” functions. The master node reads and divides uncertain data into partitions. The worker node corresponding to each partition

P_i then performs constraint checking and outputs $\langle \{x\}, P(x, t_j) \rangle$ for every *valid* item x in transaction $t_j \in P_i$ (when $\{x\}$ satisfies the constraints):

- map: $\langle \text{ID of transaction } t_j \in \text{partition } P_i, \text{contents of } t_j \rangle \mapsto \text{list of } \langle \text{valid item } x \in t_j, P(x, t_j) \rangle$.

Then, the reduce function sums all the $P(x, t_j)$'s for each valid x to compute its expected support $\text{expSup}(\{x\})$, and outputs $\langle \{x\}, \text{expSup}(\{x\}) \rangle$ (representing a valid frequent 1-itemset $\{x\}$ and its expected support) if $\text{expSup}(\{x\}) \geq \text{minsup}$:

- reduce: $\langle \text{valid } x, \text{list of } P(x, t_j)\text{'s} \rangle \mapsto \text{list of } \langle \text{valid frequent 1-itemset } \{x\}, \text{expSup}(\{x\}) \rangle$,

where $\text{expSup}(\{x\}) = \text{sum of } P(x, t_j) \text{ in the list for } x$. Afterwards, BigAnt rereads the big databases to form an $\{x\}$ -projected database (i.e., a collection of transactions containing x) for each *valid* item x in the list produced from the first reduce function (i.e., for each valid frequent 1-itemset x). The worker node corresponding to each projected database then performs the following:

1. builds appropriate local UF-trees (based on the projected database assigned to the node) to mine frequent k -itemsets (for $k \geq 2$), (ii) performs constraint checking to find valid ones from these mined frequent k -itemsets, and (iii) outputs $\langle \text{valid } X, \text{expSup}(X) \rangle$ (which represents a valid frequent k -itemset X and its expected support) if $\text{expSup}(X) \geq \text{minsup}$ and X is valid with respect to the user-specified constraints. To summarize, BigAnt executes the second set of “map” and “reduce” functions as follows:
 - map: $\langle \text{ID of transaction } t_j \in P_i, \text{contents of } t_j \rangle \mapsto \text{list of } \langle \text{valid } \{x\}, \{x\}\text{-projected database} \rangle$, and
 - reduce: $\langle \text{valid } \{x\}, \{x\}\text{-projected database} \rangle \mapsto \text{list of } \langle \text{valid frequent itemset } X, \text{expSup}(X) \rangle$.

Note that BigAnt pushes the user-specified anti-monotonic constraints into the big data mining process so that it directly discovers frequent patterns that satisfy the constraints.

To a further extent, Jiang, Leung, & MacKinnon (2014) proposed the BigSAM algorithm to explore additional property of some anti-monotonic constraints. Specifically, BigSAM explores the succinctness of the constraints, which reveals that all and only those itemsets satisfying the succinct anti-monotonic (SAM) constraints can be explicitly and precisely generated using only individual items that satisfy the SAM constraints. For instance, any set Y of branches with $\min(Y.GPSCoordinate) = 49^\circ\text{N}$ must consist of only branches with GPS coordinate of 49°N . Hence, the BigSAM only needs to perform constraint checking in the first—but not the second—map function.

FUTURE RESEARCH DIRECTIONS

Besides the MapReduce model in Apache Hadoop, alternative approaches include the use of Apache Spark (which relies on the concept of resilient distributed dataset), edge computing, and fog computing (Zaharia et al., 2010; Garcia Lopez et al., 2015; Yi et al., 2015). Hence, a logic future research direction is to adapt and perform *big data analytics and mining for knowledge discovery* (e.g., constrained

or unconstrained frequent patterns about an organization) in *Spark, edges, or fogs* (Leung et al., 2017b; Sarumi, Leung, & Adetunmbi, 2018; Braun et al., 2019).

Due to the popularity of Web-based communities and social networking sites, huge volumes of big social media data (including those Facebook, Instagram and Twitter data about an organization) are available. Embedded in these big data are rich sets of meaningful knowledge about the social networks (e.g., social networks within an organization, among different organizations). Hence, a second future research direction is to apply *social media mining and social network analysis* (Leung, Medina, & Tanbeer, 2013; Xu & Li, 2013; Leung et al., 2016; Jiang et al., 2018; Leung, 2018b) to social media data for discovery of rich sets of meaningful knowledge from these big data.

Many existing big data mining algorithms return the mined results in a textual form—e.g., a *textual list* of all (constrained or unconstrained) frequent patterns. As “a picture is worth a thousand words”, visual representation of the mining results is usually easier to comprehend for users than its equivalent textual representation. Thus, it is desirable to show the mining results interactively by applying the concepts of visual analytics. As such, to enhance user experience in exploring big data, a third future research direction is to incorporate *visual analytics and interactive technologies* (Zhang, Segall, & Cao, 2011; Leung et al., 2017a; Jentner & Keim, 2019; Leung & Zhang, 2019) into big data mining so that the (constrained or unconstrained) frequent patterns mined from big data are returned to the users in visual forms.

CONCLUSION

Big data analytics and mining aims to discover implicit, previously unknown, and potentially useful information and knowledge from big databases that contain huge volumes of valuable veracious data collected or generated at a high velocity from a wide variety of data sources. Among different big data mining tasks, this chapter focuses on *big data analytics and mining for knowledge discovery*. By relying on the MapReduce programming model, researchers only need to specify the “map” and “reduce” functions to discover frequent patterns from:

1. big databases of precise data in a breadth-first manner (e.g., by using the SPC, FPC, and DPC algorithms) or in a depth-first manner (e.g., by using the PFP algorithm), and/or
2. big databases of uncertain data (e.g., by using the MR-growth algorithm).

Such a big data analytic and mining process can be sped up (e.g., by using the BigAnt and BigSAM algorithms, which focus the mining according to the user-specified constraints that express the user interests). The resulting (constrained or unconstrained) frequent patterns mined from big data provide users (e.g., executive and management teams of an organization) with new insights and a sound understanding of users’ patterns about the organization. Such knowledge is useful in many real-life information science and technology, as well as organizational, applications.

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KEY TERMS AND DEFINITIONS

Anti-Monotonic Constraint: A constraint C such that, if an itemset S satisfying C, then any subset of S also satisfies C.

Big Data: High-velocity, valuable, and/or multi-variety data with volumes beyond the ability of commonly-used software to capture, manage, and process within a tolerable elapsed time. These Big data necessitate new forms of processing to deliver high veracity (& low vulnerability) and to enable enhanced decision making, insight, knowledge discovery, and process optimization.

Data Mining: Non-trivial extraction of implicit, previously unknown and potentially useful information from data.

Frequent Pattern (or Frequent Itemset): An itemset or a pattern with its actual support (or expected support) exceeds or equals the user-specified minimum support threshold.

Frequent Pattern Mining: A search and analysis of huge volumes of valuable data for implicit, previously unknown, and potentially useful patterns consisting of frequently co-occurring events or objects. It helps discover frequently co-located trade fairs and frequently purchased bundles of merchandise items.

Itemset: A set of items.

MapReduce: A high-level programming model, which uses the “map” and “reduce” functions, for processing huge volumes of data.

Succinct Constraint: A constraint C such that all itemsets satisfying C can be expressed in terms of powersets of a fixed number of succinct sets using the set union and/or set difference operators. A succinct set is an itemset, in which items are selected from the domain using the usual Structured Query

Language (SQL) selection operator. In simple terms, a constraint C is succinct meaning that all and only those itemsets satisfying C can be explicitly and precisely generated using some precise “formula”.

Strategies for Increasing Knowledge Translation of Evidence-Based Practice in Athletic Training

11

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INTRODUCTION

The field of health care needs to change in order to address challenges such as rising health care costs, aging populations and the need to treat increasing numbers of people with chronic health conditions. All of this must be accomplished while reducing costs and maintaining quality of care. Health care professionals are being tasked with facilitating this change. Like many other health care professions, athletic training has turned to evidence-based practice to assure that athletic trainers are trained to deliver the highest quality of care in the most efficient way to their patients. The transition to integrating evidence-based practice will be challenging and will require a massive diffusion of innovation throughout the field of athletic training.

Athletic trainers (ATs) are defined as “health care professionals who collaborate with physicians. The services provided by ATs comprise prevention, emergency care, clinical diagnosis, therapeutic intervention and rehabilitation of injuries and medical conditions. ATs work under the direction of physicians, as prescribed by state licensure statutes” (Profile of athletic trainers, 2014, para. 1). The profession of athletic training is constantly growing, and athletic trainers can be found in many different settings including high schools, colleges, working with the athletic teams, the military, and workplaces. Despite many employment opportunities, some people in the health care industry are unfamiliar with the responsibilities of the AT and it is apparent that athletic training as a profession is still lagging behind other allied health professions (Hankemeier & Van Lunen, 2013a).

BACKGROUND

The National Athletic Trainers' Association (NATA) introduced the use of evidence-based practice (EBP) in both the education of new ATs, and in the clinical setting with athletic trainers already working in the field (Hankemeier & Van Lunen, 2013; Hankemeier et al., 2013; McCarty Hankemeier, Walter, Newton, & Van Lunen, 2013; Welch, Van Lunen, & Hankemeier, 2014b). There are many benefits to increasing the use of evidence-based medicine (EBM). A benefit frequently discussed is improving both the image and recognition of athletic trainers as health care professionals and not personal trainers, physical education teachers, or the people carrying water bottles on the sideline of games. Other benefits to using EBM

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include improving the care provided to the patients and justifying third party reimbursement (McCarthy et al., 2013; Welch et al., 2014a).

Using EBP can be broken down into five steps as shown by Sackett et al. (1996). These steps include: defining clinically relevant questions, searching for the best evidence, critically appraising the evidence, applying the evidence, and evaluating how effective evidence-based medicine was when put to use. While these steps seem relatively simple when written out, most athletic training clinicians are not using EBP in their current treatment practice, but 98% of them were found to believe that it is important for the credibility of the profession (McCarty et al., 2013). Hankemeier et al. (2013b) showed that clinicians had a lower perceived importance score and a lower knowledge score when compared with post-professional educators. ATs who work in athletic training education programs have more exposure to the notion of EBP and therefore are more knowledgeable about the importance of EBP than individuals that only work in clinical settings.

Since EBP is very new to the field of athletic training, practicing clinicians that are not recent graduates likely did not learn about EBP in the educational curriculum and would not be familiar with it unless the individual took initiative to learn the process independently. In a study completed by Hankemeier and Van Lunen (2013a) less than 20% of the surveyed clinicians received any form of EBP training. Based on the information provided in this survey, very few clinicians have been trained to use EBP. These clinicians with no background in using the five steps would need some training in order to be able to effectively integrate EBP into daily clinical practice.

Disseminating knowledge about EBP to ATs is essential in this transition. Continuing education (CE) is an important method for educating athletic training clinicians on what EBP is and how to use. In order for CE to be truly effective, athletic trainers need to understand what modes are best for presenting this information to promote long term knowledge retention and knowledge translation. Popular ways that CE is presented is through online learning, in person lectures, discussions, hands on demonstrations, and mixed mode learning. Studying modes individually for these gains or comparing one type of CE with another could help to advance understanding of how EBP should be presented to maximize an increase in knowledge and use.

Distance education, e-learning, computer mediated, web-based, and online instruction are terms used to describe education delivered through computer-based technologies. Whatever term is chosen, such computer-based technologies are essential components of the preparation and continuing education of health professionals. One of the most frequently used modes of CE, particularly for learning EBP, is online learning. Web-based learning has become very popular due to its flexibility and ease. This type of learning can be done from anywhere and completed at the convenience of the individual taking the course (Militello, Gance-Cleveland, Aldrich, & Kamal, 2014).

Allied health care tends to use three models of online learning and instruction: blended learning, online learning, and continuing education (Stewart & Wright, 2004). Blended learning includes both face to face and online learning and instruction. Online learning is learning and instruction that is completely web-based. Continuing education for health professionals is offered in both blended and online formats. In fact, most health-related disciplines are using a combination of online and face-to-face learning in their programs.

From a theoretical standpoint, characteristics of an effective online learning experience have been outlined. Reeves and Reeves (2008) provided 10 dimensions to be considered when designing, implementing and evaluating an online class in health and social work. The model they described for health and social work education included 10 dimensions of interactive teaching and learning: (1) pedagogical philosophy; (2) learning theory; (3) goal orientation; (4) task orientation; (5) source of motivation; (6)

teacher role; (7) metacognitive support; (8) collaborative learning support; (9) cultural sensitivity; and (10) structural flexibility. In the discussion of developing online learning formats, best practices often discussed include attention to instructor and student interaction, application of active learning techniques, providing prompt feedback, and attending to diverse ways of learning. While the aforementioned guidelines make sense, they have not been vetted through research. This brings us to the next questions of whether web-based instruction can be as effective as face-to-face education. The answer is that we really do not know how effective face-to-face education is, because comprehensive assessment is rarely conducted of student learning for specific courses. Many factors play a role (i.e., faculty training and course design) in the effectiveness of any course. Most health professionals rely heavily on technology in their practice and thus, it seems appropriate for technology to play a role in the education of future health professionals. In fact, Hollis and Madill stated (2006), “Evidence suggests that blending combinations of technologies with computer mediated learning enhances interaction and could address the higher order learning needs of professional programs such as occupational therapy”(p.61).

Through a review of research focused on computer-enhanced classroom-based teaching, online courses, online degree programs, and online continuing professional education, Hollis and Madill (2006) recommended that both online and face-to-face teaching and learning opportunities accommodate all types of students and faculty. Hollis and Madill (2006) emphasized the use of multiple technologies to enhance interaction between students, and between students and instructors. However, to optimize the effectiveness of online learning, they suggested appropriate preparation and support is required for both students and faculty. Again, these suggestions make sense, but also must be vetted through research designed to assess effective online learning experiences.

How is blended and online learning and education being used in health professions? Konin (2004) discussed how to enhance clinical education, like athletic training, through the use of web-based programs. Like most health professionals, education and training includes some type of fieldwork, or internship placement. Information and assessments for clinical instructors can be delivered electronically through an online course management system such as Blackboard. Face-to-face class formats can be enriched through the availability of a multitude of supplemental online materials.

A study was completed with nursing clinical preceptors who worked with undergraduate nursing students. In this study the preceptors took part in a series of online CE course objectives. These objectives were geared toward the roles and expectations of a clinical preceptor. The results showed that there was a statistically significant gain of knowledge between the pre-test and post-test, showing that knowledge was gained from online learning (Zahner, Tipple, Rather, & Schendzielos, 2009). While this study showed that online learning can increase knowledge, it did not compare online learning with traditional learning methods such as live lectures.

There is research that has been done that compares online learning with traditional live lectures. One study completed by Phillips (2015) investigated the effects of teaching a lesson online versus the traditional in person lecture class. This study was completed using a class in a pharmacy program. Students were randomly assigned to either the control group of traditional lectures, or the experimental group of active online learning. The experimental group performed higher on a multiple choice quiz given immediately after the lesson, but there was no significant difference on the final exam scores between groups. The experimental group did express that the online class was enjoyable and felt that it should be used in conjunction with traditional lectures, but should not replace lectures altogether.

Online learning and instruction is also essential to the continuing education of health-related professionals. Williams (2006) conducted a meta-analysis of 25 studies assessing achievement in distance education in allied health and found that distance education is as effective as face-to-face instruction.

Student achievement outcomes were positively correlated with work experience and professional knowledge. Outcomes were also better for distance education experiences that included multiple learning and instructional strategies including, but not limited to, interaction and introspection.

Continuing education for ATs is offered in many different forms including taking college courses, publishing papers, presenting at conferences, attending in person meetings or education seminars, and online learning (Board of Certification, 2016). Studies have shown that online CE is frequently used because of the cost effectiveness and the ease of completing it individually (Armstrong & Weidner, 2011). There have been two reporting periods that required athletic trainers to complete CE in an evidence-based practice category. During this period, ATs could choose from many different online options. These were typically formatted with a lesson that ended in a quiz to test knowledge. Passing the quiz was necessary for receiving the continuing education units. A study was completed by Welch et al. (2014a) that looked at the web-based modules pertaining to EBP.

In this study, there was an experimental group that had access to the continuing education learning modules, and a control group that did not. Both groups were given a pretest and a posttest to assess knowledge. The experimental group did significantly better than both their own pretest and the control group's scores on the pretest and the posttest. Learning was achieved in this study, but only short team knowledge gain was investigated. Whether this knowledge was retained in the long term from the online learning modules has not yet been concluded.

The experimental group in the previous study was also interviewed on their perceptions of evidence-based practice following the intervention. Overall, the response was positive with the individuals all feeling that they had learned from the modules and had a better understanding of the concepts of EBP and how to use it (Welch et al., 2014b). However, the clinicians reported that the modules did not cause a change in clinical practice and that although they learned they did not change the way they made treatment decisions. Other qualitative studies have been done regarding the attitudes toward EBP education. A topic that was emphasized was the need for constant repetition and increased exposure to evidence-based practice. These participants felt that the more exposure one has to EBP, the more comfortable they will become with it and the more likely they will become to use it (Welch et al., 2014c). A recent study by Keeley et al. (2016) found that participants felt that EBP was important, but overall they had not used EBP concepts at all in the eight weeks prior to completing the survey. The importance of EBP and short-term knowledge gain seem to be occurring, but there is still a gap between putting that knowledge to practice.

More recent research, following the requirement of EBP for continuing education has also been conducted. A study by Keely et al. (2016) surveyed athletic trainers regarding their knowledge and use of EBP following continuing education. This study found that despite an increase in knowledge that is being attributed to the continuing education, and an understanding of why EBP is important for the profession, there is little increase in use. Furthermore, research has shown that the barriers that were being presented by clinicians as hindering use, are still being presented currently (Manspeaker & Hankemeier, 2017). This is considered significant because despite the increase in continuing education, and the emphasis being placed on EBP in the field of athletic training, clinicians are not finding ways to overcome those barriers and meaningfully use EBP (Manspeaker & Hankemeier, 2017).

The reason that EBP is such a hot topic in the world of health care is to improve clinical outcomes, decrease cost, and increase patient satisfaction. To effectively implement EBP into athletic training, the athletic trainers must be using what they are learning through CE (Hankemeier & Van Lunen, 2013; Welch et al., 2014a; Welch et al., 2014b). More research needs to be done that helps to understand whether online, traditional, or a mixed mode of CE is most effective for knowledge gain and clinical use. Research designed to measure how well an individual is learning and whether that person is retaining the

knowledge could help make adjustments to the current situation regarding EBP. Comparing different ways of receiving the knowledge for effectiveness would also help to promote meaningful learning and knowledge translation. The addition of EBP to continuing education requirements is still relatively new, and it is likely that this will not be perfect on the first attempt. Continuing to understand the best ways to increase the translation of knowledge in athletic training could help the profession to successfully incorporate EBP into daily practice.

Some studies have been completed that investigate the notion of using a mixed mode method of learning. This type of CE would include different methods of learning such as combining web-based learning with an in-person discussion, or hands on demonstration that compliments what was previously learned (Militello et al., 2014). The idea that mixing a passive lecture whether online or in person with an active discussion or demonstration works well with the idea that individuals learn differently. Furthermore, reinforcing a topic often promotes long term retention, comprehension, and may increase the chance that it will be implemented into clinical use (Schreiber, Perry, Downey, & Williamson, 2013; Zahner, et al., 2009).

A particular study that utilized a more comprehensive and multifaceted approach was completed by Schreiber et al. (2013). This study used a course that was geared for physical therapist (PTs) and met on three separate occasions in conjunction with an online community used to foster discussion. During the in-person meetings, there were lectures, hands on demonstrations, and time to talk about successes and barriers to implementing the clinical change learned. In the final session, all PTs were required to discuss how they had already used what was learned in the previous courses in the clinical setting with patients. They also needed to describe an EBP activity that they had undertaken in the clinical setting. This study showed that the participants enjoyed this mixed methods learning and showed improvement in knowledge and practice behaviors such as supporting colleagues' use of interventions and tests and measures that were related to the course content.

Studies are showing that multifaceted learning increases knowledge and the translation of knowledge into clinical practice (Schreiber et al., 2013; Zahner et al., 2009). In order for change to truly occur in the field of athletic training more research needs to be completed that investigates how effective the current CE learning methods are. Short term knowledge gain is not enough to truly make a change. Whether long term knowledge gain is occurring is also important. If an individual is forgetting the course content immediately following the course then the information is not being relayed effectively (Phillips, 2015). This information must be something that the AT can comprehend and remember after a period of time. Even more importantly, however, is the idea of translating this knowledge in to clinical practice.

FUTURE RESEARCH DIRECTIONS

Understanding whether knowledge translation is occurring by looking at the knowledge to action framework for future research may be beneficial. There are several models for looking at knowledge to action, with a model by Graham et al. (2006), frequently used in allied health professions. The Knowledge to Action (KTA) process is a multidirectional process where knowledge is created and then developed to allow information to be better understood and used by healthcare professionals (Graham et al., 2006). This framework is divided into two parts, the knowledge creation funnel, and the action cycle. Through the knowledge creation funnel, new information is created and refined in order to be disseminated to the intended targets (Graham et al., 2006). The action cycle around the funnel helps to identify steps that can be used in order for the information to be spread and used widely. This begins with identifying the problem, and understanding the gaps (Graham et al., 2006). Athletic training has begun to take steps

to identify problems with EBP use, but understanding why there is an increase in knowledge and not a change in behavior is important to truly diffuse EBP into the profession. The next steps involve adapting the knowledge and assessing barriers. Barriers have been addressed in many studies (Manspeaker & Hankemeier, 2017; McCarty et al., 2013). The next steps include implementing interventions based on the problems and barriers, monitoring knowledge use, evaluating outcomes, and sustaining knowledge use (Graham et al., 2006).

The profession of athletic training is currently in the process of monitoring knowledge use, and evaluating outcomes based on the continuing education that is being provided to AT clinicians. The KTA framework is cyclical and multidirectional meaning that the process can go forward or backward, and information is constantly being evaluated. One method that has been shown to be effective in physical therapy that could warrant more research within the field of athletic training is the use of knowledge brokers (Glegg & Hoens, 2016). The idea of a knowledge broker (KBs) stems from knowledge translation and frameworks such as KTA. KBs are viewed as humans who facilitate knowledge sharing between groups such as researchers and clinicians (Glegg & Hoens, 2016). They are used to bridge the gap between evidence and practice (Hoens, Reid, & Camp, 2013). Physical therapy as a profession has been implementing this role with some success in increasing knowledge by fostering relationships with clinicians and building trust (Hoens, Reid, & Camp, 2013).

Athletic training should begin to look into whether the addition of KBs would be beneficial to the profession to help promote a more widespread use of EBP when making clinical decisions. Clinicians have discussed the importance of mentors when learning about and using EBP, and KBs can facilitate that mentorship through online relationships. Using the internet allows the KBs to reach a wide net of clinicians, and allows the clinicians to connect with the experts in an asynchronous fashion that may be more convenient the busy schedules. Using the KTA framework, and incorporating trusted KBs may help to bridge the knowledge to action gap that is being seen following the incorporation of EBP into continuing education (Keeley et al., 2016; Manspeaker & Hankemeier, 2017).

CONCLUSION

A major transition is occurring to achieve the implementation of EBP throughout the field of AT. To date, there have been two reporting periods that required ten of their fifty CEUs in an EBP category. This was the first time that athletic trainers needed a portion of CEUs to come from an EBP section. The goal is that this will familiarize all ATs with EBP in hopes that it will begin to be used more. However, research is showing that despite an increase in knowledge, there are still barriers, and little increase in use (Keeley et al., 2016). Changing the way online continuing education is presented and completed by ATs may increase comprehension and understanding of EBP. This understanding may lead to using it in clinical practice. Using the KTA process to evaluate barriers, and provide strategies to improve translation may help (Graham et al., 2006). The use of KBs in the field of physical therapy has been seen to help disseminate information and provide clinicians with support when implementing new ideas (Hoens, Reid, & Camp, 2013). One major complaint for using EBP in the clinic is a lack of comfort with how to use it (Hankemeier & Van Lunen, 2013a). Increasing frequency of exposure may help to make clinicians more comfortable with how to use EBP causing a change in practice. While there will no doubt be challenges associated with the implementation of EBP in athletic training, the use of online learning and investigating whether KBs could provide a much needed mentorship in an online setting may ease the transition for athletic trainers, managers, and organizations.

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KEY TERMS AND DEFINITIONS

Allied Health: The segment of the workforce that delivers services involving the identification, evaluation and prevention of diseases and disorders; dietary and nutrition services; and rehabilitation and health systems management.

Athletic Trainers (ATs): Healthcare professionals who collaborate with physicians to provide prevention, emergency care, clinical diagnosis, therapeutic intervention and rehabilitation of injuries and medical conditions (Profile of athletic trainers, 2014, para. 1).

Continuing Education: Education provided for adults after they have left the formal education system, consisting typically of short or part-time courses.

Evidence-Based Practice: Evidence-based medicine is the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients (Sackett et al., 1996).

Knowledge Broker: Individuals who work to bridge the gap between researchers and users (Hoens, Reid, & Camp, 2013).

Knowledge Translation: A dynamic and iterative process that includes synthesis, dissemination, exchange and ethically-sound application of knowledge to improve the health of patients, provide more effective health services and products, and strengthen the health care system (Graham et al., 2006).

National Athletic Trainers' Association (NATA): A professional membership association serving certified athletic trainers and others who support the athletic training profession in the United States.

Transitions: Change processes that involve a beginning, middle, and an end.

Section 12

Management Science

Management Tools: From Complexity Reduction to Complexity Creation

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INTRODUCTION

Anticipate, decide and control are the three structuring pillars of everyday management activities (Moisdon, 1997). Regardless of the operating field or organization structure, the management tools deployed to support these activities are expected to display two key characteristics. First, they need to vehicle a formal rationality (Weber, 1978), i.e. the results or orientations privileged by the tool are to be interpreted as the reflect of objective and well-structured calculations. Second, they allow managers to circumvent their limited rationality by providing meaningful syntheses that encompass a set of parameters or dimensions which would not have been approachable through cognitive capabilities alone. With respect to these expectations, it seems fair to state that management tools are first and foremost perceived as reducers of organizational complexity.

It is therefore unsurprising that organizations confronted by unprecedented competition, rapidly-shifting environments, and strengthened governance structures rely more and more heavily on such tools in order to adapt to their context and demonstrate accountability to a variety of stakeholders (authorities, partners, shareholders, clients, and even the public at large).

However, such a vision does not sustain a serious reflexive approach on the way in which management tools are used on an everyday basis. Indeed, by shedding light on the appropriation of management tools and the associated strategies deployed by the users thereof, assorted literature on management tools sociology as well as organizational behavior have provided us with the prerequisite hindsight to criticize what now can be assumed as a naive vision of management. Consequently, the analysis of management tools' life cycle - from conception to effective deployment and potential obsolescence - reveals how they may be at the source of a chain of human and organizational reactions, which may lead to unintended consequences and the emergence of new behaviors. Simply said, we're speaking here of complexity.

This chapter will first introduce the reader to the literature that provided, through theoretical and empirical approaches, the seeds to grow a new vision of management tools that goes beyond their supposed rationalization impact. With this background in mind, the following section describes two mechanisms through which organizational complexity is directly linked to the introduction of a new management tool. In order to do so, two distinct real case studies focused on performance indicators (PIs) in the field of industrial safety are presented. Largely deployed as a means of organizational control, PIs have spread in organizations thanks to their supposed ability to provide synthesis that directly support action. Focusing on this kind of tools should therefore reveal mechanisms of interest to a large sample of managers and researchers.

Finally, future developments are suggested, especially regarding the ability of exploiting the description of complexity mechanisms in the management tool design phase so to prevent their occurrence.

Comparatively to existing literature, this work goes beyond the observation of empirical facts resulting from the introduction of management tools to describe the underlying mechanisms at play and

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relating them to existing concepts already made available by management science. In doing so, this work contributes to:

- provide additional empirical evidence on the need in management science to pay higher attention to the way our tools are appropriated and modified by organizations and vice versa;
- a better formalization of complexity creation mechanisms due to the introduction of management tools;
- endow managers with elements of attention to be considered at various stages of management tools life cycle (diagnosis, design and implementation) to confine the potential chain of negative reactions out of which emerges organizational complexity;
- Remind that complexity creation is inherent to management tools deployment and remains a valuable source of organizational knowledge.

BACKGROUND

Management science has flourished at the intersection of various disciplines: mathematics, sociology, psychology, philosophy, etc. In parallel, the increased specialization and segmentation of organizations has resulted in management approaches being equally specialized and autonomous. Given this context, it is unsurprising to witness the cohabitation of a large range of management trends and schools of thought the epistemic grounds of which are yet to be homogenized (Pfeffer, 1993) (Van Maanen, 1995).

Management tools are good tracers of this background, as they bear with them clear representations of the variety and evolving scientific grounds on which they rest. This starts from the very definition of this concept. A positivist-oriented definition would consider management tools as satisfactory representations of reality (Dumez, 2008), on which managers may rely in order to anticipate and act on organizational dynamics. Resulting orientations are seen as the vehicles of an objective rationality that should impose itself on users whose roles are limited to (i) providing the required inputs for the tool to operate, and (ii) apply orientations or decisions resulting therefrom (Chiapello & Gilbert, 2019). In so doing, management tools are expected to act as organizational stabilizers thanks to the compliance and even standardization of its members' actions and decisions. A very widespread trend of thought and practices that heavily relies on this philosophy is Operations Research (Ackoff, 1979) and the cybernetic approaches of organizational control (Otley, 1983). This vision, combined with rapidly-increased computational capabilities, has shaped the representation of management tools as complexity reducers (Berry, 1983)

In practice, these hypotheses have been proven limited both in terms of philosophical structure and practical applications. A short account of the main criticism is provided in the following:

- Game theory (Von Neumann & Morgenstern, 1944) allowed economics to put on the map the option of inter-organizational cooperation to achieve better results than individual optimizations. The opportunity of constant rationalization and the seeking of local optimums therefore appears, at least in some circumstances, as under-achieving compared to the anticipation of other stakeholders' moves and the design of adapted cooperation strategies.
- Human relation theory (Damachi, 1978) has stressed the importance of interactions in shaping organizational performance. It revealed the extent to which motivation, leadership and commit-

ment to shared values act as strong determinants of organizational performance, regardless of the management tools deployed.

- Behavioral theory¹ has shed light on actors' strategies within organizations when confronted with various stimulus, including the introduction of new management tools. Excessive rationalization through continuous monitoring combined with incentives and rewards systems, for instance, appeared to bear important unintentional and highly prejudicial consequences. Enlightening examples can be found in New Public Management (NPM) literature where the introduction of market-like approaches to management has led, in some cases, to public services favoring the satisfaction of performance indicators to the detriment of service quality; or to develop the systemic cheating and manipulation of data, thereby making such figures totally misleading for decision-makers (Rouse, 1993) (PASC, 2003).
- The sociology of organizations has clearly highlighted the systematic tendency for management tools design to carry out important reductions in organizational complexity (Chiapello & Gilbert, 2019). Consequently, organizations may experience the emergence of unintended consequences due to a lack of communication between tools or misinterpretations of their results.
- Decision theory also has its fair share of critics, especially the 'garbage can model' (Cohen, March, & Olsen, 1972) that puts at the forefront the concept of organizational anarchies to describe the inconsistency of decision-makers' preferences, their lack of understanding of an organization's processes, and the volatility of decision-making structures in which members' interests and influences vary over time. This depiction of organizations offers a stark contrast with the image of rationalization machines as assumed in the vision described above.

From such criticism a new vision of management tools emerged, whereby stronger priority is given to the complexity of the social and political dynamics that accompany the deployment of such tools in organizations. Such a vision starts with the redefinition of management tools as *artefacts which, thanks to the mobilization of one or several management techniques, provides managers with the ability to pursue their objectives in a given context* (Gilbert, 1998). Three keywords merit our attention here. First, *artefact* is used to remind that management tools are collective human constructs the validity scope of which should be questioned. Second, the term *technique* is directly linked to the third *context* so as to highlight their interdependence. The relevance of techniques used to build a management tool are to be questioned with respect to the social context in which implemented. The evolution of social context implies the revision of a tool's application scope.

With respect to this vision, additional efforts to highlight and describe the cognitive and social consequences of deploying management tools have come to light. Two such developments appear enlightening with respect to this chapter's objectives:

- First, the status of management tools has moved from objective prescribers of rationality to that of *rational myths* (Hatchuel, 2000). The term *rational* is used here to recognize the ability of management tools to vehicle a rationality that can be traced and revised within reflexive procedures. However, this term is combined with *myth* to emphasize the limited character of this rationality due to the reductions and simplifications that always occur when management tools and technologies are conceived and implemented.
- Given this new status, the finality of management tools is no longer to prescribe behaviors, but rather, more modestly, to create new opportunities for collective learning (Hatchuel, 2000). Dumez

(2008) follows this path further to distinguish three configurations in which management tools can achieve such an objective:

- i. when used as a means to investigate the organization's formal and informal functioning;
- ii. when used to pilot organizational change, including reorganizations or developments in new markets;
- iii. Finally, as a means to investigate uncertainties through forecast and foresight approaches (for instance).

This epistemic and methodological journey has allowed management science research to explore new areas, amongst which the analysis of management tools as complexity creators should be further investigated.

Management Tools as Complexity Creators: Two Illustrative Mechanisms and Associated Cases

Despite the still diverging literature on the epistemic grounds of complexity science (Chu, Strand, & Fjelland, 2003), it is widely acknowledged that the term refers to systems the components of which are highly connected, autonomous, interacting in a non-linear fashion, and coevolving in order to ensure the system's survival through adaptation mechanisms (Richardson & Cilliers, 2011) (Zarboutis & Wright, 2006). As a direct result, new and unpredicted system states may emerge (Holland, 1998).

Organizations have been characterized as 'complex systems' since the 1960s (Anderson, 1999). This has resulted in numerous descriptive and prescriptive theories and models, amongst which organizational design (Galbraith, 1982), cybernetics (Ashby, 1956) and Complex Adaptive Systems (Gell-Mann, 1994) have had a large echo in organization theory. This chapter will more modestly discuss how the introduction of new management tools may trigger the complex mechanisms described as the development of new and unexpected interactions, leading to the emergence of new representations or relations in an organization.

The mechanisms of complexity creation to be further discussed rely on an action research approach in the industrial safety sector. More precisely, two contexts are presented whereby the introduction of new safety indicators - intended as rationalizing mechanisms to control hazardous sociotechnical systems - have resulted in unforeseen yet highly-informative observations. These observations will be analyzed through various management science models in order to evaluate the extent to which such observations may be representative of repeatable mechanisms of complexity creation. In so doing, it is not expected to provide the reader with an exhaustive description of the mechanisms through which management tools' implementation may trigger a chain of complex reactions. However, the mechanisms described in this chapter can be generalized as they refer to repeatable patterns which description can be performed through existing concepts and models already described in management science.

According to the above, the reader may first find some elements relating to the specific context of industrial safety and safety performance indicators, before discussing in more length how the introduction of these tools has triggered complexity in organizations.

Process Safety and Safety Performance Indicators

Process safety refers to the detection, evaluation and management of the threats posed by high-risk industrial activities, the consequences of an accident at which may impact beyond the workplace and even the plant. Explosions, fires and toxic releases are examples of physical consequences that process

safety strives to avoid, or minimize the impact of which in the event of occurrence. Bhopal (1984), Chernobyl (1986) and more recently Deepwater Horizon (2010) are vivid examples of wide-scale failures in industrial safety approaches.

Industrial accidents have long been recognized as resulting from a combination of events, the roots of which may be found in technological, human and managerial inputs (Reason, 1997). This has naturally led to industrial systems being defined as sociotechnical (Emery & Marek, 1962) (Eason, 2008) in the sense that these three inputs are constantly interacting to move organizations closer or further from accidents.

Accordingly, a central theme of process safety management is the ability of organizations to continually monitor how a set of predefined factors² evolve, and to consequently act either by reinforcing positive dynamics or detecting and correcting negative ones (Hollnagel, Wears, & Braithwaite, 2015).

Performance indicators can be defined as synthetic information aimed at orienting actions. In terms of safety, SPIs³ or KPIs⁴ are widely used by the industry as a means to control their systems (CCPS, 2011) through a classical cybernetic control loop. Accordingly, these are thought to provide a satisfactory representation of reality that leads to rational decisions with regards to deployed corrections and adaptations. Such an approach is therefore a genuine exemplification of the first paradigm of management tools, as described in the previous section.

We will go in the followings through two case studies out of which two distinct mechanisms of complexity creation will be described and discussed.

Case 1: You can Never Change Just one Thing

This first intervention has been carried out at plant A that wants to monitor and optimize maintenance intervention delays in a highly hazardous part of its production process. The following contextual specificities have proven to be of particular importance for our demonstration.

- The plant used to be part of a larger industrial installation, the activities of which were split before being sold to two companies (Plant A and B). At the operational level, the two plants maintained strong ties both physically (sharing utilities) and organizationally (shared subcontracting). Plant A subcontracted maintenance to Plant B which then, for cost reasons, subcontracted it to external companies.
- This cascade subcontracting structure was organized as follows: the maintenance department collects daily requests for intervention from plants A and B. These requests are discussed at the morning meeting with representatives of the two plants, and priorities are defined according to various factors including criticality of intervention and available resources.
- Available resources, expressed as the number of intervention hours/year, are defined contractually and renegotiated every year between plant A and B on the one side, and Plant B and the contractors on the other side.

Given this context, Plant A's *Environment, Health and Safety Department* (EHS) requested the development of one or several indicators to monitor the effects of cascade subcontracting, due to the feeling that intervention delays were increasing. However, they needed "numbers" to prove it, and consequently ask for a renegotiation in favor of increasing available resources in next maintenance contracts.

Thanks to electronic traceability, intervention requests, deliverance of work permits, and the issuing of intervention reports were all dated to allow for the measurement of the *mean delay* between requests and the effective completion of maintenance work, as well as its *variance* to detect peak loads.

If the design of this KPI was straightforward, its implementation has been a more troubled story. First, the monitoring of trends using past data provided the expected “numbers” to justify increased maintenance resources. So management consequently decided to (i) increase the annual maintenance budget, and (ii) further specify prioritization rules in order to reduce intervention delays for safety critical installations.

This first set of reactions was welcomed by the EHS department, whose initial objectives behind this intervention appeared to have been satisfied. However, the new prioritization rules have slowly but surely eroded delays of some interventions considered as less safety critical but more important with respect to production constraints. Consequently, a decrease in production system availability has quickly raised flags - leading to tension between production and safety objectives. If accident investigations on several occasions have emphasized how production optimization can be conducted to the detriment of safety constraints (Graham, et al., 2011) (Jiang & Probst, 2015) (Zohar, 2010), the tension observed here is the direct result of the introduction of a new KPI. Following this, a second round of discussions included representatives from the production department and production workshop first line managers. The discussion soon raised the issue of the dynamic and ever-changing balance between safety and production. Recognizing the dynamic character of this balance puts aside the static option of fixing prioritization rules, and puts at the forefront the experience and competence of first line managers in finding appropriate tradeoffs between these two dimensions. Accordingly, prioritization rules have been replaced by new organizational arrangements where the daily maintenance meeting includes first line managers as well as the EHS departments from sites A and B.

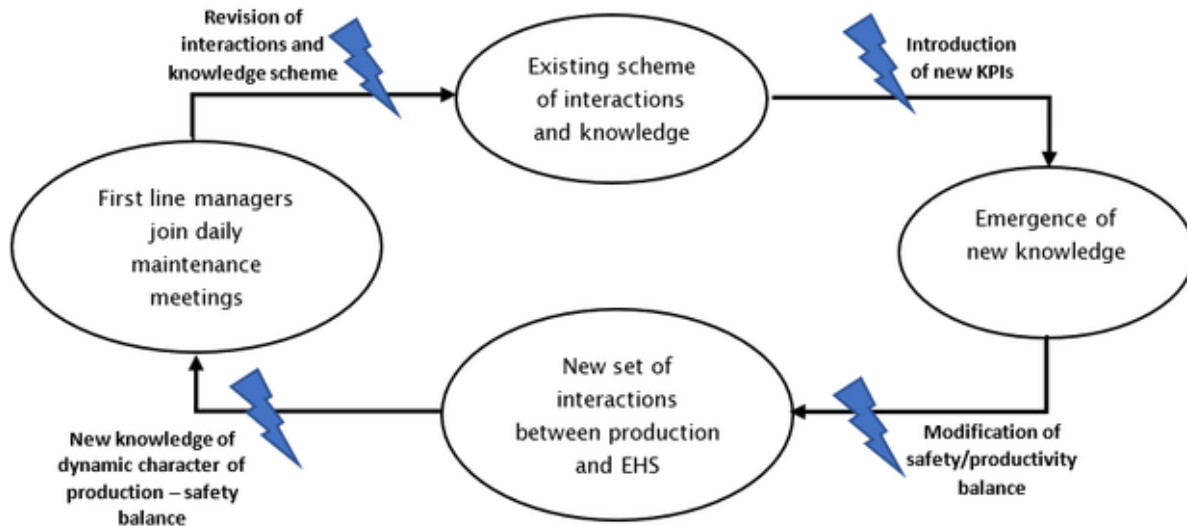
This abbreviated history of organizations A and B illustrates one key mechanism of complexity creation as being the non-separability of knowledge and relations (Hatchuel, 2000). Indeed, organizations can be defined as schemes of interactions between knowledge and relations. A snapshot of organizations provides a representation of the interactions allowed through hierarchical structure to process available knowledge at a given time. Accordingly, the capacity of each actor in an organization to reach out for internal or external interactions is constrained by this predefined structure. However, as soon as new knowledge is introduced, its processing requires the creation of new relations inside or outside the organization, leading to the modification of the interaction scheme either by introducing new interactions or by modifying existing ones. This new set of interactions is fertile ground for the emergence of new knowledge and opportunities, which once again lead to a new round of interaction modifications.

Returning to our first case, the introduction of the new KPI, or more generally a new management tool, is the formalization of new knowledge the consequences of which lead to the generation of a new set of interactions between production and EHS. These interactions modified organizational knowledge by recognizing the unsuitable character of static rules, and the need to rely on workshop first line managers to define maintenance priorities. In turn, this new knowledge led to a new set of interactions where first line managers are included in daily maintenance meetings (Fig.1).

The dynamics of this cycle is of course conditioned by the ability of the organization to acknowledge informal interactions, and its willingness to accept structural modifications so as to adapt to its internal as well as environmental changes.

Accordingly, this non-separability of knowledge and interactions can be seen both as an opportunity for organizations to constantly adapt to the impacts of internal and external dynamics, and also as a source of complexity, since every change may modify the subtle balance between interactions and knowledge.

Figure 1. Revision cycle of interactions and knowledge illustrated by the case 1 example



Case 2: There is no High Architect of Rationalization

This second case describes an intervention in a worldwide reinsurance company, which is interested in developing a framework for the detection of new or emerging risks. An emerging risk is a new risk or a familiar one that becomes apparent in new or unfamiliar conditions (IRGC, 2010) (Mazri, 2017).

As risk is the very essence of the insurance business, detecting emerging risks and acting on the obsolescence of older risks is a key activity for insurers, as it allows new insurance products to be developed that fit clients' evolving risk profiles and retires older products that are no longer profitable.

Accordingly, an emerging risk unit has been established with the objective of investigating societal and technological dynamics that may lead to new risks emerging or older ones disappearing. Based on these investigations, the unit was expected to provide the headquarters with emerging risks candidates for which foresight capabilities highlighted the high possibility for them to trigger demands for new insurance products. The unit's business model was quite straightforward: the more emerging risks candidates integrating the portfolio of insurance products, the more successful the unit.

The unit started working with the objective of "selling" emerging risk candidates to headquarters, which in turn, assign them to risk portfolio managers in other departments. When a new risk is assigned to a department's portfolio, it is expected to trigger a process through which an insurance product is designed - with respect to technical and market constraints - so as to make it financially profitable as soon as possible. In this case, profitability was evaluated through a classic three colors model: *green* for very profitable, *orange* for low levels of profitability, and *red* for non-profitable. Every department's success was assessed according to its ability to place a maximum of insurance products in the green zone according to a predefined set of financial ratios.

Quite quickly, conflicts between the objectives assigned to the emerging risks unit and those of other departments came to light. If the emerging risk unit was pushed towards providing a maximum number of emerging risks candidates, other departments were eager to minimize the inclusion of new risks in their portfolio for two reasons. First, when a new risk is assigned to a department portfolio, it is expected to remain a few months in the unprofitable area. This lag time is necessary to tailor an insurance product

economically and technically to reach the market and win customers. However, some emerging risks may require more time, as they rely on long-term societal and technological developments. Second, developing an insurance product for emerging risks remains a bet. The high-level of uncertainties surrounding their emergence process makes it plausible for risks to emerge much later, in a different form, or never emerge at all. Accordingly, the risks taken by the company to develop an insurance product are transferred to departments, which may find themselves carrying a “deadlift”⁵. A final key element of the case’s backdrop is the formal link established between department profitability and the financial bonuses annually attributed at the individual level. In other words, every emerging risk assigned to a business unit becomes a risk of decreasing the financial bonuses of its members.

This second case illustrates how complexity may result from the design and deployment of separate management tools, which promote rationalities that are local and potentially conflicting finally leading to a *conflict of objectivation*. Two recurrent mechanisms that go far beyond the example provided above lay behind this type of conflicts:

- First, the local character of objectivation in management tools is inherited from their design and implementation. Hatchuel and Weil (1992) distinguish three descriptive dimensions that may be used to understand the forms of simplifications adopted when designing any management tool. The first dimension is the *management philosophy* conveyed by the tool. This term refers to the set of objects and objectives targeted by the rationalization effort. For instance, Taylor (1919) expected scientific management to improve production efficiency through the division of labor, whereas decision aiding focuses its rationalization efforts on one specific moment of an organization’s lifecycle being the process of decision-making. The second dimension is the *technical substrate*, i.e. all the concepts and formalisms used to model reality. Mathematics, logic, algorithmics or sociology and psychology are the usual technics used by management tools to build abstractions of reality. Indeed, the selection of one technic over another is not a neutral choice, as it constraints the modelling of reality to aspects approachable by the technic. Practitioners may reach out for more sophisticated formalizations by using a combination of technics through multimethodological approaches (Mingers, 1997), but the limitations remain structurally unchanged. Finally, the third dimension is *organizational simplification*. Actually, all rationalization efforts require the targeting of a subset of stakeholders in an organization. These stakeholders are basically those in charge of using the tool, and potentially those affected by the new knowledge it may generate. For instance, decision aiding is only interested in ensuring that its final recommendations fit the decision maker’s preferences. In so doing, the whole intervention process is centered around the central figure of the decision maker and its first circle of interactions. All other aspects of the organization’s lifecycle remain beyond the intervention’s scope. Very similarly, interventions using knowledge management approaches focus on a subset of stakeholders of knowledge holders and how they acquire and share this knowledge.

These three dimensions describe the intrinsic mechanisms through which management tools’ conception and deployment remain local in their rationalization effort, regardless of the technic used or the aspects of the organization targeted.

- Second, it is fair to acknowledge that management is subject to fads and trends (Birnbbaum, 2000), the promises of which are often followed by disappointments (Dreilinger, 1994) (Carson, Lanier, Carson, & Birkenmeier, 1999). A remarkable consequence for organizations is the accumula-

tion over time of strategic reorientations and structural reorganizations, the distinct rationalities of which have often been translated into new management tools and philosophies. This constant quest for novel approaches leaves organizations with layers of management tools that have been designed at different times to serve different philosophies. Combined with their local character as discussed above, the set of management tools residing in an organization is far less the result of a unique and visionary higher architect and more the consequence of the accumulation of successive rationalization efforts that have not always been anticipated or coordinated.

SOLUTIONS AND RECOMMENDATIONS

By shedding light on the complexity of mechanisms resulting from management tools deployment, this chapter provides additional empirical evidence regarding the need for a deep cultural shift that moves the status of these tools from objective and representative of reality to subjective, partial and context-related. It also reminds managers that the outputs collected through these tools need to be questioned and put into perspective in order to understand their limits and potential to provide strong grounds for building representations of reality or decision-making.

However, one should not throw the baby out with the bathwater. Chains of reaction possibly triggered by management tools, as well as the limited and incomplete character of their outputs, remain valuable means to explore organizational complexity and engage in collective learning. But this comes at a price. First, high level managers should exemplify such a culture by avoiding reflex-based decisions and favor inclusive interpretation processes before reaching conclusions. Second, such leadership needs to embrace a systematic approach that tackles complexity issues throughout the management tools life-cycle. In the following are discussed a set of recommendations organized according to three key life-cycle moments - *diagnosis*, *design* and *implementation*:

• *Diagnosis*

When facing the need to design a new tool or select one from the market, it is suggested the questioning two aspects.

First: what do we really need?

Management tools are usually conceived as means to resolve problems. However, problem formulation is a complex task that deserves full attention. Dewey (1929) noted that problems are nothing but a (necessarily subjective) *sensation of discomfort*. Subsequent decision theory revealed through a descriptive lens how the emergence of problem formulations may follow a chaotic process, in which transient alliances and opportunities for exploiting existing solutions contribute to shaping the problem-formulation process. Through its prescriptive lens, problem formulation is identified as a key part of the decision-aiding process (Tsoukias, 2007), the construction of which should avoid the risk of providing the right answer to the wrong problem.

Second: what do we already have?

The opportunity presented by a new or modified management tool should be examined with respect to the organizational context in terms of the existing ecosystem of tools, as well as the formal and informal practices gravitating around such tools. If possible, upgrading existing and already accepted tools should be given priority. Otherwise, the contextual description should provide a clear representation of the context in which the new tool should fit. Two aspects should be more thoroughly explored:

§ The potential interfaces with existing tools.

§ The risk of existing tools and practices clashing with new developments, and consequently acting as perverse incentives.

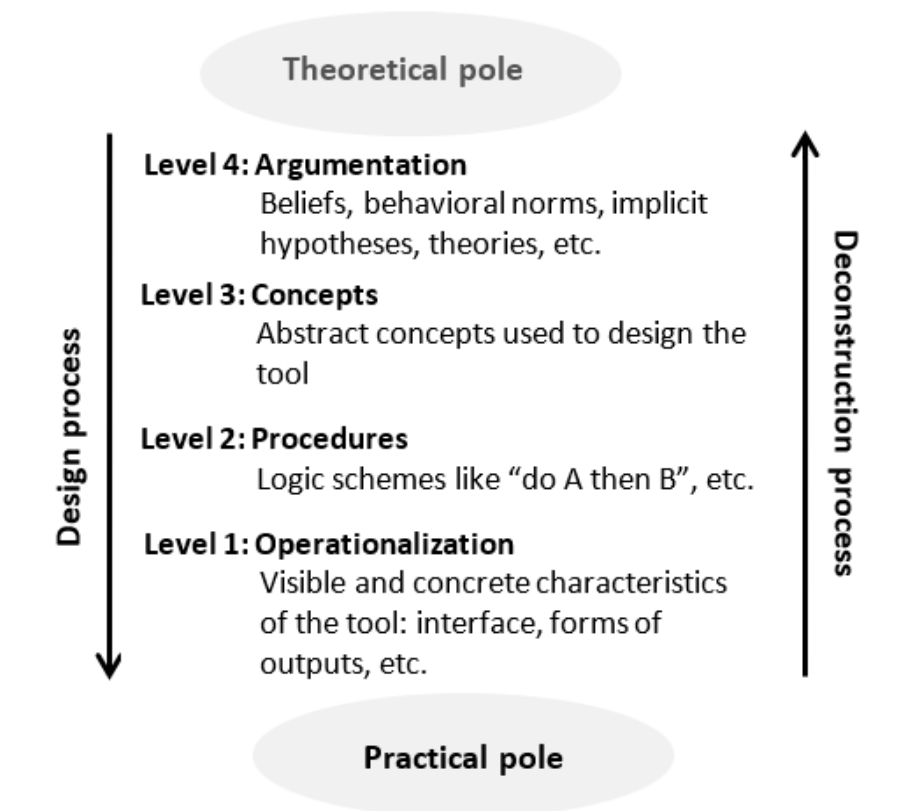
• Design

Designing/selecting a new management tool or upgrading an existing one should satisfy two key constraints: inclusiveness and deconstruction.

Inclusiveness implies the early involvement of stakeholders, the activities of which may impact or be impacted by the tool. Their contribution is expected to provide early insights on the possible chains of reactions that the design hypotheses may have on the organization once the tool is implemented. Of course, the quality of the participatory process (Mazri, Daniell, & Tsoukias, 2019) will strongly influence the predictive ability of the group.

Deconstruction is the act of making explicit to future users all the key philosophical, technical and practical hypotheses that shaped the tool's design. In order to perform this deconstruction, one needs to rely on a descriptive model of management tools, like the one by Hatchuel and Weil (1992) that identified management philosophy, technical substrate and organizational simplification as key descriptive features that can be used to highlight the key design orientations. Another model has been suggested by Gilbert (1998) that distinguishes four levels that may serve to design the tool and also deconstruct it - making its key hypotheses explicit. (Fig.2).

Figure 2. Design and deconstruction of a management tool (Gilbert, 1998)



• Implementation

Management tools are hybrids of the artefacts and practice schemes associated thereto (Lorino, 2002). Accordingly, their analysis cannot be performed without taking into consideration the set of context dependent interactions they may initiate.

Given this, implementation is not the phase where the tool is finally cut free and may navigate independently in the organization; rather it's an opportunity to track the sequence of changes it may trigger. Either positive or negative, these changes need to be identified, analyzed and used as sources of collective learning. To do so, terms of interpretation and associated organizational settings (who should participate in this interpretation, when, how interpretations are communicated and to whom) need to be clearly defined and tested to ensure that the tool's outputs are given the required attention.

FUTURE RESEARCH DIRECTIONS

By analyzing management tools through complexity creation, this chapter's ambition was to provide an additional resource to the scientific effort of gaining a better understanding into why management philosophies and models may lead to failure and disappointments. Accordingly, an exhaustive description of the complexity mechanisms associated with these tools did not need to be sought. Those tools discussed above should act as illustrations of the mechanisms that go beyond the technical substrate of management approaches to question the entangled social interactions resulting from their use.

In doing so, two future research directions emerge. First, a more exhaustive description of complexity mechanisms is needed if we want to achieve a better understanding of success and failures in management practices. This requires engaging in ex-post analyses that trace all alterations in knowledge-relations schemes that follow the introduction of a management tool.

Second, these analyses should not be focused on technical aspects alone. Sections above have discussed the extent to which social interactions around management tools, in their formal and informal mode, could be crucial in shaping such tools' effectiveness. Accordingly, it appears essential to systematize the sociotechnical analyses of management tools' success and failure, which should question the very structure of the tool thanks to the decomposition models discussed earlier as well as the social interactions and their impacts on stakeholders' representations. Needless to say, such work takes time, in fact at least the time required for the complexity mechanisms triggered to become visible so to be analyzed with the necessary hindsight.

CONCLUSIONS

This chapter discusses two key mechanisms of complexity creation that illustrate the paradigmatic evolutions of management tools' status from objective and satisfactory representations of reality to partial, subjective and sources of organizational complexity. The fact that these mechanisms strongly relate to formal management models and concepts provides elements of proof in favor of their repeatability in other contexts. They become therefore not only elements of empirical evidence, but also repeatable mechanisms that should capture managers attention.

Indeed, detecting and dealing with the forms of complexities that result from management tools should be at the top of managers' agenda. Two perspectives should be combined at this level. First, deploy the

required monitoring capabilities to observe and track the alterations in knowledge-relations schemes in order to correct them and eliminate negative externalities. The previous section provides elements of investigation that span from diagnosis, design to implementation. Second, use these alterations to develop collective learning about an organizational, and the very often informal mechanisms that shape everyday life in organizations.

Finally, we believe that this kind of research should act as a warning to managers eager to constantly challenge their organizations by adopting very short cycles of change and implementation of new tools, approaches and philosophies in accordance with the latest management trends. It appears that following recent trends comes at a cost, and therefore necessitates the careful calculation of potential costs and benefits before the adoption of such tools.

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KEY TERMS AND DEFINITIONS

Artefacts: A human artificial construct bearing a significant meaning in an individual or collective process.

Industrial Safety: The set of methods and models aiming at identifying and managing adversarial consequences of industrial activities on all aspects of environment.

Key Performance Indicators: Synthetic measures of performance against key objectives.

Management Tools: Every mean through which a management technique is conveyed in the organization with the mean of rationalizing at least one aspect of its functioning.

Organizational Complexity: The result of highly connected, interacting, and coevolving entities within an organization.

Rationalization: The process of matching an individual or collective behavior with a set of predefined, not necessarily shared, set of preferences.

ENDNOTES

- ¹ The human relation school of management can also be considered part of behavioral theory. It is however distinguished for the sake of clarity, and further acknowledgment of these two trends diversity.
- ² To be found in technology, human behavior, or management.
- ³ Safety Performance Indicators.
- ⁴ Key Performance Indicators.
- ⁵ Term used in the organization to designate a risk that remains longer than expected in the non-profitable area.

Strategic Thinking

12

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INTRODUCTION

Over the last 40 years, strategic management has attempted to provide a normative framework that can be of use to managers in their strategic decision-making. This normative model has featured the typical traits of rational decision-making. The combined efforts of academics, consultancy firms and productive companies have produced a fully-fledged theory of strategy. Furthermore, the contributions of distinguished researchers in the field have given rise to a wide-ranging literature that has helped to guide the training of managers and business leaders, in accordance with the principles and models inspired by the predominant paradigm of the day. The presumed value added by strategic planning even led many large companies to establish specialized departments and allocate significant resources for external consultancies to develop and implement strategic plans.

Despite this, the business world remains plagued by corporate failures, erroneous (or at least misguided) strategies, and inconsistent strategic decision-making (Liedtka, 2000; Chussil, 2005). This raises the obvious question of why, despite the growing knowledge base and information accessible to managers and business leaders, the strategic process continues to be so ill-fated. When called on to speculate about the causes underlying this state of affairs, some have ventured that the reasons may lie in errors of analysis, being lured from the right path by excessive ambition or greed, or other corporate vices. However, the academic debate has leaned towards questioning the normative-rational model of strategic decision-making.

Criticizing traditional approaches to strategic planning has also become the favourite pastime of many business leaders and gurus. The long litany of negative critiques of rational and deliberate planning processes includes arguments that are hard to dispute: that they have lulled managers into a certain complacency by giving them the comforting illusion of certainty; that they have stifled initiative by opting for incremental change over more radical change; that they have emphasized analytics and extrapolation over creativity and proactivity; and that they have denied those closest to the customer a voice in the process. This criticism of strategic planning has emphasized the risks that such transgressions entail in the typical situations surrounding strategic problems, which are characterized by the VUCA environment model (volatility, uncertainty, complexity and ambiguity).

However, when we toss several decades' worth of the strategy literature onto the rubbish heap, what can we replace it with? According to a growing current of thought, the answer is strategic thinking (Dushkov, 2018). This concept has gained an impressive foothold among strategy experts, quickly earning the devotion of critics of strategic planning, who believe in the potential of strategic thinking as a groundbreaking approach to setting strategy that can play a decisive role in maintaining or boosting competitiveness in VUCA environments (Bonn & Christodoulou, 1996). They argue that strategic thinking is the soundest basis for making strategic decisions; indeed, when managers lack this perspective their decisions and subsequent actions are adopted in a way that is fragmented and inconsistent with the company's objectives, that fails to adapt to changes and is lacking in innovation and creativity, thus

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jeopardizing company performance. This shift in the strategy literature has occurred in parallel with the growing conviction since the 1990s, among the management profession, that top-level managers' main problem is the weakness of their strategic thinking, regardless of whether or not their organizations have formal approaches to strategic planning (Bonn, 2001). The thesis is now the real heart of strategy is the "strategist", a strategic thinker who can discover novel strategies which open views to change the rules of competition and modify the chain of events that define the future (McKeown, 2015).

Although an acceptance of the need for strategic thinking has quickly taken hold among management, managerial competence in this regard has remained at unsatisfactory levels for the past two decades (Garratt, ed., 1995). The concept of strategic thinking, what it really entails, and what it looks like in practice, all remain controversial topics (Horwath, 2008). Indeed, there is currently no consensus as well-developed as that on strategic planning. The term strategic thinking is often used so widely and so imprecisely that it runs the risk of becoming a meaningless notion and one that, like many others, has a minimal impact on managers (Horwath, 2002, Oestreicher, 2017). The empirical research on the relationship between strategic thinking and performance has not reported conclusive results to date (Rajagopalan & Spreitzer, 1997; Vance et al., 2007).

This study attempts to address this concern and how to overcome it. The aim is to present the foundations of strategic thinking. Since learning to think strategically can be understood as equivalent to learning to make strategic decisions, the first step is to define what strategic decisions are and what are the drivers that shape them. Different paradigms have been applied to the analysis of the complex nature of strategic decisions and the factors that influence them (Moon, 2013). Our review of these explanatory frameworks for the strategic decision-making process starts with the rational-analytical model of strategy, based on strategic planning, before then reviewing and criticizing it from the perspective of the adaptive strategic approach. Third, we attempt to provide a well-founded explanation of what strategic thinking is and what skills are required of people who want to develop powerful strategic thinking.

BACKGROUND

Not all managerial decisions are equally pivotal. The repercussions on a company's efficiency and competitiveness vary substantially depending on whether the decisions relate to tackling problems, identifying and exploiting opportunities, managing resources, setting objectives or drafting competition and growth plans in known or new businesses; or whether the focus is on everyday choices about how to carry out repetitive and optimizable tasks and processes that form part of the day-to-day life of organizations. The former are examples of strategic decisions, while the latter should be classified as tactical or operational decisions.

The essential strategic decisions can be summarized in the six questions listed in Figure 1. Therefore, the strategic process starts by defining the strategic objectives and, within those, the area of activity or set of activities where the company wants to compete, which requires a strategic analysis of the attractiveness of different industries. Having made this choice, senior management should then decide how to compete in each of the activities, which calls for competitive strategies for each business. They must also identify the desired growth path in the different markets, choosing between organic growth, external expansion or growth in cooperation with other organizations; the corporate strategy is derived from these choices. The decisions regarding the competitive strategy and the corporate strategy both have at their core the generation and maintenance of competitive advantages. However, in open economies, the forces of creative destruction unleashed by Schumpeterian innovation can thwart any competitor who

does not pay enough attention to the sustainability of their competitive advantages. Therefore, managers must also be concerned about competitive dynamics and the assets at their disposal to constantly renew the company's leading position through continuous innovation—both incremental and radical. No less critical are the decisions aimed at fostering an industry-wide transformation that sets new rules of the game in the market. Since these new rules better suit the company's resources and capabilities, the company—led by the decision-maker—can more easily claim an advantage. The sixth decision-making dimension for senior management focuses on the development and management of the resources and capabilities it needs to compete and grow. For this task, it is essential to manage innovative practices and teams and promote learning pathways.

Figure 1. Fundamental strategic decisions



Strategy can thus be seen as a model that inspires, compiles, systematizes and aligns this set of strategic decisions. To carry out this role, the strategy must act as the axis that balances a series of forces that can exert conflicting pressures on managerial decisions: the environmental challenges come in the form of problems or opportunities; the internal forces of the company that dictate its strengths and opportunities; the means that management has at its disposal to achieve corporate objectives, both in the

form of resources and capabilities as well as beliefs and values; and the orientation and pattern that inspire decisions and courses of action, whether analytical (analysis and plans) or forward-looking and creative.

Although this concept of strategy can cover the opposing dimensions and antagonistic forces that operate in any strategic process, we are still a long way off a generally-accepted description of how managers think and make decisions. Following Johnson & Scholes (1999), we can identify at least six approaches to decision-making, each with different assumptions regarding the factors that guide the choice between the available alternatives:

1. The rational manager approach. This approach reflects the classic concept of the decision-making process, which assumes a context of perfect competition with complete, free, openly-available information. The decision-maker's rational behaviour in an environment of this kind would be aimed at the search for the optimum, for a decision that is better than the other alternatives.
2. The satisficing approach. There has been growing acceptance of the decision-maker's bounded rationality in decision-making, as it has been gradually acknowledged that the information available is imperfect. In such circumstances, the decision-maker's behaviour is no longer aimed at seeking an optimal solution—which does not exist or cannot be identified with the means available—but rather a satisfactory alternative given their expectations. Different acceptable solutions to the same problem can thus be identified, depending on what each agent understands by “satisfactory”.
3. Incremental adaptation approach. The satisficing approach still aspires to a decision-making process executed within the classic means-ends framework. However, the increasing complexity and turbulence of the environment and the challenges it raises have multiplied the possible prospective scenarios and the speed at which they are changing, creating an imperfect or multiple future. The decision-maker's rationality would then be limited by unplanned change. Adaptive behaviour would thus be aimed at a decision-making process focused on learning through trial-and-error, and adopting solutions accordingly.
4. Cultural approach. This approach is also based on an incremental explanation of strategy development, although in this case it emphasizes the fact that the manager's decision-making rationality is limited by the cultural frames of reference for the individual, the organization (paradigm), the industry (recipe book), the profession (trade) and territory (regional/national culture), which will dictate the ethical and economic efficiency limits of what solutions can be considered acceptable, as well as the adoption of certain values and routines. Thus, cultural behaviour predicts a decision-making process attuned to accumulated experience, to ways of doing things that are taken for granted (that is, the unquestioned assumptions and routines that are taken as a given) and to the body of decisions accrued over time, as well as the manager's degree of opportunism.
5. Visionary approach. Decision-makers' rationality can also be limited by their perception of the problem and the organizational goals. In this case, their behaviour would be explained by their person profile. This includes leadership skills, through which their decisions map out the course to be followed by other members of the organization. Strategy would thus result not from a premeditated plan, but rather from the governance of an autocratic leader who uses their authority to impose the decision, or from a charismatic leader who can employ their positive influences (reputation, trust, personality) to ensure that all members of the organization are on board.
6. Political approach. The political dimension is also a source of bounded rationality. The decision-maker works in the cross-fire of the power games between actors and networks of multiple interests competing for scarce resources to achieve objectives that may potentially be incompatible. In doing so, they may deploy processes of competition and coalitions. In this scenario, managerial

behaviour can be described as a process of alignment, in the sense that the strategy is the result of negotiation, persuasion and the mutual accommodation of objectives among stakeholders (to resolve differences in expectations between different groups, preventing potential conflict). The ultimate aim is to balance the diverse aspirations of the group in order to secure agreement as to the most politically satisfactory decision that can reconcile collective objectives.

Strategic planning has its roots in the classic rational solution to the problem of strategic decision-making. Viewed from this perspective, a strategy is a considered plan aimed at orienting activities towards the desired objectives, and which is determined on the basis of a limited number of competitive actions for the company to choose from. The rational analysis of the position should then lead to a process of defining the objectives and the plans to achieve them.

Strategic planning as a “way of thinking” is largely similar to the general process of problem solving. The **rational decision-making model** is aimed at choosing the best alternative in any situation, by following a predetermined series of stages. The first is the intelligence phase, which consists in becoming aware of the problem (the reasons behind the need for the decision to be adopted); next, defining the problem (which means obtaining information); then analysing it (which involves analysing the information); developing and evaluating different alternatives (that is, organizing the information to filter out the most interesting ideas so that the plans/ specific alternatives start to take shape); and finally, choosing and applying the best alternative (according to the selected decision criteria). The strategic plan must therefore be consistent with the analysis carried out, addressing both the opportunities and threats that the position presents, as well as corresponding to the company’s strengths and weaknesses and those of its competitors, and any other factors that may arise unexpectedly in the course of competition.

Well-considered strategy approaches help to provide a better understanding of how to manage the principles and structures that apply to specific positions and can result in decision-makers developing a valuable skill. Strategic planning offers a series of advantages: it facilitates a more systematic, logical and rational analysis of the decision; it enables the company to be proactive rather than reactive when defining its future; it helps members understand what the desired goals are; it helps to evaluate less strategic decisions; it enables progress-checks on the strategy (strategic control); and it empowers more people to participate in the process.

Nevertheless, there are still some significant limitations to the rational paradigm of strategy, and overlooking them can entail a series of risks for the company. Despite its popularity, in reality the strategic process does not always adhere to the norms of rational paradigms. We must acknowledge that, quite often, the search for information is not rational. An additional problem with the rational approach is that it involves the belief that there is an optimal way of competing dictated by the structure of the industry. The problem with this approach is that it offers up a choice of strategies that simply reflects the limited number of alternatives proposed by the literature on the basis of an analysis of the competitive environment for the activity. This position entails accepting the notion of a single possible future and excludes the possibility of diverse capacities, while overlooking the inherent problems relating to innovation and creativity or the possibility of surprising strategies from unexpected competitors.

Academic frustration with the problems inherent in the rational approach to strategy, relating to information, copycat strategies, determinism and innovation, prompted explanations that value cognitive issues, as well as the political and cultural dynamics that can generate *emergent strategies*. These strategies are constructed without intentionality, or even in spite of it (unconscious development of behaviour patterns). A preference for one of these approaches to strategy over the other has triggered impassioned academic debates, including the one led by Ansoff (1987, 1991, 1994) and Mintzberg (1990,

1991, 1994a, b, c), and between Seth & Zinkhan (1991) and Montgomery, Wernerfelt & Balakrishnan (1989, 1991). While one school of thought defends the formal nature of the strategic decision-making process, which should be directed by clear guidelines and carried out on the basis of a rational analysis of the problem, the other argues that it is impossible to *a priori* define planned strategies that delineate the future of the organization, when in fact they can only really be seen *a posteriori*, when analysing the company's past performance.

Nevertheless, when it comes to making strategic decisions one cannot approach it in too cavalier a fashion, disregarding possibilities that may turn out to be crucial. As Simon & March (1958) also argued, one cannot go from a rational model, which is supposed to be capable of producing an exhaustive examination of all decision alternatives and their consequences, to a garbage can model, where problems and solutions are haphazardly mixed together, throwing out decisions at random. Faced with complex decisions, many managers end up making decisions without having properly evaluated the requirements of the situation and the available resources, thus giving rise to unintended consequences.

FOCUS OF THE ARTICLE

The Presumed Dichotomy or Analogy Between Strategic Planning and Strategic Thinking

Strategic thinking has been put forward as an alternative paradigm capable of overcoming the limitations of strategic planning. However, the term is not without its difficulties. The first is of a conceptual nature. The proliferation of studies that employ this concept has generated a great many definitions of the term strategic thinking; however, they do not converge on a single meaning and differ notably in terms of their specific characteristics.

One group of authors (i.e., Morrissey, 1996) has used this term almost interchangeably with other concepts such as strategic planning or strategic management. For example, Wilson (1994: 14), when describing the evolution of strategic planning processes, observed the following: "This continuing search for improvement has profoundly changed the character of strategic planning so that it is now more appropriate to refer to it as strategic management or strategic thinking"

Another line is taken by those who have opted for broad, seemingly all-inclusive definitions, such as that offered by Nasi (ed., 1991): "Strategic thinking extends both to the formulation and execution of strategies by business leaders and to the strategic performance of the total enterprise. It includes strategic analysis, strategic planning, organization and control, and even strategic leadership. Therefore, strategic thinking basically covers all those attributes which can be labeled "strategic".

These pioneering conceptualizations have left serious gaps in the understanding of what strategic thinking is. Their main limitation is that they fail to specify the characteristics of strategic thinking. None of these uses of the term is consistent with the idea that inspired its advocates, for whom thinking is not the same as planning. Thinking is a mental process applied by an individual for achieving success in some game or problem. Then, as cognitive activity, it gives thought. Planning is also a mental process but with objectives very different (Liedtka, 1998b; Bonn, 2001; Graetz, 2002; Abraham, 2005). Within the defenders of conceptual differentiation, it is also possible to distinguish two approaches.

The first conceptualization conveys the idea of a dichotomy between the analytical and creative aspects of strategy making. Thus, Raimond (1996) divides strategic thinking into two modes: "strategy as intelligent machine" (an information processing approach, driven by or based on data) and "strategy

as creative imagination”. Nasi (ed., 1991) differentiates between the harder analytical approach, with its traditional focus on competition, and the softer approach, which emphasizes values and culture. This literature gives the impression that strategic thinking is incompatible with strategic planning, as we understand it. This polarization does not seem advisable since both aspects are clearly required in any serious strategy-making process.

Another perspective holds that thinking strategically and planning strategically refer to sequential processes, at least in cases where good strategic planning helps strategic thinking (Ohmae, 1982, Porter, 1987). As such, the notion of thinking strategically refers to the conception of ideas, the generation and application of knowledge to create business strategies through which an organization meets its objectives. The planning process serves as a tool to help implement the strategy chosen as a result of strategic thinking. The objective of strategic thinking is to discover novel and imaginative strategies that can rewrite the rules of the competitive game and visualize potential future scenarios that are significantly different from the present. Therefore, its essential features are creativity, synthesis and divergence. Conversely, the objective of strategic planning is to operationalize the strategies developed through strategic thinking, and to support the process of strategic thinking. To that end, it is based on analytical, conventional and convergent processes.

For Mintzberg (1994c: 107-108), the term “strategic thinking” is not merely alternative nomenclature for everything that falls under the umbrella of strategic management; rather, it is a particular way of thinking, with specific characteristics. Mintzberg has devoted a great deal of attention to articulating the differences between strategic thinking and strategic planning. He argues that strategic thinking is a process more related to synthesis (connecting the dots) than analysis (finding the dots), “capturing what the manager learn from all sources (both the soft insights from his or her personal experiences and the experiences of others throughout the organization and the hard data from market research and the like” and then synthesizing that learning into a vision of the direction that the business should pursue”. Therefore, strategic thinking cannot be systematized and should involve intuition and creativity. Whereas strategic thinking is the critical part of strategy formation, strategic planning is an analytical process happens around the strategy formation or strategic thinking, by providing inputs for the strategist and programming the implementation of strategies that have already been already identified. Then the outcome of strategic planning is a plan.

Mintzberg argues that rather than occurring hand-in-hand with strategic thinking, traditional planning processes tend to leave no room for strategic thinking, and as a result, they hinder the successful adaptation of the organization rather than support it. Prahalad and Hamel (1996), two other highly influential strategy theorists, join Mintzberg in denouncing traditional approaches to planning, which they describe as “strategy as form filling.” Although they use the term “crafting strategic architecture” rather than “strategic thinking”, the concept involves the same themes of creativity, exploration and understanding discontinuities.

There is a clear need to implement processes and plans to ensure that managers’ packed daily schedules do not cause them to overlook strategic issues. Therefore, we cannot entirely lose focus of strategic thinking definition on the strategy formulation process; what we need is to know how to transform today’s planning process into a way of strategy-making that integrates rather than undermines strategic thinking (Liedtka, 1998a, b). Thereby, as Graetz (2002) writes, strategic thinking and strategic planning are “distinct, but interrelated and complementary thought processes”. In the model of Graetz, the role of strategic thinking is “to seek innovation and imagine new and very different futures that may lead the company to redefine its core strategies and even its industry”; and the role of strategic planning es “to

realise and to support strategies developed through the strategic thinking process and to integrate these back into the business”.

Stacey (1991) approaches strategy through a different lens, referring to the discoveries yielded by the new science of quantum physics and complexity theory. In so doing, he reaches almost all the same conclusions as the authors mentioned above. However, he is wary of identifying future vision as a key driver of strategy, since he sees the strategy-making process as successful when it is founded on “designing actions on the basis of new learning”, rather than following “pre-programmed rules.” He claims that strategic thinking is not “an intellectual exercise in exploring what is likely to happen (...) strategic thinking is using analogies and qualitative similarities to develop creative new ideas.”

Heracleous (1998) distinguishes between strategic planning and strategic thinking with reference to the analogy between single-loop learning and double-loop learning. While single-loop learning involves thinking about strategies within the preestablished framework of assumptions and putting them into action through a fixed set of programmed movements, double-loop learning is characterized by challenging pre-existing assumptions and by developing innovative solutions and actions. The first type of learning would correspond to strategic planning and the second to strategic thinking, although the author points out that both processes are interrelated in a dialectical dynamic, with both being equally essential for effective strategic management.

The Concept of Strategic Thinking

From these ideas, strategic thinking is understood as the mental or thinking process in which individuals make strategic decisions in organizations, with a view to making a difference in terms of results through imagining both innovative and challenging conventional responses to difficulties, and unique insights focused to create competitive advantages for a firm.

Strategic thinking implies some notes:

1. The critical strategic question is not the conventional “what”, as “why” or “how” (Raymond, 2010).
2. Its basis is the will to positively change an organization’s future. Therefore, it includes the capacity for developing a strategic prospective for exploring all possible futures (Conway, 2016).
3. This ability is becoming increasingly crucial to identify and seize opportunities before competitors do, and to prevent risks that may negatively impact the company’s competitive position, when it is in a scenario characterized by complexity, uncertainty, fast-changing, work under the pressure of competition and incomplete or limited information.
4. Strategic thinking incorporates mission, vision and strategy, which tend to be intuitive elements (based on feelings) rather than analytical (based on information). The company vision is based more on the decision-makers’ feelings and perspectives than the results of any systematic analysis.
5. Reaching an agreement on these elements among the members of the company’s management team is an essential prerequisite for effective strategic planning. Strategic thinking is therefore the result of the coordination of creative minds within a shared perspective that visualizes progress towards the desired objectives.
6. It can be a process developed individually or collaboratively. Group strategic thinking should create more value because it enables a creative dialogue among people within share on complex issues.

FUTURE RESEARCH DIRECTIONS

Future research should primarily focus on more precisely delineating the characteristics that define strategic thinking and on drafting practical models that facilitate its incorporation into managerial practice. The lack of a generally accepted definition for strategic thinking leaves open the question of how strategic thinking is different from other ways or styles of thinking.

But there is also no a standardised list of key competencies of strategic thinkers (Hussey, 2001). Strategic thinking integrates elements of 10 other types of thinking (Figure 2). As indicated by Bonn (2001), the defining elements of strategic thinking can be categorized on two levels: individual and organizational.

Figure 2. Types of thinking incorporated in strategic thinking



The first revealing feature of strategic thinking is its positivity. **Positive thinking** (Miller, 2005) implies the will to shape the future and the eagerness to pursue it, without fear of risks and the unknown, trusting in one's own strength and taking responsibility for one's destiny. A good strategist must, by nature, be an optimist, someone who believes in their ability to shape the future and who conveys an enthusiasm for pursuing this goal. As the French writer Maupassant claimed, the only true fear is fear of the unknown.

This is precisely the challenge that the strategy-maker must overcome: the fact that people are typically averse to any processes of change that involve risks. The positive management of change must be able to successfully deal with these fears and emotions. The empirical study of the effects of expecting good things to happen has been developed from Scheier & Carver (1985). The empirical literature review on the effect of positive psychology interventions in organizations by Meyers, van Woerkom & Bakker (2013) concludes this attitude can be a promising tool for enhancing employee well-being and performance.

Second, strategic thinking is **competitive-cooperative thinking** because it is endowed with a competitive spirit but works within a pattern of cooperation. Competitive thinking (Porter, 1987) is focused on achieving objectives in conditions of competition against opponents, who often have irreconcilable objectives of their own. This forces us to make the best possible decisions, in a spirit of self-improvement, as well as to analyse and understand our adversary's strategies. At the same time, however, the strategy to compete requires the cooperation of different resources to lock down a joint strategy. The collaborative problem solving skills have been identified among the most critical competencies necessary for success in the workforce (Oliverly, Lawless & Molloy, 2017).

The mere fact that we are talking about strategy connects this topic to the future. **Proactive-anticipatory thinking** (Alsaaty, 2007; Bindl & Parker, 2010; Wu & Wang, 2011) emphasizes seizing opportunities or anticipating problems in advance, so that, without neglecting the present, it is possible to plan for the future and then strive to make it a reality. Strategic thinking "is not driven by future intent alone" but it is *thinking in time* being able to combine past, present and future at the same time in the mind of strategic thinker to create better strategies (Liedtka, 1998b). This type of thinking therefore incorporates three aspects:

- a) Proactively anticipating what is to come. Compared to "reactive management," which spends its time "putting out small fires," dynamic managers strive to anticipate future events in order to deploy actions that prevent threats and give them a head-start on seizing opportunities.
- b) Taking the initiative to convert the threats or opportunities identified into action plans. Although strategic thinking entails reflecting on the future, it goes beyond an intellectual exercise and must be driven forward by people who take realistic action, and who have the determination to overcome the difficulties in identifying and exploiting opportunities. Their work is intense as they spend most of their time "doing" and identifying and solving problems.
- c) Adaptability. Dynamic thinking shows a great capacity to adjust quickly to changes in the environment.

Such proactivity has been empirically recognized as a positive behaviour than can lead to the increased performance of individuals and organizations, specially when they are required to respond to changing issues (Griffin, Neal & Parker, 2007; Wu & Parker, 2013).

Strategic thinking not only engenders intense activity to identify and solve problems (development of new products, creation of new markets, innovative organizational designs, etc.), but also displays the ability to find solutions that can be achieved through linear or non-linear pathways. Therefore, it requires combining logical-analytical-systemic thinking with critical-creative-intuitive thinking. Below we examine what these two skill areas consist of.

Logical or logical-linear thinking (Hume, 1739, 1748; Newton, 1728, 2004; Cohen & Smith, eds., 2002) is the traditional way of thinking that can be called "mechanistics" or "Newtonian" and is thus positioned within pre-established systems analogical line paradigms developed by Laplace and Newton. Accordingly, it seeks to solve problems and achieve objectives based on logical predictions (linear interpretation of the cause-effect relationships between facts or data and results) and by applying lessons

learned in similar experiences from the past (Vance et al., 2007). This way of thinking results in incremental approaches to change within an existing organizational mindset in order to develop a deliberate strategy (Mintzberg, 1990). However, there is some empirical evidence humans reason deductively on logic problems and they can reach a good level of formal deductive operations if they are educated in logic disciplines (i.e., Bringsjord, Noel & Bringsjord, 1998; Coetzee & Monti, 2018). Together, from Simon (1956), it is widely accepted even in theory it might be possible to make a rational (and therefore perfect) decision, real-world decisions are made using fast and frugal heuristics that would satisfice rather than maximize utility over the long run (Rachlin, 2003).

Logical thinking rests on **analytical thinking** (Turney, 2009; Brown, Moore & Turney, 2012) or vertical thinking (De Bono, 1970), which in turn is based on the linear application of a series of steps following a pre-established and inflexible order and adhering to certain norms that are considered infallible. It works by breaking down complex processes and realities into parts so that we understand their principles and components, which are identified and categorized. We visualize the interrelationships between these components and organize all the information according to pre-established criteria for the achievement of an objective or the resolution of a problem. Therefore, it is deductive, rational and convergent.

Developing the ability to devise plans begins with an objective and exhaustive evaluation of the problem. Strategic thinking raises managers' awareness of the need for an in-depth examination of the market position, going beyond the superficial features of complex situations to understand their structure, and the strengths and weaknesses of both the company itself and its competition. The analysis should be set within the renowned SWOT framework, as well as the processes that lead to such structures.

Under the rational model of decision making, the process of selecting a strategy, a plan or even a movement entails the strategy-maker following a process inspired by the standard problem-solving approach. This is based on a systematic analysis of the problem, which involves collecting, selecting, organizing and applying information. With this approach to problem solving, each idea and action must have an underlying intention and must be supported by an evaluation process as to why one alternative has been chosen over another. This procedure trains its practitioners to make rational decisions, and to be able to give a logical explanation of the reasons for their choices.

But strategic thinking also requires synthesis. As such, it calls for **systemic thinking** (Hamel, 1996; Raymond, 2010; Chussil, 2005), which seeks a global vision of the system rather than just the agent, an understanding of the organization and its environment. Compared with analytical thinking, which typically involves breaking things down into parts, systemic thinking constructs an overarching mental model of the complete end-to-end system of value creation (Liedtka, 1998b). Making up the whole from the sum of its parts uncovers the interconnections between the pieces and gives rise to archetypal structures or patterns. The mind of the strategy-maker is generalist par excellence. "The strategist must have a great capacity for both analysis and synthesis; analysis is necessary to assemble the data on which he makes his diagnosis; synthesis in order to produce from these data the diagnosis itself" (Beaufre, 1965).

It is undeniable that rational analysis supported by logical-analytic-systemic thinking can provide many useful ideas. But logic, analysis and synthesis are only three of the components of strategic thinking, which also involves critical vision, open-mindedness, intuition, creativity and innovation. They all follow non-linear paths of thinking, which diverge from the known linear pathways. Moreover, strategic thinkers are often characterized by their ability to find innovative and creative solutions, which they generally prefer to solutions which have already been tested and proven. As Liedtka (1998b) indicates, strategic thinking is *hypothesis driven* and so ensures that both creative and critical thinking are incorporated into strategy making. The empirical research of critical factors for strategic success born from creative and analytical thinking points out it is non-linear thought that is the main responsible for an improved score

(Hussey, 2001). But there is also empirical evidence managerial thinking is a continuum identified with the linear and non-linear patterns of thinking which are used in different contexts: linear thinking pattern should be used in structured and static situations or problems, while non-linear thinking patterns produced better decisions when out-of-the-box decision-making are required (Bratianu & Vasilache, 2010).

Open-minded and critical thinking (Lai, 2011; Chatfield, 2017; Lovell, 2018) involves breaking free from the pre-established systems, conventions, and truth systems. Critical thinking is the ability to think rationally, and to evaluate the information presented to us, as well as our own thoughts. The idea behind this concept is to give us a greater capacity to identify true and false ideas and ideologies. Along with knowledge and technique, creative thinking is essential in order to break down the barriers of routine when defining objectives and plans. With creativity and imagination, options can be found that a routine analysis would fail to unearth. While logical thinking assumes positions within pre-established systems and paradigms in line with similar past experiences, strategic thinking also implies the ability to break free from pre-established systems, conventions, and truth systems. **The strategic thinking process does not look for out-of-the-box thinkers, but rather critical thinkers**, who question the information they receive and make sound decisions on the basis of clearly established objectives.

The reason why this mental process needs to be developed is because these days we are faced with thousands of readily-available sources of information, which, unfortunately, are not always genuinely grounded in a rational way of thinking, based on real knowledge that has been challenged. Critical thinking is the tool that allows us to evaluate the new pathways that an open mind will put in front of us. It is the mental process that we must follow to objectively choose the most appropriate way to reach the goal that we have set.

Creative thinking thus challenges the conventional mental model with: (1) an open-mindedness that allows us to weigh up facts that were not initially considered and so find pathways that are normally overlooked; (2) a forward-looking orientation that allows us to anticipate the actions that will be triggered by our strategy and to anticipate measures to address them (De Bono, 1970; Katz, 1997; Hussey, 2001; Runco, 2004; Sternberg, 2006).

Intuitive thinking (Sadler-Smith & Shefy, 2004; Dane & Pratt, 2009) is the unconscious process of making quick—though not necessarily irrational—choices, based on distilled experience and instinctive reasoning. Experts accumulate experiences and classify them, consciously and unconsciously, in the form of cues or patterns that they can later use to choose one option or another without the need for exhaustive analysis.

Lastly, **dynamic-adaptive thinking** displays an aptitude for rapidly adjusting to changes in the environment. The ability to adapt is thus one of the most relevant skills in a company. It is the key to determining whether the strategy that was successful in the past may now be leading us to failure. Managers therefore need skills to align their organizations with their environment (Senge, 1990). Liedtka (1998b) talks about *intelligent opportunism* in the sense of responsive attitude in front of good opportunities: “The dilemma involved in using a well-articulated strategy to channel organizational efforts effectively, and efficiently must always be balanced against the risks of losing sight of alternative strategies better suited to a changing environment”.

The empirical research has confirmed strategic thinking can help business leaders both to develop confident forecasts and to reduce the uncertainty of strategic decisions (Barnett & Berland, 1999), but the relationship between strategic thinking and performance shows uncertain findings (Rajagopalan & Spreitzer, 1997; Vance et al., 2007). Whereas authors as Hambrick & Schechter (1983), Haveman (1992) and Zajac & Kraatz (1993) reports a positive relationship, other researchers have found strategic thinking is associated with a low performance (Jauch, Osborne & Glueck, 1980; Singh, House & Tucker, 1986),

there are mixed results (Smith & Grimm, 1987) or not are significant relationships (Zajac & Shortell, 1989; Kelly & Amburgey, 1991). This state of the question indicates strategic thinking has a hard challenge to improve firm competitiveness and performance, because requires reconciling competing hypothesis about the industry and firm futures and integrating divergent views into a coherent strategy. The contradictory findings in empirical research show the effects of strategic thinking on results are not direct, as explicitly or tacitly a lot of prior studies have assumed, but they depend on the conjunction of a varied portfolio of capacities integrated by different thinking modes. However, we know little about how developing these key skills for strategic thinking (Casey & Goldman, 2010). Therefore, it is necessary to promote longitudinal research that allow us to better understand the process of training of the ability to think strategically.

CONCLUSION

Starting from the premise that equates learning to make decisions with learning to think, this article conceptualizes intelligent decision-making as clarity of thought (not clairvoyance) based on uncertain and incomplete information. A good decision (and a good strategy) will probably be a shrewdly calibrated combination of rational analysis and pre-emptive actions based on the economic logic stemming from the dominant paradigm in the management team, along with a good dose of intuition, judgment, experience and an ability to unlearn the established models and explore new ones.

“Change for the sake change” should be avoided, but we should bear in mind that inability to change can be disastrous. The strategic plan must be well defined such that it involves the least change possible. Frequently switching plans is often an obstacle to achieving excellent results. Thus, once a strategy has been chosen, the company should execute it consistently. But great managers are always willing to modify their plans according to the circumstances. The competitor is a key element in the game, as it has the power to alter the course of the situation; to win, the strategy-maker must adapt to this shift by changing the plan and outmanoeuvring competitors to build a sustainable competitive advantage. The emergent approach is necessary to maintain this adaptive climate. Great managers excel at detecting these emerging opportunities and are thus always willing to modify their plans to take advantage of them.

Shifting circumstances and management’s constant efforts to improve strategy mean that a company’s strategy evolves over time. Strategy is always temporary and is being tested or is evolving. Thus, strategy-making is a process and not a one-off event. Strategic thinking should therefore view strategy not as a single, long-term detailed plan that must be followed to the letter, but as a portfolio of future options. Strategic thinkers work with a considerable range of strategic plans, with a series of consecutive plans. Given the prevailing uncertainty in any position, the strategy only aims to define a long-term vision of where the company wants to go and how to get there, but always allows a degree of flexibility to adapt to the circumstances.

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KEY TERMS AND DEFINITIONS

Creative Thinking: This is the type of thinking that challenges the conventional mental model with an open-mindedness that allows us to weigh up facts that were not initially considered, and thus find pathways that are normally overlooked. It encompasses a forward-looking orientation that allows us to anticipate the actions that will be triggered by our strategy and to anticipate measures to address them.

Critical Thinking: This is the type of thinking that involves breaking free from the pre-established systems, conventions, and truth systems, and that questions the information received to detect false or obsolete paradigms. Along with knowledge and technique, creative thinking is essential in order to break down the barriers of routine when defining objectives and plans.

Emergent Strategy: The type of strategy that is formed without an intentional, deliberate plan, or outside of such a plan. Its basis is the unconscious development of patterns of behaviour inspired by cultural and cognitive standards.

Strategic Decisions: These are the management decisions considered pivotal due to their impact on the company's efficiency and competitiveness. They concern how to tackle problems, identify, and exploit opportunities, manage resources, set objectives or draw up competition and growth plans in known or new businesses.

Strategic Planning: This is the process aimed at developing a deliberate plan that orients the company's activities towards the desired objectives. It is based on the systematic and analytical analysis of the competitive position and the model of the rational decision-maker.

Strategic Thinking: Strategic thinking is a particular way of thinking about new strategies, whose characteristics include a taste for competition, an optimistic outlook, the combined application of data and logic, judgment based on experience as well as critical assessment, intuition, creativity and imagination, and a global vision—all aimed at creating a completely new perspective.

Strategy: The strategy is the path that is consciously and purposefully chosen (from a number of alternatives) by the management of the company to mobilize all its resources and capabilities over the long term in order to compete in selected markets and adjust to the challenges of the environment. The company can thus provide value to consumers, achieve a sustainable competitive advantage that can be defended against competition, meet its strategic objectives and satisfy all its key interest groups.

Neurostrategy

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INTRODUCTION

One of the most prominent and fascinating advances that have helped us to understand many of the facets of human behaviour in organizations is the rise of the interdisciplinary approach. This is especially true when it comes to the role played by management experts in formulating and implementing their organization's strategy, and in the subsequent results. Of all the disciplines that currently have implications for strategy, particularly notable is the interdisciplinary contribution from the field of neuroscience (Butler, 2014). Following the path opened up by the Human Genome Project, neuroscience took an exponential leap forward when the United States government declared the 1990s to be the Decade of the Brain. The rapid expansion in research continued during the first decade of the 21st century, known as the Decade of the Mind. The advances made in our understanding of the complex network of interconnections between the language of the brain and of the mind has radically expanded the frontiers of neuroscientific knowledge.

More advanced knowledge about the human brain has brought with it a deeper understanding of its internal functioning. At the same time, this has called into question the key premise of economics, which views people as utilitarian individuals who make completely rational economic decisions. Since economics has thus far been the most influential discipline behind strategy theory, managers should attempt to understand the principles of behavioural neuroscience (Glimcher & Rustichini, 2004; Lieberman, 2006). This field highlights the capabilities of the human brain; however, it also raises awareness of its inherent risks, habits and oversimplifications and their implications in terms of decision-making, given that they are behind a lot of bad economic and business decisions.

Although the study of the biological bases of human behaviour in organizations is still in its infancy (Zyphur et al., 2009: 70) and the application of this knowledge to managerial practice does not seem to be on the immediate horizon (Balthazard et al., 2012; Peterson et al., 2008; Waldman et al., 2011), there is a broad current of thought endorsing the benefits of neuroscientific decision-making research and the role played by emotions, gestures and symbols, semantic processing, human interactions and neuronal connections, almost to the point of putting knowledge of the human brain at the very core of modern management. In 2004, the magazine *Frontiers in Human Neuroscience* published a special issue on *Society, organizations and the brain*. In the field of management, it is worth mentioning the study on "Information, attention and decision making" published by the Academy of Management Journal in June 2015.

Hannah et al. (2013) describe a cognitive revolution driven by an understanding of the mental processes that explain people's behaviour and effectiveness. They argue that this paves the way for a multidisciplinary and multi-method approach to the conceptualization of organizations and their management. Neuroscientific research applied to human behaviour in organizations could thus be seen as providing profoundly innovative, heterodox and even radical ideas, and it may also give rise to new approaches and methods aimed at uncovering the human decision-making process, in a way that would otherwise be

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unattainable. This could represent a significant step forward in knowledge about how to more effectively design and govern social groups with predetermined objectives.

Neuroscience promises especially significant contributions to strategic management research and practice. This discipline is focused on studying the behaviour of a specific type of decision-makers and decisions: those of a strategic nature. There is an ongoing debate about the pros and cons of substantive collaboration between neuroscience and strategy, in a field referred to as **neurostrategy** (Powell, 2011; Ascher et al., 2018). An emerging literature has argued in favour of the potential of neuroscience to improve our understanding of the biology of the brain and how it links to economic and financial decisions (e.g., Camerer, Loewenstein & Prelec, 2005; Camerer, 2008). An emergent notion is that strategic management needs neuroscience and can benefit from its research in three ways: by validating constructs, testing theory, and informing strategic practice. But the intellectual boldness entailed in ideas about the neuroscience of behaviour, and the direct threat that these ideas pose to established, accepted paradigms have shaken certain disciplines, which claim such notions are incompatible with the conventional heuristic approaches of their fields of study. Therefore, there is a notable school of thought that has criticized the application of neuroscientific research to economic decision-making and to management and organization studies (Gul & Pesendorfer, 2008; Bernheim, 2009). Regarding the criticism of the application of neuroscientific research to organization studies, and by extension to strategic management, it poses some relevant theoretical and methodological challenges, rightly identified by Lee, Senior & Butler (2012). This line of criticism advocates a careful evaluation of the organizational applications of this field (Foxall, 2014), while some even directly rule out the notion that neuroscience can make a positive contribution to the advancement of management (Lindebaum, 2013; McLagan, 2013).

As Butler et al. (2016) point out, behavioural neuroscience “is at a crossroads in its theoretical development”. Healey & Hodgkinson (2014: 76) succinctly capture the state of affairs in the following terms: “At one extreme, advocates such as Becker et al. (2011) are calling for a new, biologically rooted, subfield that aims to map neural mechanisms as the prime causes of organizational behaviour (...) At the other extreme, scholars are warning that applying neuroscience to management and organization studies is a dangerous distraction”

This article presents a review of the literature that analyses the contributions of behavioural neuroscience to the study of managerial decision-making and offers a critical evaluation of its implications for management and organization studies, especially in the field of strategy. First, the paper explains the scope of Neuroscience as discipline and its developments applied to social sciences, with the purpose readers can understand its potential to explain human behaviour in general and the economic behaviour specially. Second, it reviews the most recent literature on neurostrategy by developing its implications to understand the mind of the strategy-maker and so approximating to the authentic expert judgement in strategy. The analysis continues by offering both an approximation to the possible applications of the neuroscientific knowledge to managerial practice with the objective to identify and prevent some problems as cognitive biases, and useful recommendations for decision-makers. The description of the forms of strategic behavior categorizes them into four models: rational, limited rationality, psychologically motivated and biologically induced. Finally, the paper maps out the main strands of the debate in the future.

BACKGROUND

Neuroscience is a relatively new discipline that seeks to better understand the neurological and cognitive bases of human decisions and actions. It incorporates the contributions of a set of scientific disciplines

that study the structure and function, biochemistry, pharmacology and pathology of the nervous system, as well as how the different elements interact, giving rise to the biological bases of behaviour.

At the highest level, interest is focused on the contributions of the emerging field of **behavioural neuroscience**. This is an eminently interdisciplinary field, bringing together neuroscientists, economists and psychologists (Ochsner & Lieberman, 2001; Glimcher & Rustichini, 2004). Lieberman (2006) defines this subject as dedicated to the study of human brain processes to allow people to better understand themselves and others. The discipline incorporates three areas of work: social neuroscience, concerning the relationships between brain mechanisms and aspects such as trust, cooperation, altruism, reputation or social status; cognitive neuroscience, centred on the biological underpinnings of decision-making; and affective neuroscience, exploring the relationships between brain activity and feelings and emotions. Nowadays, behavioural neuroscience provides a new way of understanding the brain and consciousness that is sure to change current conceptions about the mental processes involved in human behaviour and their biological bases.

The discipline that is being formed through the application of behavioural neuroscience theories and methods to the field of organizational studies has been labelled **organizational cognitive neuroscience** (Butler & Senior, 2007; Senior, Lee & Butler, 2011; Senior & Butler, eds., 2007)¹. Senior, Lee & Butler (2011: 805) define organizational cognitive neuroscience as “a genuinely multidisciplinary approach (...) [that may] incorporate the use of prior knowledge of brain systems to develop new hypotheses about organizationally relevant issues.” Within the framework of organizational cognitive neuroscience, there are a number of works that combine its theories and methods to explore questions of interest in the field of organizational studies. These include attempts to better understand the cognitive bases of decision-making and the actions of business leaders, in order to provide recommendations on exercising a managerial role, and to analyse and understand human behaviour within organizations. This literature is also concerned with gaining a deeper understanding of key aspects of the biology of the human brain, in the hope that it will provide ideas to characterize good leadership, and will offer equally valuable lessons on how to become a better leader.

The term **neuromanagement** was originally proposed by Quingguo Ma (2006), director of the Neuromanagement Laboratory of Zhejiang University, to designate the scientific field that relies on organizational cognitive neuroscience and technology to explore the brain activity and mental processes involved when people face typical management problems, such as decision-making, as well as other key social behaviours in organizations such as leadership or teamwork. As such, its focus of attention is on the micro-mechanisms of managerial activity, which it studies via an interdisciplinary approach that integrates management science, economics and cognitive neuroscience.

Within neuroscience there is a field of special significance for strategy: neurostrategy. Despite the broad domain covered by neuromanagement, a new field of knowledge has emerged; Powell (2011) coined the term neurostrategy to define it, describing it as “research at the intersection of strategic management and behavioural neuroscience”. As such, neurostrategy is the discipline dedicated to uncovering the process of formulating and implementing an organization’s strategy, by examining the biological determinants of the functioning of the strategy-maker’s brain.

Working in parallel, the study of non-rational choice behaviour and its impact on human health and well-being comes under the term **behavioural economics**. The principal differences between this and the dominant economic paradigm is that it takes into account irrationality and environmental influences on the dynamics of choice behaviour. This new perspective of economic decision-making represents an intersection of psychology and microeconomics (Jarmolowicz et al., 2015). A seminal contribution to cognitive psychology was that of Daniel Kahneman, who in 2002 was awarded the Nobel Prize in

Economics “for having integrated insights from psychological research into economic science, especially concerning human judgment and decision-making under uncertainty”. Kahneman’s principal contribution to economics was prospect theory, which he developed together with Amos Tversky (Tversky & Kahneman, 1974, 1981; Kahneman & Tversky, eds., 2000). The central postulate of this theory is that, in conditions of uncertainty, people do not make decisions based on the probability of greater gains but rather are guided by a series of heuristics (Kahneman, Slovic & Tversky, 1982). Following the path of the cognitive approach, behavioural economics research (Thaler, 1980; Russo & Schoemaker, 1990; Baron, 1994; Hammond, Keeney & Raiifa, 1998; Thaler & Sunstein, 2008; Camerer & Loewenstein, 2004; Kahneman, 2011) has focused on the cognitive biases and emotional factors that influence individuals’ decision-making preferences.

Powell (2011: 1495) set out four key questions that could be used to judge whether the neuroscience-inspired programme of empirical research on strategy is positive and promises to be of value:

1. Does it focus on a core problem in strategic management research or practice?
2. Does it pose pressing new questions for neuroscientists?
3. Has it been neglected in other fields and is it likely to remain so?
4. How does the neuronal evidence improve our understanding, by validating constructs, testing theory or informing strategic practice?

FOCUS OF THE ARTICLE

The Study of Core Problems of Strategy From the Rational Paradigm and its Criticism

The first critical theoretical point to be resolved regarding neurostrategy is whether it can contribute to a better understanding of core strategic management issues. It would only make sense for strategy research to ask questions about the brain if it helped us to better understand the mechanisms of strategic decisions. Therefore, a first step should be to identify core strategic problems.

The essential strategic questions are: where to compete, which forces us to analyze the attractiveness of the structure of the different industries, consumer trends, the dynamics of competition and to decide the portfolio of activities of the firm; how to compete, which involves designing competitive strategies in each business; how best to take advantage of the resources and capacities to grow, which forces us to choose between the various growth strategies (alliances, mergers, etc.); how to maintain and increase the competitive advantage, which leads to think about the differentiating elements in which to sustain a unique positioning in the market; what will be the profit model; how strategic movements will be organized in time and place; and how to change the rules of the game, an aspect that refers to decisions aimed at transforming the industry and the market for the benefit of a competitor.

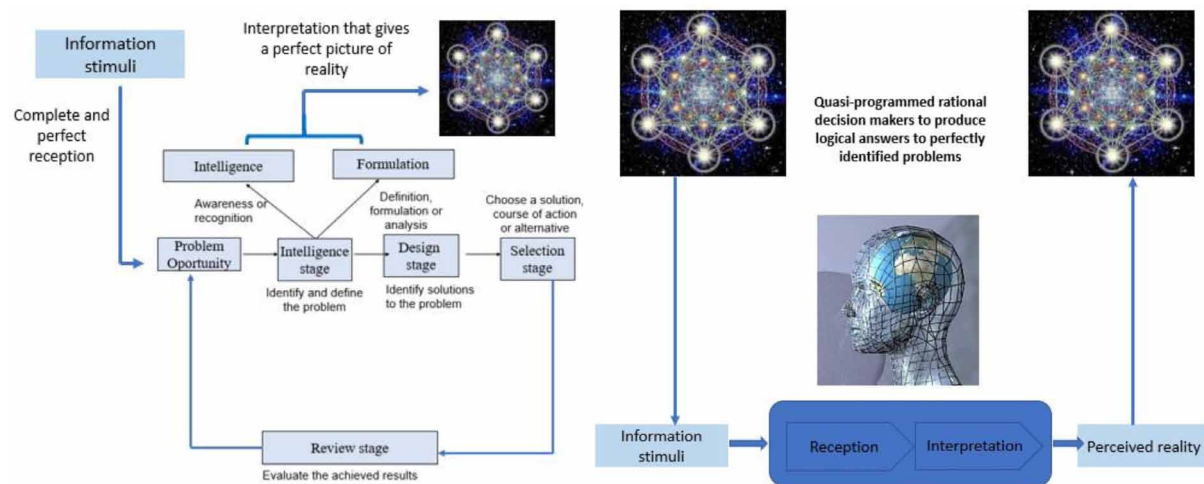
Many of the phenomena studied in strategic management (for example, the analysis of an organization’s strengths and weaknesses, the competitive dynamics in a business or the competitive structure of an activity) occur at supra-individual levels or at levels above the behaviour of the CEOs; they occur, for example, at the level of the company, the industry or the strategic group. This approach to strategy is inspired by neoclassical economics, and is essentially concerned with the competitive game in the markets, not the company or with the individual psychology and behaviour of the managers (Simon, 1991). The *Homo economicus paradigm* thus emerges in its fullest sense within a markedly deterministic explana-

tory model of the economic behaviour of organizations: agents' behaviour and results are determined the impersonal game and the automatic adjustment of supply and demand, that is, **Adam Smith's invisible hand of the (aggregate) market**. The manager is not given any weight, and is limited to choosing the optimal alternative in a context of information that is complete, freely available and free of charge.

The approach of economics applied to the research of the bases of expertise in organizational management gave rise to the **normative rational decision-making paradigm**. This perspective is purely concerned with the means of achieving certain objectives, and therefore massively simplifies the intra-firm decision-making process and the human role therein. This vision conceptualizes strategy as an intentional plan to achieve goals that are consciously set following rational analysis. The classical paradigms in economics and strategy have thus paid scant attention to the role of managers in decision-making. Its axis has revolved around the development of tools for the rational analysis of problems and the efficient choice of alternatives in terms of cost-benefit. The managerial development has therefore concentrated on the mastery of these techniques and their rigorous application.

The **general model of the rational problem-solving process** (Figure 1) assumes that human beings (both managers and non-managers) are rational decision-makers quasi-programmed to produce logical solutions to perfectly identified problems. This approach involves considering the process of perception, analysis and decision-making as occurring in a black box.

Figure 1. The strategic decision-making process according to the general black box model of problem solving, based on the rational theory of perception



However, the idea that entrepreneurs, managers and leaders in other organizations—whether for-profit or not-for-profit—are first and foremost conscious rational beings, with absolute power to control and make their own choices and select the optimal option, is increasingly being called into question. The limitations of the rational paradigm have prompted another stream of research on how the decision-making process unfolds. The common thread running through it is the need to model non-rational economic behaviour.

The first attempts to draw attention to the need to formulate new theories of strategic choice came in the 1950s. The main line of criticism came from the seminal works of March & Simon (1958) and Cyert & March (1963) on the role of agents (with their own interests and objectives) in organizational behaviour and the **bounded rationality paradigm**. This approach sets agents' decisions within the context

of the imperfect information available, and the expectations they have which dictate what results they consider satisfactory.

Within the strategy literature, some pioneering lines of research have explored certain *psychological foundations for strategy-makers' behaviour and decision-making* (Hodgkinson, 2008). The initial phase has resulted in interesting insights into decision-making preferences and the way in which strategies are developed. The first such contribution came from the upper echelon theory, which focused on the influence of the top management teams' individual and sociodemographic characteristics (such as gender, age or training) as well as environmental stressors (Hambrick & Mason, 1984). Hambrick & Fredrickson (2001) emphasize that the key to a successful strategy is to achieve a solid consistency between the elements of the strategy that have non-linear relationships among all of them. Since the development of the strategy is not a linear and simple process, the great strategists are interactive subjects and of cyclical and systemic thinking (Quinn, 1980). A parallel agenda has influenced the study of managerial attention (Cho & Hambrick, 2006), managers' perception and use of information (Powell et al., 2006) and deliberate learning processes (Zollo & Winter, 2002) as drivers of their efforts to seek out and select a strategy. Along with this paradigm, certain schools of thought on strategy subsequently emerged that were critical of the rational vision and espoused the idea of strategic processes characterized by adaptive learning and trial-and-error (Mintzberg & Waters, 1985; Mintzberg, 1991).

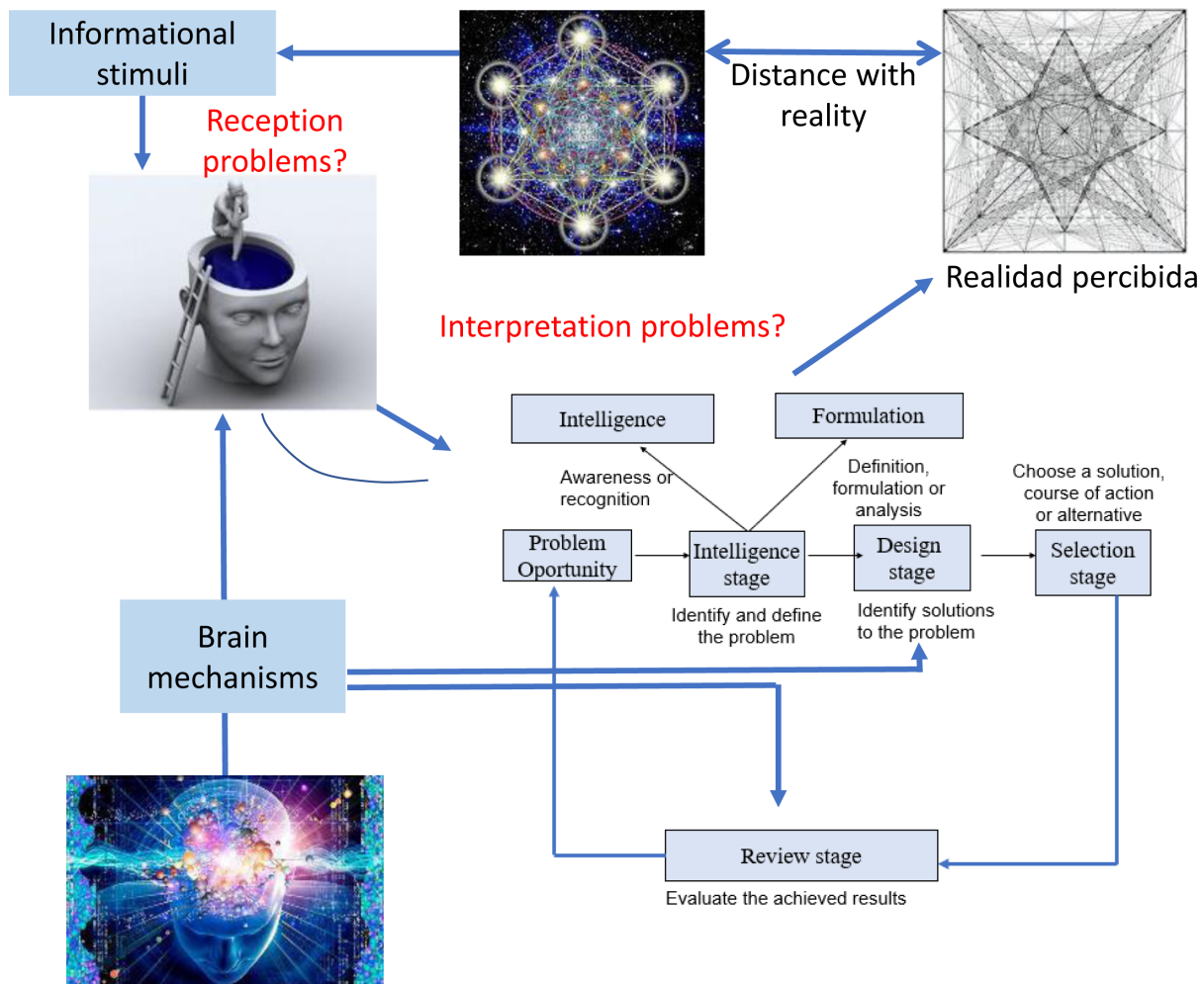
The Mind of the Strategy-maker and Expert Judgment in Strategy

Viewing the managers themselves as components of the decision-making problem represents a great step forward in gaining a clearer understanding of the importance of the decision-maker's profile in determining how strategic decisions are taken. Although the general model of the rational problem-solving process was a valuable starting point for the study of the decision-making process and provided a basis for developing the rational paradigm of the strategy-making process, it is generally accepted these days that, in many cases, the search for information and alternatives is not rational. The impersonal explanation of strategic decision-making as a rational process omits the strategic process is biased and limited by the decision-makers' perception and cerebral activity. The limitations of the rational approach become evident in problems relating to information, to perception and to the choice of strategy.

The problem of information. Viewing strategy as a plan implicitly entails the assumption that the decision-maker can control the strategy on the basis of their calculations. Drawing up a plan requires an interactive reading the chains of actions and decisions, whereby the decision-maker has to anticipate the consequences of their own decisions and interactively respond to competitors' decisions. The problem that emerges is the complexity involved in assessing all the consequences of the different decisions and competitors' responses. The cost entailed in finding out about all the alternatives and uncertainty about the future, as indicated by Simon (1947), can prevent or seriously hinder the identification of the optimal decision. The information that a rational decision-maker needs in order to make optimal strategy decisions is not readily available, especially in complex and changing environments. This complicates the analysis, as well as the identification of opponents' possible responses and the alternatives themselves.

The problem of perception. The rational approach to strategy also effectively erases the problem of managerial perception in strategic choice. The limitations of the rational approach to strategic decision-making are not only due to the complexity of the scenario and the lack of information, they also relate to how this approach disregards the biological imperative. The asymmetric perception of results (Kahneman & Tversky, 1979) represents another knock to the idea of the optimal choice. Cognitive psychology has shown that perception and decisions are directed by the brain, and that this is not the coldly rational,

Figure 2. The problems of receiving and interpreting information



deliberate computer that we often imagine. Hence the problem of perception. The way in which the decision-maker receives and interprets external informational stimuli does not follow the logical, rational and objective model described above; as such (Figure 2):

1. In the intelligence phase, awareness or recognition of the problem may take some time or may not occur at all. There may also be a loss of objectivity, because the sensory stimuli received by the decision-maker do not capture his/her attention, are misinterpreted, or are undervalued due to the poor reliability of the sources. The very nature of the problem also conditions the decision-maker's perception of the opportunity. There may thus be problems of reception.
2. An inaccurate picture of the situation may be formed during the formulation phase of the problem. It may even be a long way off the true reality, due to imperfections in the informational stimuli and other brain mechanisms specific to each individual. A second category of problems therefore relate to interpretation. Just as markets are analysed with a series of instruments provided by strategic management to seek out imperfections that can be exploited or against which to defend themselves, the brain also has its imperfections, and strategy-makers must guard against these.

3. The analysis of information and the formulation of strategies can be “contaminated” by aspects internal to the decision-maker, such as their skills in handling different types of information (qualitative, statistical, computational, etc.), their preferences (which may lead to opportunistic decisions) or their psychological circumstances. Relevant discoveries have been made concerning the **cognitive biases** that influence individuals’ decision-making preferences, such as loss aversion, the sunk cost fallacy or reward discounting (Tversky & Kahneman, 1974, 1981; Ainslie, 2016).
4. The appraisal of the results achieved with the chosen alternative may suffer from the same problems of subjectivity, opportunism and uncertainty that affect the decision itself.

The individual elements that determine the decision-maker’s perception of a situation can be categorized into three groups:

- Information factors. Of course, information asymmetries such as the level of access to and the recency of the accumulated information can partially explain these behavioural asymmetries.
- Psychological or attitudinal factors. Among the psychological factors that influence the perception of a problem, the main one is the conception and playing style of those involved. Trade-offs may sometimes be due to different perceptions of the dynamics of the positions.
- Cognitive factors or factors related to the ability to compile, process and apply information, as well as learning and experience.

The problem of creativity in identifying and selecting strategies. The last problem associated with the rational approach is the difficulty in articulating the possible decisions that the company can take based on the information available, and choosing the most suitable option for the situation in question from among all the possibilities. An organization’s search for its own alternatives and attempts to identify those of its competitors is often muddled and lacking in logical criteria.

One way to prevent this problem is to massively simplify the alternatives available to managers from which to define their strategic response, offering different types of theoretically distinct strategies. The second way to simplify the problem of identifying and selecting strategies is based on the hypothesis that there is an optimal way of competing dictated by the structure of the industry. When it comes to drawing up a plan of action, the classic rational paradigm of the strategic process adopts a structuralist perspective. Under this perspective, the company must orient its strategy towards achieving a competitive position in the market that allows it to prosper by effectively taking advantage of the opportunities offered by the structure of the industry or shaping those opportunities to suit its own needs. In addition, the paradigm holds that within the structure of each sector (which is taken as a given, even though it is recognized as an endogenous factor), there is an optimal way to compete and in order to discover it, the company must conduct a thorough situational analysis.

These approaches follow a deterministic reading of the effect of the competitive environment that completely overlooks the role of managerial discretion and perception. The problem with this approach is that it ends up producing copycat strategies, chosen from among the limited number of alternatives suggested by the literature on the basis of an analysis of the competitive environment for the activity. This position entails accepting the notion of a single possible future and, by restricting the problem of strategic choice to the selection of the strategy recommended by the structure of the industry, neglects the possibility of innovation and surprising strategies from unexpected competitors.

Furthermore, criticism of the rational perspective has effectively highlighted a key pitfall: no matter how much theory there is on a particular position and no matter how deterministic the path to be followed

in that position, real-world experience has shown over and over again that decision-makers take very different paths even in contexts where there is a high degree of convergence in terms of recommended approaches. There are three implications to this:

- (1) Although managers are subject to the deterministic reading dictated by the most widely-recommended deliberate strategies, their personal interpretation may differ depending on their ability to “read” the situation in order to take advantage of imperfections, guard against threats to the organization and develop effective actions to exploit opportunities.
- (2) The situation does not mechanically determine the decision-maker’s response, since those involved have free will and their own style and personality. Along these lines, Day & Nedungadi (1994) hold that it is the manager’s process of perception that gives meaning to the data stemming from the situation, and this is what leads to the selected strategy.
- (3) Managers can also differ in their desired vision (for the company and the surrounding environment), thus giving rise to differing perceptions of the resulting performance, which in turn could lead to organizational conflicts or ineffective, misaligned actions.

The vast strategy literature on organizational resources and capacities that has emerged since the 1980s has been pivotal to gaining an understanding the causes of the differences in a company’s strategies and results. However, it continues to rely on aggregate approaches to explain firm-level heterogeneity. Under these paradigms, the only step taken to uncover heterogeneity at the infra-firm level has been to shift the focus from the product market to the factor market, thereby identifying an organization’s group competences and managerial capacities (Camisón, 2005), as well as the processes of creation, absorption and application of knowledge flowing through it (Camisón & Forés, 2010). However, such analyses have been limited to a competitive assessment of these capabilities, without delving into the critical issue of how the interaction between individuals and organizational processes can promote (or prevent) the development of such competencies.

Neuroscientific Approach to Core Problems of Strategy

Research within behavioural economics has helped identify a series of irrational prejudices that appear in economic, financial and strategic decisions. However, the cognitive-psychological explanation leaves many questions unanswered. The most important outstanding issue is why people make non-rational decisions, how such decisions coexist with rational decisions, and how both types of decision are made by successful experts, entrepreneurs and risk managers. The based-psychology research has also produced results with limited normative and predictive capacity and thus has done little to improve managers’ emotional regulation or control over their behaviour.

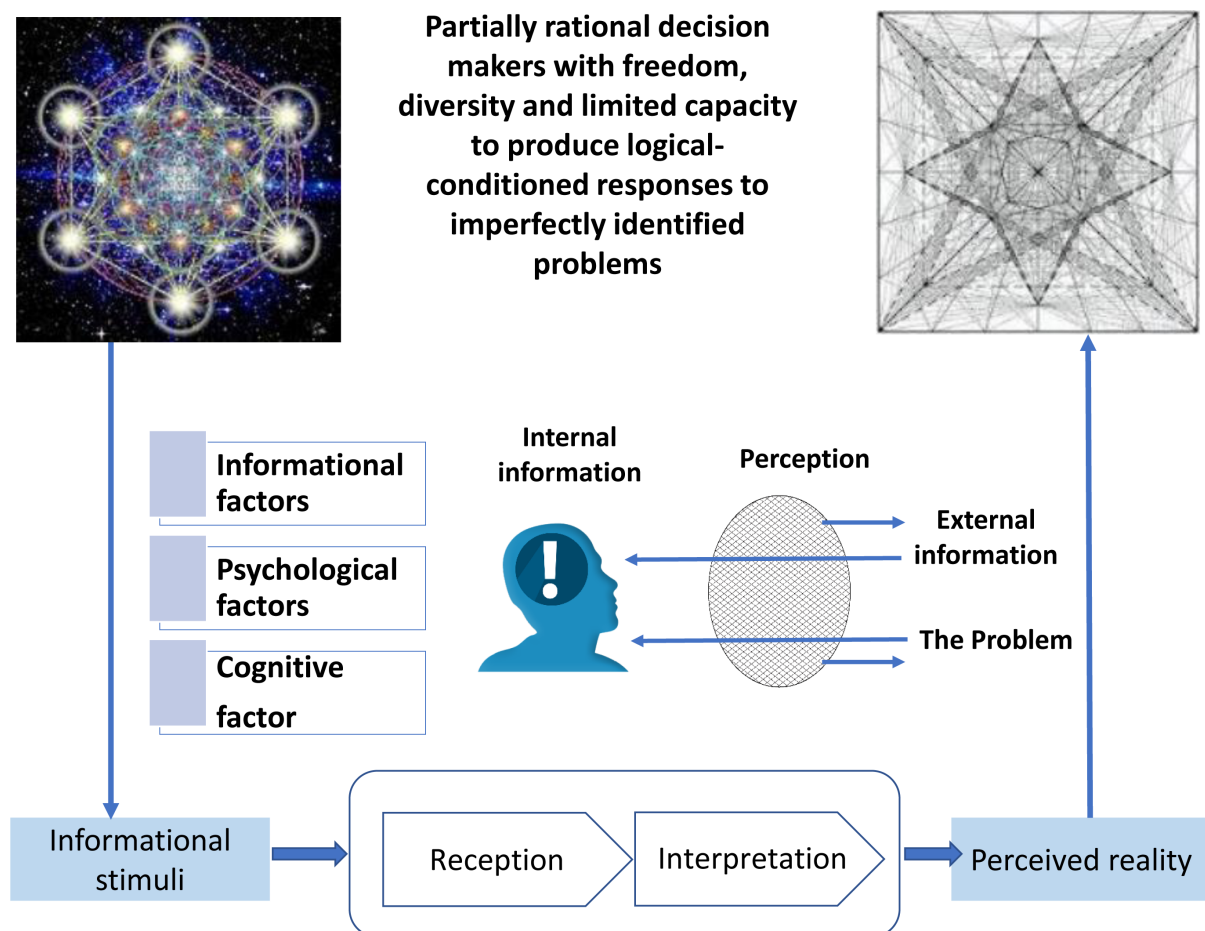
The reason of this limited utility of non-rational models of strategic process to guide the improvement of the managerial decisions quality is they involve an inherent contradiction: trying to explain how managers think about strategies, while dodging the fact that strategy formulation is a cognitive process that takes place in the mind of the strategy-maker and therefore has a neurological basis. Strategy is the product of strategy-makers’ perspectives and perceptions of their environment and of their understanding of the messages it sends them; however, these perceptions and preferences are conditioned by their brain mechanisms or genetic differences.

Research into the biology of the brain and its association with economic and financial decisions has led to a line of study that examines the relationships between individuals’ neuronal and genetic profiles

on the one hand, and economic behaviour on the other. Interesting results have been reported, especially regarding an explanation for risk preferences (Glimcher et al., eds., 2009; Kuhnen & Knutson, 2005). Evaluation of future rewards has also been correlated with neural bases, pointing to a neural underpinning of risk aversion (Tom et al., 2007) and a neural explanation for why future gains and losses are discounted asymmetrically in the brain (Gehring & Willoughby, 2002; Knutson, 2008; Xu et al., 2009). This diverging assessment of results also appears in the evaluation of information (Minas et al., 2014).

Especially interesting for neurostrategy is everything we are learning about the **executive brain (the E factor)**. In 2001, Elkhonon Goldberg provided a masterful account of the executive brain in his book of that name. In recent years, neuroscience has attentively studied the **executive functions** of the brain, so called because they are the functions that organize all the other functions (intellectual, emotional and motor) and direct them towards a goal. It seems inevitable that the metaphor of the conductor of the orchestra would be employed here, and indeed it was used by Goldberg in chapter 6 of his work.

Figure 3. The neuroscientific model of decision-making based on neuronal dynamics



The new **neuroscientific model of decision-making** (Figure 3) thus defines human beings as partially rational decision-makers with freedom, diversity and a limited capacity to produce logic-conditioned responses to imperfectly identified problems. Under a rational strategic approach, the cerebral mechanism

underlying decision making supposes that the reception of a sensory stimulus (external information) increases neuronal activity and a decision is reached when this activity exceeds a certain threshold. In the presence of a weak stimulus, or in the absence of a stimulus, neuronal activity would stem from background brain activity, that is, neuronal noise. As such, the decision would display a random behaviour, which could explain why the subject claims to have received a stimulus even if it has not been applied. However, a recently published study (Carnevale et al., 2012) provides evidence that contradicts the prevailing theory regarding brain activity when we make decisions based on perception.

The positive contribution of neurostrategy to the understanding of the strategic decisions has not been accepted peacefully by the academy. The principal criticism emphasizes the inability of neuroscience to test economic and strategic models because such models do not make predictions about the brain (Gul & Pesendorfer, 2008). Critics also dispute the idea that a better understanding of the decision-making process leads to better choice models (Bernheim, 2009: 38).

SOLUTIONS AND RECOMMENDATIONS

Despite the expectations created, there has been very little progress made in the study of the mind of strategic management experts. This is largely because, unlike with other activities, it is difficult to measure their level of skill and subject them to experiments in their natural environment. There is therefore a need for research in lab to determine whether the brain mechanisms of strategic management experts follow the same patterns as those already identified in other disciplines.

Research in neurostrategy also needs to advance in the formulation of the processes that lead, before a certain problem, from the initial and unconscious neuronal response to the final decision that the decision maker presupposes that he has meditated and adopted rationally. The research has barely cleared the path that follows the manager's thought, since he perceives the need to make a decision in a certain situation, until finally adopting it after following a process that, in his / her inner heart, presupposes that it is rational. Does the unconscious neuronal impulse always prevail? Can an informed decision maker control that impulse and decide objectively? These are critical issues that are still ajar.

Much more qualitative study is needed at the observation level of the decision-making processes of the strategic actors, in a controlled environment of their neural records, to collect information about their guidelines. This research should be developed both on individuals at times of individual decision and when participating in group decisions. It will be possible to contrast the characteristics and differences between the strategic decisions taken by the top managers of the organizations alone, and those that arise from interactive processes in boards and management teams. The analysis of the differences between both contexts could shed much light on how the weights of neuronal impulses vary due to the exchange of information, the debate process and the influence of the biology of other debaters, which take place in decision scenarios inside of expert groups in top-level management.

FUTURE RESEARCH DIRECTIONS

The expectation is that neuroscience will enable us to identify the neurological obstacles to change, creativity and innovation. Each region of the brain has a role that affects behaviour differently, and understanding them will help break down the common myths associated with these three functions. Laureiro-Martínez et al. (2014) have gone some way in this direction by studying the cognitive processes

and brain areas that allow decision-makers to switch between exploitation and exploration alternatives, finding different patterns. The regions of the brain associated with exploitation are those linked to the search for rewards, and tracking and evaluating current options. Conversely, exploration relies on the brain regions associated with controlling attention and seeking out alternative options. A comparison of the decisions made by entrepreneurs and by managers also allowed the authors to identify a neuronal trait characteristic of entrepreneurs, appearing in the frontopolar cortex, a key region for exploratory choices.

CONCLUSION

The dialogue between neuroscientific knowledge and technological developments offers up remarkable possibilities for advancing the analysis, explanation and prediction of people's behaviour and thereby developing smarter strategies that draw on the best current understanding of the functioning of the nervous system and genetics. The knowledge contributed by organizational cognitive neuroscience can help academics and practitioners better understand the biological mechanisms—whether physical or neural—that mediate the choice in decision-making, and to break down the decision into its components (Butler et al., 2016). Over the longer term, it will also help to develop models that can better predict decisions.

The extension of neuroscientific research can also support theoretical-practical research in disciplines clearly applied to improving the effectiveness of organizations and their management, such as strategic management. In light of this convergence of knowledge, **neurostrategy** has flourished as a promising field of work.

Nonetheless, it is essential to remain cautious about how the results of neuroscientific research can be applied ethically to today's organizational management. In particular, we must carefully handle the reductionism entailed in identifying the basic neuronal-level mechanisms and raising their explanatory capacity to higher level organizational phenomena, such as how inspiring leaders are identified and developed (Lindebaum & Zundel, 2013).

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KEY TERMS AND DEFINITIONS

Behavioural Cognitive Neuroscience: Interdisciplinary field bringing together neuroscientists, economists and psychologists, applying behavioural neuroscience theories and methods to the organizational field, mainly to understand the biological underpinnings of decision-making.

Behavioural Economics: A field dedicated to the study of non-rational choice behaviour and its impact on human health and well-being. The principal differences between this and the dominant economic paradigm is that it takes into account irrationality and environmental influences on the dynamics of choice behaviour.

Bounded Rationality: Paradigm that explains agents' strategic decision-making based on the imperfect information available to them and the expectations they have that dictate whether they will view the results as satisfactory. It leads on to the idea of adaptive learning and trial-and-error processes.

Cognitive Biases: These are irrational prejudices that appear in economic and financial decisions, which influence individuals' decision-making preferences. They include loss aversion, sunk cost fallacy or reward discounting.

Neuromanagement: Scientific field that relies on organizational cognitive neuroscience and technology to explore the brain activity and mental processes involved when people face typical management problems, such as decision-making, as well as other key social behaviours in organizations such as leadership or teamwork.

Neurostrategy: This is the discipline dedicated to uncovering the process of formulating and implementing an organization's strategy, by examining the biological determinants of the functioning of the strategy-maker's brain.

Prospect Theory: The central postulate of this approach, proposed by Kahneman and Tversky, is that, in conditions of uncertainty, people do not make decisions based on the probability of greater gains but rather guided by a series of heuristics.

ENDNOTE

12

- ¹ See Butler, O’Broin, Lee & Senior (2015) for a review of the literature that analyses the contributions of cognitive neuroscience to decision-making in management, and a critical evaluation of its implications for management and organization studies, economics and marketing.

The Use of Design Thinking to Develop Corporate Skills and Competencies

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INTRODUCTION

Design thinking is a methodology for proposing creative and innovative solutions for problems that use the mindset of the designers (IDEO, 2019). The Bootcamp Bootleg (Doorley, Holcomb, Klebahn, Segovia & Utley, 2018), produced at Stanford University, suggests the following steps for design thinking: empathize, define, ideate, prototype, and test.

Corporate training usually aims to develop critical analytical skills and competencies, such as analytical thinking, decision making, problem-solving, leadership, and strategic thinking. However, 21st-century holistic and intuitive skills are also required in management today, such as communication, creativity, innovation, and empathy.

Design thinking roots are business and design, and its application to the area of education is recent. Scheer, Noweski and Meinel (2012), for example, claim that John Dewey's ideas are not enough to overcome the difficulties of teaching complex phenomena in a holistic and constructivist way. They compare the methodology proposed by Dewey to design thinking, arguing that the latter can offer concrete recommendations to approach a complex phenomenon without the excess of abstractions.

The objective of this chapter is to discuss how design thinking, combined with information and communication technologies (ICTs), can be used to promote 21st-century skills and competencies in the corporate environment.

No previous literature review on the subject was identified. A literature review was conducted following Okoli's (2015) guidelines for a standalone systematic literature review, including eight steps: identify the purpose, draft protocol and train the team (two scholars), apply practical screen (screening for inclusion), search for literature, extract data, appraise quality (screening for exclusion), synthesize studies (analysis), and write the review.

Google Scholar was the database used for the search. The choice for a single database is justified by results such as those presented by Harzing and Alakangas (2016), who compared Google Scholar with two other recognized databases: Scopus and Web of Science. The authors concluded that all three offer stability and enough search coverage, but Google Scholar outperforms others by criteria such as the number and growth of publications, and the number of citations, thus providing more comprehensive coverage.

The query for the search was:

competencies OR competences OR skills OR skill "Design Thinking"

The search was conducted on August 14, 2018, with 42 initial results. Four titles were repeated and five unavailable. All the 33 remaining texts were included in a Google Drive Sheet, where the data

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extraction was performed. Coding and categorizing followed the competences and skills frameworks indicated in this chapter.

BACKGROUND

After the 1990s, the world entered a new phase of globalization. For Grundke, Jamet, Kalamova, Keslair and Squicciarini (2017), information and communication technologies, trade liberalization, and lower transportation costs have enabled companies and countries to segment the production process into global value chains (GVCs). Various products are designed in one country, but assembled in another country, from parts manufactured in several countries. Thus, 30% of the value of OECD (Organization for Economic Cooperation and Development) exports comes from abroad.

According to Ismail (2014), the average life of an S&P company fell from 67 years a century ago to only 15 years in 2014, and 40% of Fortune 500 companies would cease to exist in 10 years. Competition from many of the US Fortune 500 companies is not coming from China and India but a new generation of organizations leveraging exponentially growing technologies. Moore's Law and Kurzweil's Law of Accelerated Returns can explain the constant and extraordinary pace of change that organizations are facing today (Ismail, 2014). These changes lead to the challenge of dealing with ill-structured problems (Simon, 1973).

Innovation considered a source of differentiation and competitive advantage in the increasingly complex and rapidly changing business environment of the 21st-century can determine the survival of a project or business (Lee & Benza, 2015). Companies increasingly believe in innovation for their success in the ever-changing business environment.

In today's business context, CGVs and skills are more closely interrelated than ever before. Skills play a crucial role in determining the comparative advantages of countries in CGVs. Many of the opportunities and challenges brought about by CGVs are being affected by country skills (Grundke et al., 2017).

Considering current development processes in society and economics, there is a need for educational systems to prepare young people with new skills and competences that will enable them, in addition to benefiting from emerging new forms of socialization, to actively contribute to economic development under a system in which the principal asset is knowledge (Ananiadou & Claro, 2009).

Organizations that have corporate education structures historically offer developmental actions geared toward critical skills and competences related to the left brain that deals with logic and objectivity. Due to the new phase of globalization and the importance of innovation in business, the skills and competences related to the right hemisphere of the brain, such as holistic thinking, creativity, intuitive thinking and innovation are the objects of attention of business education professionals.

Lee and Benza (2015) report that educational institutions and programs of various types and sizes have successfully incorporated design thinking to foster innovative leadership education, and firms such as Apple and IDEO have demonstrated how it can improve business results. According to Wagner (2012), there seems to be a similarity between innovation skills and the essential elements of design thinking, such as empathy, listening, collaboration and experimentation.

The impact of ICTs on all dimensions of human existence, including the teaching-learning process, is undeniable. The internet, social networks and educational technologies are part of the educational process and the development of professionals. The value added to the Internet and information technologies is not attributed to their existence in the classroom or their characteristics, but to the way they are applied in education (Gebre, Saroyan & Bracewell, 2014; Kim & Reeves, 2007).

According to Kay (2014), Internet and web-based learning tools have a positive impact on teacher and student attitudes as well as student learning outcomes. Researchers have shown that the leading cause of the improvement is not the Internet itself, but rather the increase in the time spent studying online that Internet use for educational purposes can lead to (Tsai, 2015).

DESIGN THINKING APPLIED TO DEVELOP 21ST-CENTURY SKILLS

21st-century Skills

There is a widely shared belief among teachers, educators, policymakers, politicians, and employers regarding the importance of 21st-century skills teaching and assessment (Noweski et al., 2012). It is believed that the present century requires a very different set of people's skills and competences to be able to deal with the challenges of life as citizens, at work and leisure (Pink, 2006; Wagner, 2010; Noweski et al., 2012).

According to Grundke et al. (2017), globalization and modernization are creating an increasingly diverse and interconnected world. To make sense and function correctly in this world, individuals need, for example, to master technological change and understand the vast amounts of information available. They also need to address the collective challenges of society, such as the balance between economic growth and environmental sustainability and prosperity with social equity. From the purely economic point of view, individuals' skills are vital because they contribute to boosting productivity and market competitiveness, minimize unemployment through the development of an adaptive and skilled workforce and create an environment for innovation in a world dominated by global competition.

Several organizations have developed frameworks for competencies and skills for the 21st-century, such as Partnership for 21st Century Skills, EnGauge Framework, 21st century skills and competences for millennium learners (OECD), and Assessment and Teaching of 21st Century Skills. DigComp 2.0 (Vuorikari, Punie, Gomez, & Bran), for instance, identifies critical components of digital competence. DigComp into action (Kluzer & Priego, 2018), by its turn, presents examples and case studies on the framework application. The Basque Government, for example, launched the Ikanos project in 2012 based on DigComp to develop digital competence within the Basque society. Ikanos aimed to address digital competence needs of citizens, enterprises, teachers and other segments of the Basque society. Workshops were organized to disseminate the role of digital technology in education, certification, and the creation of new digital professional profiles. Ikanos project intended to provide support to individuals and organizations to encourage collaboration, explore, share and disseminate digital competences. The project also focused on the definition and development of professional digital competence profiles related to industry 4.0.

Wagner (2010) states that there are seven survival skills for careers, faculty, and citizenship: critical thinking and problem-solving; the collaboration between networks and leading by influence; agility and adaptability; and initiative and entrepreneurship; effective oral and written communication; access and analysis of information; curiosity and imagination. For Himmelmann (2005), the psychological categorization of competences is divided into cognitive abilities; moral and affective attitudes; and practical and instrumental skills. Additionally, Himmelmann (2005) warns of the emphasis that the American and German school systems provide on the measurement and comparison of cognitive abilities, to the detriment of the other abilities.

Pink (2006), in turn, presents what he calls essential attitudes for professional success and personal fulfilment. He distinguishes skills in design, story, synthesis, empathy, and meaning.

According to a 2002 United Nations survey, UNIDO Competencies, some of the skills required for management are: analytical thinking, decision making, troubleshooting, guidance for achievement, organizational knowledge, results orientation, customer orientation, leadership, and strategic thinking (Agarwal & Salunkhe, 2012). Most of these skills refer to the left hemisphere of the brain, responsible for logical reasoning, sequential, rational and analytical thinking. However, the authors argue that it is becoming increasingly important for individuals in the new age to stimulate the right hemisphere of the brain, responsible for skills called: creative thinking, design thinking and innovative thinking.

For Lee & Benza (2015), innovation is recognized as a critical strategic capability in business today. Students and professionals need to be better prepared with innovation skills to meet not only 21st-century requirements in the workplace but also succeed in the careers of their choice. Jobst, Endrejat and Meinel (2001) relate five essential skills that help to train innovative people and are essential for problem-solving and the development of innovations in society: open-mindedness, empathy, T-shaping, dealing with ambiguity, and creative confidence.

According to Hoidn and Kärkkäinen (2014), three overlapping skillsets for innovation are required: technical skills, reasoning and creativity skills, and social and behavioral skills. The last two skills are related to social skills that are grounded in individuals' attitudinal and personal qualities, such as open-mindedness, self-confidence, communication, and collaboration.

Design Thinking

Considering the complexity, speed and ambiguity of the business environment of the 21st-century, and the pressure that professionals undergo to remain relevant, educators seek pedagogical methodologies that help students develop the skills needed to become innovative professionals of the future (Lee & Benza, 2015). More and more, what differentiates a professional prepared for the challenges of the 21st-century work environment are the skills of innovation.

Several experts share the belief that most people can become more creative and innovative if appropriate opportunities and the appropriate environment are offered (Wagner, 2012; Sherman, 2011; Hoidn & Kärkkäinen, 2014; Lee & Benza 2015). However, despite the importance of developing innovative skills, recognized by both employers and educators, most corporate education programs do not seem to offer these skills (Lee & Benza 2015).

Design thinking, according to Brown (2018), is an approach to innovation, practical and widely accessible, that can be integrated into all aspects of a business. Individuals and teams can use it to generate innovative ideas that are implemented to make a difference. It can be described as a set of principles that can be applied by diverse people to a wide variety of problems and organizations. According to Brown (2018), "the mission of design thinking is to translate observations into insights, and these into products and services to improve people's lives." The bridges of insight are specially constructed through empathy, the capacity to try to see the world through the eyes of other people, to understand and feel the world through their experiences and emotions.

The five "modes" or design thinking components can be identified in the toolkit and methods developed by Doorley et al. (2018) from Stanford University's d.School through D.SCHOOL BOOTLEG DECK. They are:

- Empathize: the basis of human-centered design. This mode involves actions: observing, engaging and immersing (putting yourself in the user's shoes).
- Define: when discoveries identified through empathy mode are transformed into needs, insights, and a significant challenge.
- Idea: when radical design alternatives are generated, when possibilities for solutions to identified needs, insights and challenges are explored. Actions involved: innovating, thinking "out of the box," exploring unexpected areas of exploration, flexibility to act with focus and think creatively.
- Prototyping: when, from the creation of prototypes, ideas are transformed into something concrete, to allow the design team thinkers, the user and others to experience and interact.
- Test: when, from prototype testing, the design thinker gathers feedback from users to refine the solutions.

Design thinking combines, briefly, empathy with the context of a problem, creativity in generating insights and collaborations, and rationality in analyzing and adapting various solutions to the context of the problem presented (Lee & Benza, 2015).

The design thinking characteristics make this approach effective in developing empathy skills, as it uses human-centered observation to develop products, services and strategies in its process. Its circular process - establishing empathic relationships, ideation, prototyping, testing, and refinement - encourages students and practitioners to engage with the open mind, ensuring empathy and unexpected discoveries (Lee & Benza, 2015).

Dealing with severe multidimensional problems that do not have recognizable requirements and solutions is one of the most common uses of design thinking. Design problems are mostly ill-structured, and design thinking uses the strategy of problem decomposition to solve it (Ho, 2001). Design thinking was used successfully, for example, to address wicked problems and develop responsible innovation in the French financial industry (Pavie & Carthy, 2014). Innovation emerges in the process of problem-solving through the combination of empathy, creativity, and analysis. This process uses our ability to be intuitive, to discover patterns, and to construct ideas that are meaningful and functional (Fabri, 2015; Shu-Ling & Hui-Lan, 2017).

In this paper, we present the results of a study conducted with several major actors from the French financial industry, which aimed at developing a process for developing responsible innovations by deploying a Design Thinking method. We begin by presenting the context for the study, which includes a brief description of our approach for understanding and exploring the issues raised by responsible innovation. This first part also includes a comparative analysis of the characteristics of RI (responsible innovation) and wicked problems in order to establish a potential link between the two concepts. Secondly, the Design Thinking method is introduced as a potentially suitable approach for addressing wicked problems and thus, RI. Finally, the process for developing responsible products and services which was developed throughout the study is presented.

Design thinking is not a linear process (convergent thinking) that follows step-by-step procedures, but a process of discovering connections (divergent thinking) to see new patterns and possible relationships that exist in your school, even though both types of thinking are needed within all types of organizations (Gould, 2018).

As practitioners increasingly embrace design thinking to achieve innovation, corporate education professionals have begun integrating design thinking into business curricula to enhance students' creative skills (Schiele & Chen, 2018).

Design thinking stimulates and develops a mindset that seems to meet 21st-century demand. A design thinker uses all his senses and analytical and creative skills to develop activities. When, for example, he/she goes on the field, establishes dialogues with different stakeholders in the solution, observes and genuinely knows the world of another person, puts himself/herself in the other person's place, and collaboration with other colleagues, creates possible solutions (Noweski et al., 2012).

Active Learning Methodologies

Learning is understood by constructivism as a personal process of meaning-making, in which the individual assimilates information, relates it to the knowledge already possessed, and processes it cognitively. Constructivist teachers work on students' development through reflection, analysis, and gradual construction of knowledge through the conscious and permanent mental process mediated by experience (Fabri, 2015). Designing is aligned with the principles of constructivism, in which learning is primarily understood as a social process, which requires interaction between participants, facilitators and others (Noweski et al., 2012).

Lee & Benza (2015) reports that several suggestions have been made regarding methods and tools that enhance the development of innovation skills, such as problem-solving, critical thinking, and collaboration. Project-based learning (Markham, 2013) and problem-based learning (Hoidn & Kärkkäinen, 2014) are student-centered methods and can improve the development of innovation skills as students benefit from direct involvement in problem-solving. However, the design thinking approach is, in comparison to these methodologies, admittedly the most inclusive because it covers the process, tools and experiences of the project in solving innovative problems (Brown, 2008; Liedtka, King and Bennett, 2013; Wagner, 2012; Coakley, Roberto & Segovis, 2014).

According to Kolb & Kolb (2017), the Theory of Experiential Learning (TAE) seeks to convey the teachings of twentieth-century scholars, especially William James, John Dewey, Kurt Lewin, Jean Piaget, Lev Vygotsky, Carl Jung, Paulo Freire, Carl Rogers and others, who put experience at the center of the learning process and the learner-centered educational system. TAE is a dynamic view of learning based on a learning cycle driven by the resolution of the dual dialectic of action/reflection and experience/abstraction (Kolb & Kolb, 2017). Students learn through their reflexes and their colleagues, necessary for students' metacognitive development. The approach considers a cyclical model with four stages of learning: concrete experience, reflection, abstract conceptualization and active experimentation (Fabri, 2015). The learning cycle is driven by the integration of action and reflection and experience and concept.

According to Kolb and Kolb (2017), TAE is a dynamic and holistic theory of the process of learning from experience and a multidimensional model of adult development. The differential of experiential learning lies in the unique relationship created between the teacher, the learner, and the subject under study. The experiential approach puts the subject to be learned at the heart of the process. Both the educator and the learner experience the subject. According to the learning cycle, all participants receive from the subject information through concrete experience and transform it through reflection and conceptualization, and then transform it again, including what information has been served with the new experience. Both the teacher and the student are receivers of information and creators of information. This process promotes a levelling effect on relationships, as all can directly experience the subject (Kolb & Kolb, 2017).

According to Rauth, Köppen, Jobst and Meinel (2010), design processes and thinking can be seen in analogy with learning concepts of the Experiential Learning Theory, considering its cyclic vision of learning.

Design Thinking Applied to Corporate Education

Through the literature review, it was possible to identify empirical research, guided by different theoretical references, that have been carried out in several countries to evaluate the relationships between the skills and competences of professionals with the design thinking approach. We present two of the analyzed researches, chosen because although the institutions had a similar objective, that is, to evaluate the impact of design thinking on the skills and competences of the students, the target audience of the researches had different characteristics and were carried out in different cultures and countries.

Lee & Benza (2015) present an experience in which the design thinking method was adopted as a pedagogical approach for teaching the MBA course in Innovative Brand Management at California State University / United States of America. The course, which lasted 10 weeks, aimed to: 1) equip MBA students with a design thinking toolkit; 2) help them use the tools; 3) teach students how these principles could create innovative brands. The course utilized small-scale replication materials, the Stanford d.School prototyping approach to design thinking and used texts that presented a real-world design thinking case study approach (e.g., IBM, 3M, Toyota, Intuit, and SAP). These texts were previously read at home to conduct the discussion in the classroom. Students evaluated the course in two ways. The first assessment consisted of analyzing the scope of the program's objectives, according to its perception, on a scale of 1 to 5 points. Instructors also completed this assessment, which made it possible to compare students and instructors' perceptions. The students had a second evaluation consisting of drawing up a list of the three most important lessons learned in the course. The authors stated that students realized that the course helped them achieve all goals with high grades. Regarding the most important lessons learned, the students highlighted: development of 'open-mindedness and flexibility' and 'empathy and client orientation' attitudes; 'design thinking as an innovative approach to problem-solving in real life' and 'the importance of collaboration in creative thinking'. The instructors' assessment was like that of students in most learning objectives. However, they argued that the limited time available negatively affected the results of the use of the power of coaching to understand their audience in the development of compelling stories.

Agarwal & Salunkhe (2012) present the results at the Welingkar Institute of Management, an essential Indian business school in Mumbai, with the introduction of a new graduate management course called the Business Design Program. The new program had curriculum and pedagogy as differentials over conventional management programs. The curriculum presented a holistic structure focused on integrating the knowledge of the different areas of study, in addition to the disciplines related to the right side of the brain. The pedagogy adopted in the new program involved: 1) the availability of two laboratories ("Innowe Lab" and "Design Workshop") on the Welingkar's campus to support experimentation and prototyping activities; 2) experiential learning, through rural projects; 3) practical learning, through experiential projects; 4) integrative thinking. A group of 60 students were exposed to the Business Design program for one year. The treatment group had their results compared to the results of a control group, i.e. students who were exposed to the normal course of management. The results obtained in the regular management skills, or conventional, the results of the right brain competences, that is, creative thinking, design thinking and innovation were defined as success criteria of the experiment. The data were collected from the application of a self-assessment questionnaire to the students of both groups. The results showed there no significant difference between the treatment and control groups regarding the skills and abilities related to the left side of the brain, such as decision making, analytical thinking, results orientation, organizational awareness, adaptability, client centricity, leadership, teamwork, achievement orientation and strategic thinking. However, it was possible to identify a significant difference in

the competences “creative thinking” and “thinking of design” between two groups. The mean values of “creative thinking” and “design thinking” were significantly higher in the treatment group compared to the control group.

ICT Support for Design Thinking

In the Laser Serious Courses program, a course called Practice of Engineering Skill (Shu-Ling & Hui-Lan, 2017) was developed at the School of Science Instrument and Opto-electronics Engineering (Beihang University, Beijing, China). The authors Shu-Ling & Hui-Lan (2017) state that all students and teachers have a preferred learning style and teachers teach in the way they learn. Design thinking is understood as an effective method to resolve this incompatibility. In the Beihang University program, technology is used to facilitate content delivery, as there are several ways students can access knowledge. The lecture is not essential for the delivery of content. Students, in turn, prefer courses that have online components, such as: collaborate in online discussions, conduct online research and prepare to participate in the classroom discussions of concepts previously studied.

Tsai (2015) in a quasi-experiment with 153 undergraduates, who participated in the course “Applied Information Technology: Data Processing”, reports that web-based design thinking was adopted to help students focus and study in a blended computing course and explore its effects on improving students’ computing skills. According to Lee & Choi (2011), in today’s crowded online entertainment environment, students’ inability to self-regulate learning is likely to be one of the reasons for high drop-out rates in distance learning courses. Self-regulation of learning is more critical in the context of distance learning than in a traditional context, due to the electronic, social and self-directed nature of online learning. In the quasi-experiment with undergraduate students, Moodle was used as the learning management system for all students, aiming to share useful information, documentation and knowledge management. Considering the various tasks suggested to participants, which involve forms of collaborative learning, there may also be potential to investigate the effects of co-regulated learning (Tsai, 2015).

SOLUTIONS AND RECOMMENDATIONS

As the literature review demonstrated, in the current state of research, there are still few studies on the use of design thinking to develop corporate skills and competencies. The empirical articles identified usually explore the use of design thinking in formal and academic teaching environments.

However, design thinking theoretical background has a direct relationship to what is called the 21st-century skills for work. In this sense, more research is needed with the focus on exploring the use of design thinking in corporate training.

Besides that, the use of technology in education, in general, seems to foster active teaching and learning methodologies. These methodologies, and particularly design thinking, should then be combined with the use of new technologies both in academic and corporate education.

FUTURE RESEARCH DIRECTIONS

Some researchers, whose work was read in this literature review, presented some tools, tests or categorizations to support their studies. Noweski, et al. (2005), chose to work with the psychological categorization

of competences offered by Himmelmann (2005), which classifies the main competences in: cognitive abilities, moral and affective attitudes, and practical and instrumental skills, and used ISK tool (ISK 2009) to map participants' basic social skills.

According to Shu-Ling & Hui-Lan (2017), students capture and process information in different ways, such as viewing and listening, reflecting and acting, reasoning logically and intuitively, analyzing and visualizing, intermittently. The teaching methodologies do not also vary with the multisensory forms of information processing. In the teaching-learning process, both teachers and students are subject to education. The teachers' 'understanding of the students' learning methods is strategic for facilitating the process.

As students and practitioners have different behavioral and cognitive characteristics, and this may affect the results of applying the design thinking approach as teaching-learning methodology, additional experimental studies on learning profiles and identification of skills students can contribute to the effectiveness of the 21st-century skills and competences development process.

The use of information and communication technologies is present in school environments, in the education of executives and organizations. However, through the reading of the selected articles, we have identified an opportunity to deepen theoretical and experimental research on the use of ICTs in supporting the development of the skills of 21st-century professionals, in design thinking initiatives and professional education. Considering the importance that the skills and abilities of collaboration and communication have in the process of searching for innovative solutions and in the expansion of the repertoire of learning of professionals, ICTs through tools such as forums, communities of practice, and virtual rooms can positively support several of the steps in the design thinking approach.

CONCLUSION

The current emphasis on the development of so-called soft skills, or the skills and competences of the 21st-century and its impacts on business, has been widely presented in the literature studied in this chapter.

Without innovation, there is no progress, and without creative and skilled people who can meet future demands, there is no innovation. Therefore, innovators of the future, both social and professional, need to be equipped with 21st-century skills (Carroll et al., 2010).

The design thinking characteristics make this approach effective in developing empathy skills, as it uses human-centered observation to develop products, services and strategies in its process. Its circular process - establishing empathic relationships, ideation, prototyping, testing, and refinement - encourages students and practitioners to engage with the open mind, ensuring empathy and unexpected discoveries (Lee & Benza, 2015).

The results presented by several field researches in the studied literature, reflected by the experience of students, professionals and instructors, reveal that the approach of design thinking, applied as a teaching-learning methodology experienced, is effective in sensitizing and teaching the students and professionals toward a range of essential skills and competences needed by 21st-century professionals such as empathy, creative problem-solving, collaboration, open-mindedness and communication. The ICTs, in turn, is a support for this enterprise.

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KEY TERMS AND DEFINITIONS

Co-Regulated Learning (CRL): Co-regulated learning (CoRL) refers to the coordination of the process of self-regulation through self-interactions.

Comparative Advantages: The concept of comparative advantages explains why trade between two countries, regions or people can be beneficial, even when one of them is more productive in the manufacture of all goods. What matters is the productivity ratio that each country has. Even if a country does not have an absolute advantage, it can specialize in those sectors where it has a comparative advantage.

Integrative Thinking: It is a type of thinking that gets involved with the problem differently from the conventional one. Integrative thinkers strive to keep the whole problem in mind as they work on individual parts, unlike the conventional ones that try to deal with the elements individually or sequentially.

ISK (Inventar Sozialer Kompetenzer): Is a comprehensive, multidimensional self-assessment tool that maps basic social skills (<https://www.testzentrale.de/shop/test-komplett-bestehend-aus-manual-20-fragebogen-isk-20-fragebogen-isk-k-20-auswertungsbogen-isk-20-auswertungsbogen-isk-k-20-profilblatt-isk-20-profilblatt-isk-kup-kanning-diagnostik-sozialer-kompetenzen-und-box.html>).

Law of Accelerated Returns: For Kurzweil, through the Law of Accelerated Returns, the pattern of duplication expressed in Moore's Law would apply to any information technology, being the propellant of this phenomenon, the information.

Moore's Law: The price/performance ratio of computing would double every 18 months in the case of semiconductor circuits.

Self-Regulated Learning (SRL): Involves the effort of a student to manage and evaluate their learning processes. It is also considered one of the most important skills needed for lifelong learning.

Managerial Challenges of Corporate Social Responsibility in Developing Countries

12

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INTRODUCTION

There has been a growing interest in the adoption of corporate social responsibility (CSR) practices in the advanced Western and developed Asian and emerging countries over the past several decades (Crane et al., 2019; Carroll, 1999; Carroll, 2016; Davidson & Yin, 2019; Fukukawa & Teramoto, 2009; Jamali, 2007; Matten & Moon, 2008). Such a massive amount of attention to CSR practices is largely attributed to its potential business benefits such as increased retention and reduced recruitment and training costs (Bhattacharya et al., 2008), simultaneous achievement of the triple bottom-line measures (i.e. people, plant, profit) (Kanji & Chopra, 2010; The Economist, 2009), favourable image, reputation, and customer retention (Eisingerich & Ghardwaj, 2011; Korschun et al., 2011), effective risk management (Kytte & Singh, 2005), brand differentiation, and a platform to engage with a diverse range of stakeholders (Lai et al., 2010 – see also Carroll & Shabana, 2010; Epstein, 2018; Luo et al., 2015). It has to be recognised, however, that the full realization of the potential benefits of CSR hinges, in the main, upon managerial orientation and attitude towards CSR practices. This importance is essentially that of Agle et al. (1999), Finkelstein & Hambrick (1996), Jamali et al. (2008), Pant & Lachman (1998), Quazi & O'Brien (2000) and Waldman et al. (2006) who lay stress on managerial personal values as prime factor in firm's engagement in CSR on both performance and ethical grounds (Donaldson & Preston, 1995; Duarte, 2010; Galbreath, 2010; Hemingway & MacLagan, 2004; Petrenko et al., 2016). Despite the acknowledged significance of CSR practice as a catalyst for enhanced perceptions of organizational performance and individual ethics in both advanced industrialized countries and emerging market economies (see Trajkova et al., 2018) the nature, extent and intricacies of CSR *Management* in the developing countries (e.g. Middle East region) has remained comparatively unresearched (Blowfield, 2007; Blowfield & Frynas, 2005; Jamali, 2007; Jamali & Karam, 2018).

In recognition of this lacuna of empirical research in the CSR management literature pertaining to the developing countries, this chapter aims to explore the peculiarities of CSR management and whether it is perceived the same way as is adopted and adapted by advanced industrialized countries and emerg-

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ing market economies (Dikeç et al., 2019; Eweje & Sakaki, 2015; Steurer et al., 2012; Visser, 2008).). The need for a critical analysis of CSR management in developing economies gives weight to different socio-cultural, economic, religious, individual and organisational backgrounds of managers. Indeed, CSR scholars have long acknowledged the idea that socio-economic, cultural and religious characteristics of managers are expected to affect their attitude and orientation as well as subsequent behaviour and actions towards CSR (see Darrag & E-Bassiouny, 2013; Goby & Nickerson, 2016; Jamali, 2014; Jamali & Karam, 2018; Quazi, 2003; Quazi & O'Brien, 2000; Wood, 1991; Waldman et al., 2006). This is in particular the case for developing Muslim-majority countries of the Middle East region where Islamic law (or the sharia) assumes a broader and more holistic significance for both individuals and business firms. In contrast to perceived strategic and instrumental nature of CSR in Western societies for enhancing goodwill or boosting long-term financial performance (Garriga & Mele, 2004; Windsor, 2001), corporations in Islamic societies assume the roles and responsibilities as servants and vicegerents in all situations responsible towards and ultimately responsible to God. In doing so, they view CSR as a moral and religious and obligatory initiative based on the belief that they should act in the interest of the society as a whole regardless of its financial consequences (Ahmad, 2003; Dusuki, 2008, pp. 18). Despite voluntary CSR decisions of Western organisations, performing socially responsible activities are deemed obligatory in Islamic business context (Mir et al., 2016). Thus, this chapter unravels the nature of managerial CSR attitudes and orientations in the Middle East region (Payind & McClimans, 2017) with a focus on Iran's auto industry (The Economist, 2019).

This chapter is divided into four main sections. The first section provides a review of the literature on CSR management. The second section discusses the research design and context of the study. The third section presents the findings derived from qualitative data collected from different several manufacturing firms operating in Iran's automotive industry. We finally conclude the chapter by highlighting avenues for future research.

THEORETICAL BACKGROUND OF THE STUDY

Research into managing CSR practices has evolved in different directions and caused widespread controversy among organizational scholars. This ranges from viewing CSR as a business-centred and instrumental model (Gond & Matten, 2007, pp.1) to conceptualizing the inherent nature of societally embedded CSR (Gond & Matten, 2007, pp.1). Despite the existence of competing and contrasting perspectives of CSR and resulting multiple conceptualizations of the term, we categorize CSR management research into two broad streams: (i) research into the quest for CSR; and (ii) studies of the relevance and appropriateness of managerial attitudes and orientations toward CSR (e.g. Hillman & Keim, 2001; Howell & Avolio, 1992; Jones, 1995; Kanungo, 2001; Waldman et al., 2004).

The central theme of research into the quest for CSR has focused on a number of competing and contrasting theoretical traditions. Following Wood's (1991) multilevel analysis of CSR research, we discuss the quest for CSR practices from institutional, organizational and individual perspectives. The institutional level analysis places organizational legitimacy at the core of a quest for CSR. This debate was first stimulated by the contribution of Davis (1973) who coined the phrase 'Iron Law of Responsibility' to express legitimacy as a societal level concept. As she put it, "Society grants legitimacy and power to business. In the long-run, those who do not use power in a manner which society considers responsible will tend to lose it" (1973, p. 314). Those who view the principle of legitimacy as the rationale underpinning the CSR practice describe the responsibility of business as a social institution that

must avoid abusing its power. As a societal-level concept, legitimacy connotes a prohibition rather than an affirmative duty which applies equally to all companies. Studies advocating a legitimacy approach further explore the theoretical underpinnings of this principle in terms of functional theory (Preston & Post, 1975), stakeholder perspective (Freeman, 1984), and utilitarian theory (Clark, 1916). At the organizational level, the focus is on the sensitivity and paramount importance of public responsibility. Derived from the work of Preston and Post (1975, p. 10), the principle of public responsibility refers to “the functions of organizational management within the specific context of public policy”. According to this principle, the organization’s quest for CSR is seen to solve any social issues arising from their business operations. These include both areas of primary involvement with society which arises directly from the firm’s specialized functional role and secondary involvement with society which is a function of the primary behaviours and transactions. To better operationalize this principle, Wood (1991, p. 698) translates public responsibility into a broader ‘rule of relevance: the reciprocal influences of business and society’. At the individual level, the central theme of discourses on CSR has put the stress on the idea of ‘managerial discretion’ (Ackermann, 1975). A clear expression of this principle is echoed by Wood’s (1991, p. 698) comment that “managers are moral actors. Within every domain of corporate social responsibility, they are obliged to exercise such discretion as is available to them, toward socially responsible outcomes”. Of paramount concern for Wood (1990) is how a company fulfils its voluntary or compliance-based CSR mandates. Her central line of argument is worth quoting: “A company’s social responsibilities are not met by some abstract organizational actors; they are met by individual human actors who constantly make decisions and choices, some big and some small, some minor and other of great consequence” (cited in Wood, 1991, p. 699).

As is evident from the review of research into the quest for CSR, institutional and organizational quests for CSR practices rely, in the main, upon varying perceptions and orientations of individual managers to pursue CSR decisions and strategies. Studies of the relevance and appropriateness of managerial orientations towards CSR (e.g. Hillman & Keim, 2001; Howell and Avolio, 1992; Jones, 1995; Kanungo, 2001; Waldman et al., 2004) have highlighted the paramount importance of personal attitudes and orientations as forces that shape managerial decisions and subsequent actions (Triandis, 1995; Waldman et al., 2006). The hypothesised importance of managerial attitudes and orientations in the context of CSR is largely attributed to the ‘multidimensionality of CSR values’ (Freeman, 1984). This is the position taken by the proponents of ‘stakeholder theory’ who view a firm to consist of a variety of different constituencies and that each constituent has a strategic and/or moral stake in the firm. Given such variety of different constituencies, it is no surprise to observe that each constituent advocates its own interests and values (Donaldson & Preston, 1995; Freeman, 1984, 1994). Waldman et al. (2006, pp. 824; see Wood, 1991) take the argument further with their hypothesised connection between the potential conflicts of interest between stakeholders and their direct influence on the managerial orientation toward CSR. In addition to the ramifications of the conflicting interests of the stakeholders for the way managers perceive choices to pursue CSR decisions, others highlight the paramount importance of various cultural and leadership contexts to play a part in shaping managerial orientation and subsequent actions towards CSR. The influence of these forces (e.g. for national cultural norms of work – see Hofstede 2001; for organisational culture – see Schein, 1992; Vitell & Paolillo, 2004; for profession – see Sirmon & Lane, 2004) is particularly evident in the work of Williams & Aguilera, (2008) and Waldman et al., (2006). The emphasis arising from these cross-cultural studies is not so much the effectiveness of CSR practices or their bottom line performance impact. Rather, It is the compelling evidence that managerial attitudes and orientation toward CSR vary across countries, owing to the myriad of socio-cultural, economic and political forces such as hyper and local norms, social institutional constraints, and the level of industrial-

sation (see Cullen et al., 2004; Donaldson & Dunfee, 1999; Egri et al., 2006; Jamali et al., 2008; Javidan & Dastmalchian, 1998, 2003; Quazi, 2003; Spicer et al., 2004; Storey, 1992; Waldman et al., 2006; for a review see Williams & Aguilera, 2008, pp. 460–465). Although these cross-cultural, country-level analyses have offered some potential in clarifying the hypothesized relationship between managerial orientation and firm-level CSR outcomes, they are fraught with immense difficulty, owing to the vast range of confounding variables and their heavy focus on Western-dominated and emerging economies contexts, thereby devoid of critical analysis of CSR management in non-Western organisational contexts. These studies have therefore failed to allow the progressive refinement of a CSR-oriented management model which delineates the personal attributes and values of senior managers that could influence their orientation, shape their subsequent actions, and determine the propensity of firms to engage in CSR (see Storey, 1992; Waldman et al., 2004).

One way to tease out these unresolved issues in the existing conceptualisation of and theorising CSR-oriented leadership model is to more directly examine the various managerial orientations which could determine the extent to which firms engage in CSR and result in different firm-level CSR outcomes. As Van Tulder & Van der Zwart (2006) have pointed out, the current theorisation of the role of managerial leadership of CSR is primarily concentrated on Anglo-Saxon, Western dominated contexts and this in turn makes it difficult to arrive at general conclusions.

Despite a growing body of research attesting to divergent nature of CSR practices (Jamali et al., 2015) and CSR management as a context-sensitive and -dependent phenomenon (Waldman et al., 2006), research on the actual practice of CSR and managerial leadership of CSR across the developing world has been sparse. Jamali et al.'s (2017) study of the meaning and practice of CSR in four developing countries (i.e. China, India, Nigeria and Lebanon) is suggestive of supranational and culturally embedded and nuanced institutional logics shaping CSR in developing countries. In a similar vein, Chapple and Moon's study of CSR in seven Asian countries (i.e. India, Indonesia, Malaysia, the Philippines, South Korea, Singapore and Thailand) suggests that while CSR does vary considerably among Asian countries, the difference in the actual practice of CSR is less to do with the level of economic and social development. Instead, the actual practice of CSR is a function of the national business systems. In line with these macro-level analysis of CSR adoption and diffusion, other scholars have offered a more micro- and meso-levels account of CSR practice in the developing economies. Rahaman's (2000) qualitative study of Ghanaian firms is suggestive of the reluctance of Ghanaian companies to take a stand on CSR and that they make little or no effort to measure, disclose or even adopt a formal environmental management system. Newson & Deegan's (2002) study of 150 large Australian, Singaporean and South Korean multinational corporations (MNCs) is indicative of paying lip-service to the notion of global expectations of sustainable business practices and that (e.g. non-financial and environmental disclosure policies). At the micro-level of analysis, research evidence places emphasis on the managerial perceptions towards the adoption and diffusion of CSR. In Rahaman et al.'s (2004) examination of CSR adoption motivation in Ghana, managerial interviewees referred to external pressure from international lending organisations such as the World Bank to be the main driving force behind CSR adoption. Belal & Owen (2007) followed a similar line of qualitative inquiry in Bangladesh and found that a desire to manage powerful stakeholder groups to be the main logic CSR adoption and implementation by Bangladeshi managers (see also Islam & Deegan, 2008; see for a review Belal & Momin, 2009; Goby & Nickerson, 2016; Jamali & Karam, 2018; Soltani et al., 2015).

As is evident from the above summary of CSR research in the context of developing economies, the developing Muslim-dominant region of the Middle East has received less attention than it deserves (see Payind & McClimans, 2017). This inattention is despite the fact that the region plays a major role

in global economics and politics and that Islamic law (the sharia) and institutions play a major role in shaping the nature and scope of social imperatives and consequences of business success. The Islamic law requires people to submit to the Sharia by committing themselves to the contractual obligation and leading life in accordance with high virtue and moral consciousness. More specifically, sharia assumes a more vital role than the social contract for both individuals and businesses (pp. 14). While neoclassical economics expect individuals and businesses to conduct economic, social and other worldly activities as self-centred utility-maximising economic agents, the religious bond expect individuals and businesses to maintain a balance between the rights and responsibilities of the individuals and that of society (Chapra, 1992). The essence of social responsibility in developing Middle East region is firmly inscribed within the religious bond (14). As Dusuki (2008) observes “Islam...envisages business firms as stewards and caretakers, not just o shareholders’ financial resources, but also of society’s economic resources, holding their property in trust for the benefit of society as a whole and ultimately attaining the blessing of God (pp. 22). In contrast to the voluntary and optional nature of CSR policies and practices of corporations in developed economies, CSR is a religious obligation for all Muslims and hence individuals and business firms in Muslim societies are to instil good environmental, occupational, philanthropic, mutually beneficial CSR Initiatives.

While the preceding review of research on CSR adoption in developing economies attributed the effectiveness of CSR practices to a myriad of internal and external factors, the common denominator in the extant literature on CSR appears to be the primacy of management role – as opposed to view the corporation or external constituencies as the agent (Ackermann, 1975; Hemingway & MacLagan, 2004; Matten & Moon, 2008; Wood, 1991). Despite the acknowledged significance of management to strategic and sustainable CSR programmes and long-term CSR success and renewed call for more research Western and emerging contexts (see Jamali & Karam, 2018; Goby & Nickerson, 2016; Soltani et al., 2015), the intricacies of CSR management in organisational adoption and implementation of CSR in the context of developing countries has relatively remained understudied.

The aim of this book chapter is to respond to these challenges and examine the research phenomenon through a qualitative case study of a leading automotive manufacturing group in the Middle East (identified by the pseudonym ‘Safe Car’). The automotive group in the current study has been involved in extensive joint-ventures operations with foreign firms of high CSR profile.

RESEARCH CONTEXT AND DESIGN

As the seventeenth-biggest state in the world and the second-biggest nation in the Middle East, Iran is known as a forward thinking nation in the region. It has a self-sustained automotive industry ready to embrace environmental and transportation challenges (Singh, 2016). The Auto industry is the country’s biggest non-oil industry (with contribution to over 10% of Iran’s GDP) which has grown to be the largest in the Middle East and 12th largest worldwide (Bahar, 2005; Haigh, 2018). A recent report by Organization of Motor Vehicle Manufacturers (OICA) indicates that Iran is the 12th biggest car market on the planet in 2017, with sales in the region of 1.5 million cars. In a bid to build a more competitive automotive industry, the government has sought to seek foreign-invested joint ventures with a particular focus on upgrading technology, protecting the environment, energy efficiency and passenger safety over the past several decades. Since then, its local auto-makers have established joint-ventures with prominent world carmakers with well-established local and global CSR policies (see Economist, 2019; Jamali, 2014).

Given the nature and recent calls for greater understanding of CSR managerial leadership, a qualitative case study approach was adopted (see Eisenhardt 1989; Yin 2003). The adopted case study approach had the potential to flesh out the peculiar CSR management orientations, provide context-dependent knowledge, and capture context-dependent reasoning for various orientations of CSR managerial leadership (Flyvbjerg, 2006; Klenke, 2008).

To collect qualitative data, we focused on ‘Safe Car’ (a pseudonym) Industrial Group. The primary means of data collection was semi-structured interviews with 28 managers at various functional and hierarchical levels. In addition, archival evidence, document analysis, and participation at in-house training sessions on CSR awareness (i.e. methodological triangulation) constituted other sources of the qualitative data. The frequent visits made to the parent company and two of its affiliates with most number of foreign joint ventures by each member of the research team during the course of the study constituted a valid basis for collecting personal or participant observation data. The research team actively took part in both one-off and regular as well as formal and informal in-company CSR-related meetings. They attended all the related workshops sponsored by each firm as well as those of jointly sponsored seminars, which aimed at enhancing intra-firm ethical working relationships.

For the purpose of the analysis of the data, we adopted a ‘discovery oriented approach’ (see Ogbonna & Harris, 2003) in that we, first, identified and named the emerging categories and properties from the data (open coding). Next, we attempted to establish a causal relationship between them (Axial coding). We finally revised, integrated, and refined the categories and properties into a core theory (selective coding) (Glaser & Strauss, 1967; Strauss & Corbin, 1990). Although a single case study can result in analytic generalisation, our aim here is to draw on alternative explanations for the extent to which firms engage in CSR by capturing various managerial orientations and their resulting ramifications for the firm’s CSR strategy.

FINDINGS

Founded in the 1960s, Safe Car Industrial Group (hereafter called ‘*Safe Car*’) is a large state-run enterprise with major interests in the automotive industry (e.g. assembling and manufacturing different types of cars). Safe Car is composed of the parent company, several subsidiaries and affiliates with domestic, regional and international operations. Its activities also embrace a portfolio of products and services, namely, investment in and acquisition of domestic and regional firms, trading and commercial services in collaboration with domestic and international firms and information technology. Although the U.S.-led sanctions on Iran’s auto industry and its associated services (e.g. transportation, insurance) led to a 17% plunge in the sales over the past several years, the operating profit of Safe Car had recently experienced a slow revival as the sanctions lifted (see Financial Times, 2014). Safe Car’s business model put the stress on the idea of ‘joint venture’ with both local and international car manufacturers.

The Nature and Awareness of CSR

The interviewees perceived CSR as a synonym of “self-management”, “self-control” and “self-discipline”. They felt positive about the adoption and diffusion of CSR practices and expressed a firm commitment to gain more familiarity with the complex and multidimensional nature of CSR. Owing to their religious orientations, ‘*sharia*’ (Islamic law) was frequently cited as the fundamental basis for understanding and promoting CSR. Several interviewees talked about *sharia* as the company’s “total CSR package” com-

posing of ‘*aqidah* or belief and faith’, *akhliq* or morality and ethics, and *fiqh* or legal rulings governing the acts of human beings (see Ahmad, 2003; Dusuki, 2008, pp. 14; Sardar et al., 2003; Schacht, 1964, pp.24). In the words of a senior public relation manager, “We follow the teachings of the *Quran* and *Hadith* and *Sunna* as a reliable reference point for our enquiries and needs at both individual and societal levels”. However, a key tendency appeared to be the increased emphasis upon the ‘individual’ rather than ‘collective’ well-being of all stakeholders. As a result, managers were selective in the way they exercised their CSR-driven ideas. Despite some evident diversities in their CSR approach, charitable and philanthropic measures, voluntary community services and corporate-NGO partnership were seen to be common CSR practices across Safe Car. Whilst a majority of the interviewees intended to extend CSR beyond the scope of work-related individual responsibility into the institutional and societal concerns, the level of awareness of how this could happen was rather low. As a human resource director put it, “In theory we are aware of the Islamic CSR and its message for individual employees, managers, organisations and the wider community of stakeholders. But we face challenges to effectively operationalize it. These challenges come from both the institution and the external environment. All we do is to comply with relevant institutional and industry regulations. Of course, this is not what we want but we cannot go beyond that. We all try to take it on-board at least at the individual level. That’s all we can do”.

This set of remarks reveals that whilst managers were intent on forcing CSR out of its silo and onto the management agenda as an organization-level activity, they were rather unable to utilise it as a way of unfreezing the *status quo*. In the light of the institutional and external forces, managers therefore perceived CSR to be an add-on activity and a peripheral to their main responsibilities. Quite clearly, CSR practices were therefore seen to be a priority where they could fulfil their obligatory responsibilities and more importantly the economic interests of the firm.

Triggers to Embrace CSR

The triggers for CSR in Safe Car were attributed to personal/individual, institutional/organisational and external/environmental forces. At the personal level, the respondents were bound by Sharia compliance mandates which govern all aspects of Muslim life. Three primary sources express the essence of the concept: the *Quran* – the Muslim holy book, the *Hadith* – the sayings and conduct of the prophet Muhammad, and *Fatwas* – the rulings of Islamic scholars (Dusuki, 2008; BBC, 2009). Discussion with managers at various hierarchical levels uncovered a generally consistent account of what sharia symbolised. Comments such as “the roadmap”, “the measure of right and wrong”, “the code of conduct for mankind”, “the balance between individual’s and society’s needs” and “the recipe for living a good life both at work and home” were indicative of the importance and ramifications of Sharia compliance. These instances which view Sharia as a set of rules and system of values and proselytise it as of universal applicability reflect the ways and manners in which individual managers utilise the philosophy of sharia to regulate their personal and work-related actions and maintain a good work-life balance.

At the institutional level, managers seemed to go further by indicating potential connections between their personal values with those of organisational and society needs. On the one hand, the need for sharia compliance made explicit a set of guiding principles and a work value system for the whole organisation (which was implicitly held by individual managers). The trigger element in the work value system was the notion of ‘*taqwa*’ (God-consciousness) meaning that “a company should be socially responsible regardless of the financial consequences”. On the other hand, the diffusion of the work value system within the organisation was reported to be entirely dependent on the top management orientation towards CSR. The majority of middle and supervisory level managers hold the view that the ‘vested interests of the top

management team (primarily for, as one HR manager put it, ‘personal stake and interest’) coupled with their ‘narrow focus’ and ‘ambiguous’ understanding of CSR set the tone for the rest of SAFE CAR and the broad community of its stakeholders to perceive CSR as ‘a peripheral add-on activity’ and ‘a mere functional cog in the organizational wheel’. For the interviewees, the CSR mandate at the top management level was highly passive in the spheres of society involvement and environmental sustainability but proactive in the economic and profit-maximisation sphere.

From an external/environmental standpoint, the triggers for embracing CSR were not greatly informed by the notion of triple bottom line – i.e. social, environmental/ecological, financial (see Savitz, 2006). This was partially because CSR was not taken on-board as a business strategy or effectively built into firm strategy. The following are verbatim transcripts of some of the interviewee’s comments on the external forces which trigger firms to embrace CSR: “We have initiated our CSR programmes as a response to external industry pressure in particular with regard to both vehicle and road safety”; “For us CSR programmes have the potential to make our market positioning more competitive in the eyes of the shareholders and in particular the government”; “We have made concerted efforts to increase the production rate in the global market and have active presence in foreign markets. So we need to conform to the global industry accepted pattern of behaviour”. Across the group as a whole, as this set of remarks reveals, there was a definite interest in embracing CSR as a default response to heightened competition, to meet investor expectations, and to fulfil the contractual joint venture agreements with foreign partners (see Bahar, 2005; Dubowitz, 2013).

Characteristics of Management Orientations

The dominant personal values attached to the notion of CSR (as opposed to the strategic value of CSR) resulted in a plethora of different meanings and interpretation of how CSR could be instituted. The analysis of the interviewees’ responses across Safe Car revealed that the CSR initiatives were unilaterally devised by the top management team. This implies that the path of CSR adoption and implementation had not conformed to a coherent and systematic plan with mutually beneficial and reinforcing practices for all stakeholders (Storey, 1992; Storey et al., 2008). At Safe Car, the senior management team had exposure to the well-designed CSR practices of their foreign joint venture partners. In the light of the familiarity with the universal CSR practices of the joint venture partners, the CSR programme was jointly negotiated (without middle/supervisory managers/employee involvement) and subsequently imposed on the affiliates and subsidiaries of Safe Car group. At the core of the CSR programme was a heavy emphasis placed on economic efficiency and labour productivity, owing largely to the know-how transfer by the joint venture partners. Middle managers talked of the ‘not invented here’ syndrome in the sense that the CSR programme were designed without their involvement and subsequently they felt little sense of ownership of the programme. While a set of operational and tactical plans were deployed to fulfil the minimum level of car safety standards, and tended to characterise Safe Car’s CSR approach, the plan was not linked in any coherent manner with the broad notion of CSR. As a result, the hoped for CSR as a mechanism for ‘shared values, integration of business into the community, and development of human capital’ failed to materialise. The *ad hoc* and partial approach to CSR by the foreign joint venture partners implied that they were not fully committed to their standardized global directives on CSR. To a considerable extent the *ad hoc* approach of the joint venture partners to lay stress on operational excellence as a guileless substitution for CSR was attributed to the government’s support for the foreign auto makers. A review of Iran automotive industry policies reveals that government’s inclination to support foreign car manufacturers and joint venture activities is for two main reasons: to counteract the country’s

industrial shortcomings, and to deflect the US-led economic sanctions against the country (see Peimani, 2003; Storey, 1992).

The ramifications of the dominant personal values attached to the notion of CSR coupled with the government's support to the automotive industry for the management of CSR were two-fold: a strong compliance culture with weak ethical conduct, and an inward-looking/inside-in CSR management. Each of these managerial orientations is explained below.

The dominant personal values attached to the notion of CSR inculcated (as one operations manager put it) "a culture of compliance across the group" which in turn reinforced "an organisation-wide commitment to compliance with mandatory governmental regulations". A senior advisor to the management team captured the feelings of many middle and supervisory level managers on this issue: "We are all regulatory experts. We understand and are aware of the negative consequences of noncompliance with, for example, safety standards of our products, labour legislation etc. So we do whatever we are told to do and we exactly comply with the top management's CSR mandate". According to an HR manager, "The existing managerial approach to CSR does not go beyond the labour law which regulates working conditions, minimum wages, hours of work and health and safety". For several marketing managers, the need for the management-led compliance was core to their marketing campaign as it helped lay the base for "maintaining the customer's confidence in the quality of product and service offerings". Close analysis of the marketing strategy of Safe Car industrial group revealed quite clearly certain contrasting features which played down the importance of a socially responsible corporation. For example, a senior marketing manager remarked that "socially responsible activities such as promoting a culture of traffic safety or training programmes for young drivers which are needed to counteract the country's high rate of traffic fatalities are not integral to our marketing campaign simply because we will not be rewarded or recognised for such activities by our senior management team and automotive industry authority". In a similar vein, the main thrust of the Safe Car's management-led compliance culture for several operations managers was highly suggestive of a business or economic perspective toward CSR. As our analysis of the data and publicly available CSR documentary evidence of Safe Car indicated, top management's CSR action plan centred on (in the words of a production manager) "using CSR as a business opportunity for profit-maximisation, quantifying the cost-benefit analysis of CSR-related programmes, and restricting the scope of CSR to those activities which are governed by law and decrease the costs of non-compliance with the manufacturing and environmental regulatory obligations".

The strong compliance culture with weak ethical conduct paved the way for an inward-looking managerial orientation toward CSR. The key to this managerial orientation was seen as a dual move to get the lower level managerial and non-managerial employees on board through a superficial focus on internal CSR (e.g. work health and safety, technical training) while also fulfilling their managerial self-centred priorities (to the exclusion of external CSR –i.e. those they serve or stakeholders). As one HR manager observed, "What we have as internal CSR is not different from our previous HR system. It is an update on HR policies related to work health and safety and employee training. Yes I should say that employees are more engaged now but this does not give them a greater sense of control over their work activities". As our evidence indicates, the key priority that drove the notion of internal CSR was the ability to react to the increase in Iran's booming cars market. A senior sales executive commented, "The revised HR policies which our top management label it as 'internal CSR' are meant to exercise tight managerial control over the workforce, to increase span of management control, and to meet production deadlines. It is not really to do with concerns over employee's wellbeing, care for customers, respect for society or even empathy with environment" (see for a review of managerial leadership in Iran: Analoui et al.,

2009; Javidan & Carl, 2004; Javidan & Dastmalchian, 1998, Javidan & Dastmalchian, 2003; Soltani, 2010; Soltani et al., 2011; Soltani and Wilkinson, 2011).

In a similar vein, several managers pointed to a continued ambiguity surrounding the impact of foreign partners on the adoption and diffusion of CSR practices in Iran's auto industry. Across the different foreign partners of Safe Car industrial group, there was a tendency on the part of the foreign partners to drift in the direction of the local managers and that their approach to CSR differed significantly from their global CSR concerns. A public relations manager made the nature of this approach sufficiently clear: "the fulfilment of the minimum operational necessities for car and auto parts production is the primary concern of our foreign partners. They simply comply with the government regulations and automotive industry mandates". As our evidence indicates, the foreign partners were seeking to put relations with local firms on a new footing – one which was in line with the 'self-centred priorities of the local management'. Hence, the growing number of global vehicle manufacturers in Iran seems to eschew their global CSR programmes in favour of a management style which engender the immediate interest of the management and the maximization of shareholders' wealth (see Chiou & Shu, 2019; Jamali, 2010; Storey, 1992, pp. 169).

CONCLUSION

It was evident from an analysis of Safe Car that 'the corporation management set the tone for and have the discretion to determine the extent to which their firms engage in CSR' (Matten and Moon, 2008, p. 405; Waldman et al., 2004). Whilst, at least in broad terms, there did appear to be evidence of CSR-related practices across the group, the dominant managerial orientation toward CSR neither bring corporate behaviour up to a level where it was congruent with the prevailing Islamic cultural and societal norms (Ahmad, 2002; Ahmad & Sadeq, 2002; Dusuki, 2008) nor it had resemblance to the underlying premises of CSR (Crane et al., 2008; Carroll, 1999; Visser et al., 2007). The overall trend was incontrovertibly towards more personal/managerial use of CSR. Hence, the crucial importance of a culture of compliance in helping to conjure their "unenlightened self-interest" was very evident. These managerial tendencies have typically carried out implications for the way the CSR was adopted, diffused and instituted. The results revealed that the nature and orientation of the management team was intimately linked with the potential to foster a culture of compliance with "the (minimum) regulatory safety standards of auto industry" and that the latter brought the role of supervisory level managers and employees to the fore as the crucial delivery mechanisms to fulfil the managerial myopic selfishness (de Tocqueville, 2000; Griffiths & Lucas, 1996; Steenbergen, 1935).

Contrary to speculative reports about the potential role of foreign affiliates in determining the propensity of local firms to engage in CSR activities (Cheung et al., 2010; Fukukawa & Teramoto, 2009; Jamali, 2007; Khan et al., 2013; Matten & Moon, 2008; Yin & Zhang, 2012), our findings warn of the false seduction of the developmental promise of foreign firms' adoption and implementation of CSR in developing countries. The foreign firms operating in Iran's auto industry had taken the local managers' interest in preserving authority over CSR programmes as the cue to perpetuate silence over the reality of CSR culture across the industry and to adopt a partial approach to CSR (e.g. an emphasis on mandatory safety standards as surrogate for CSR), thereby fulfilling the local management and their own self-interests (see Frynas, 2005; Jamali, 2010). It was found that the on-going US-led sanctions on Iran's energy sector established a need for the government to seek new sources of revenue (i.e. automotive industry) for the government expenditure (Felsenthal et al., 2013). However, such increasingly pressing need for a reliable

and prompt source of income for the government was less likely to recognise or approve the need for an investment in socially responsible foreign business investors. There was evidence to suggest that the government inattention to the extent to which managerial actions of foreign affiliates and joint venture partnerships bring about a marked transformation of business-government-society relations (Chapardar & Khanlari 2011) created more opportunities for foreign firms to negotiate more profitable business agreements and offer them an invaluable source of economic and commercial advantages (Frynas, 2005). As our evidence indicated, foreign affiliates approach to CSR had not been matched as yet with the kind of integrated and strategic approach to CSR which can aid the country to gain the respect and international recognition it deserves (see Frynas, 2005; Jamali, 2010; Newson & Deegan, 2002; Storey, 1992). In fact, the absence of a governance vacuum in the enforcement of national laws and taxes in the country coupled with the widespread presence of multinational firms in the lucrative Iranian auto market pave the way stakeholders and nongovernmental organizations to serve as agents to further stimulate and even sanction firms and institutions to act responsibly and sustainably in their business-development relationship with firms in developing nations (Schäfer, 2019, pp. 43). There is an important conclusion to this chapter on the local government's role. Across Safe Car industrial group, there was very considerable evidence of the absence of a transparent, explicit, developmental and uniform pattern of CSR practice. As the evidence indicated, managers were increasingly of the view that they were more in favour of the instrumental use of CSR to secure short-term profit and quick-fix orientation towards the stakeholders' concerns (see Friedman, 1970; Russo & Fouts, 1997; Waldman et al., 2004). Hence, in order to optimize their multiregional and global presence, the automotive industry has to take account of the social imperatives and consequences of the industry business operations and performance (see McWilliams & Siegel, 2001). Incorporating ethical values into strategy formulation and functional decision-making processes, enhancing transparency and self-regulation practices, developing an internal integrated reporting system as a form of moral compass to stimulate and promote CSR (Dragu, 2018, pp. 43) and promoting corporate citizenship and responsibility are deemed essential for the management and policy makers of the industry to activate their CSR managerial approach. Building on these findings and consistent with the current policy of the government to jump-start its auto industry in the face of fast-growing domestic demand, and in the wake of the on-going U.S. sanctions and its allies (see Peimani, 2003; Felsenthal et al., 2013), the onus is on the policy makers to perceive CSR as "the responsibility of companies for the impact they have on society", to utilise the notion of the sustainable development to their operations "in the interest of companies and society as a whole" (The European Commission, 2011), and to create a business environment which lives up to the socio-economic, institutional, regional and global CSR and ethical standards (See Analoui, 1999; Blowfield & Dolan, 2014).

FUTURE RESEARCH

The aim of this study was to examine the actual practice of CSR in terms of awareness, triggers and management in the context of a developing Middle East country. Despite being an obligatory on every individual and business from the Islamic perspective, the findings of this study are suggestive of CSR to be relatively insignificant, business-oriented and compliance-driven strategy in practice. In addition to these findings, further research would prove beneficial for both theory and practice of CSR. More specifically, two avenues of empirical scrutiny appear promising. First, replicative and comparative research on CSR adoption and implementation in different industries and Middle East countries with different levels of economic growth gives greater validity to the findings. Second, longitudinal research

into the performance impact of CSR and its wider consequences for all stakeholders would serve different purposes, namely, it uncovers the complex nature of religious issues of CSR adoption; it sheds light on the nature and dynamics of CSR practices and consequences; it analyses the managerial difficulties inherent in the Islamic perspective of CSR in the region; and it provides an empirical and theoretical basis for developing an Islamic-centric version of CSR that can create greater value for all stakeholders.

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KEY TERMS AND DEFINITIONS

Corporate Social Responsibility (CSR): It “encompasses the economic, legal, ethical, and discretionary (philanthropic) expectations that society has of organizations at a given point in time” (Carroll, 2016).

CSR in Islam: It refers to obligatory and compulsory business standards that individuals follow in their business operations and interactions with different business stakeholders’ (see Dusuki, 2008).

Hadith: A narrative record of the sayings or customs of Prophet Muhammad (peace and blessings of Allah be upon him) and his companions (Merriam-Webster Dictionary, 2019).

Iran: Known as Persia until 1935, Iran (officially the Islamic Republic of Iran) became an Islamic republic in 1979. It is the 19th largest country in the world with a population estimated at 82.91 million. Geographically, Iran is located in the Middle East region, bordering the Gulf of Oman, the Persian Gulf, and the Caspian Sea, between Iraq and Pakistan (CIA – The World Factbook, 2019).

Islamic Law (Sharia): The Sharia is Islamic Law based on the teachings of the Quran and the Prophet Mohammed. Islamic law or Sharia law is a religious law that forms part of the Islamic tradition. It governs both religious rituals and people’s daily interactions and transactions (e.g. individuals’ business activities and business relationships) (see Esposito, 2019). The main components of Shari’ah are *aqidah* (belief and faith) and *akhliq* (morality and ethics), and *fiqh* (legal rulings governing the acts of human beings) (Dusuki, 2008, p. 14).

Management Attitude and Orientation: It connotes managers’ basic beliefs, preferences, perceptions (positive or negative) and rationale that set a tone for subsequent actions and behaviours by managers in adoption and diffusion of CSR practices in organisations (see Dweck, 2006).

Middle East: It covers the lands around the southern and eastern shores of the Mediterranean Sea, extending from Morocco to the Arabian Peninsula and Iran’ (Encyclopedia Britannica 2013, para. 1). The Middle East region has an estimated population of over 411 million. Known as the energy storehouse of the world (Popov, 2017), the region accounts for one-third of global oil production, one-sixth of gas production, 48% of proved oil reserves and 38% of proved gas reserves (BP, 2019). The Muslim populations of the Middle East is made up 44% of the total world Muslim population.

Stakeholders: Any identifiable group or individual who has direct or indirect stake in an organization. In other words, stakeholders are those who can affect the achievement of an organization’s objectives or who is affected by the achievement of an organization’s objectives. Key stakeholders in a business organisation include creditors, customers, directors, employees, government (and its agencies), owners (shareholders), suppliers, unions, and the community from which the business draws its resources (Freeman & Reed, 1983; Essays UK, 2018).

Taqwa: it is the basic Islamic principle of God-consciousness. It connotes fear of God for self-righteousness (right conduct, virtue, wariness). Abu al-Ala Mawdudi (1979) identified taqwa together with brotherhood, equality, fairness, and justice, on which the true Islamic society is established (The Oxford Dictionary of Islam, 2019).

Chief Digital Officers and Their Roles, Agendas, and Competencies

12

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INTRODUCTION

In 2012, Gartner, a research company, conceptualized digital transformation as the nexus of four forces: social, mobile, cloud technologies, and big data (Gartner, 2012a). The same year the company brought into the global spotlight the question, “Do you Need a Chief Digital Officer?” (Gartner, 2012b). The article stated that “The Chief Digital Officer will prove to be the most exciting strategic role in the decade ahead, and IT leaders have the opportunity to be the leaders who will define it. The Chief Digital Officer plays in the place where the enterprise meets the customer, where the revenue is generated and the mission accomplished. They’re in charge of the digital business strategy. That’s a long way from running back office IT, and it’s full of opportunity.” Unlike the position of Chief Information Officer, the position of CDO was not determined by infrastructure or hardware, but by a shift in performance and innovation.

By the time the paper was published, the CDO position had already been in place for a few years. In 2005, at least one company had introduced this role (Riccio, 2016), and in 2012 there were hundreds of CDOs. Nevertheless, it was still relatively rare, and there was a great deal of debate around it. Where do CDOs come from, what is their role in the company, what problems do they solve, and what results should they achieve? Throughout the six years since the Gartner’s publication, these issues gained in media prominence, yet the range of opinions is still disconcertingly broad.

BACKGROUND

Managing complex information systems became a pressing business issue in the mid-1980s. Around this time the first literature emerged analyzing the organizational approaches to IT management, including the role of a person in charge (Benjamin, Dickinson & Rockart, 1985; Applegate & Elam, 1992). Soon the term “Chief Information Officer” emerged to describe this role, with the view that the position implies not only functional technical knowledge but also certain executive powers (Stephens et al, 1992). Much of the literature from the 1990s and 2000s analyzed the amount of executive power required for CIO to effectively perform his/her functional tasks (Johnson, Lederer, 2010), the issue remains important till the present day (Chou, Wang & Yang, 2015; Hütter & Riedl, 2017).

In the mid-1990s a new class of information systems emerged, those linked to the Internet, by mid-2000s they became a game-changer even in most conservative industries. Those systems brought significant disruption to processes of corporate IT management, creating the agenda of e-business that was different from the traditional agenda of a CIO. The significant impact of e-business on organizational IT systems was noted in the early 2000s (Reich & Nelson, 2003), however, this impact was initially seen as limited to the complexity of information systems (integration on external and internal systems

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Figure 1. Google search trend for the search term “Chief Digital Officer” (100 is the maximum number of searches for this term)



in web-sites) rather than in massive organizational change. Further market developments showed that to effectively compete in the e-business world a traditional corporation requires not just a different stack of technologies but a different organization and culture. This expanded the agenda of developing e-business competencies into the agenda of digital transformation. As noted by Matt et al (Matt, Hess, & Benlian, 2015), “IT strategies present system-centric roadmaps on the future uses of technologies in a firm, but they do not necessarily account for the transformation of products, processes, and structural aspects that go along with the integration of technologies. Digital transformation strategies take on a different perspective and pursue different goals. Coming from a business-centric perspective, they focus on the transformation of products, processes, and organizational aspects owing to new technologies”. Such a view called for a new executive role, the Chief Digital Officer¹.

Horlacher and Hess (Horlacher & Hess, 2016) introduced an important distinction between supply-side and demand-side tasks in information systems, which generally delineates the domains of responsibility of CIO and CDO. The supply-side tasks are aimed at “IT operational efficiency and performance through the sourcing and deployment of IT. Supply-side managers exploit IT resources to support business functions and engage in routine operational support.” In contrast, IS demand-side tasks are “aimed at business innovation, business growth and the creation of new business value through IT. Demand-side managers explore IT-enabled innovations and corresponding strategic opportunities for the company in the face of constantly changing market environments”. In the study of four corporate cases, they found out that CDOs concentrate on the demand-side tasks, while CIOs or CTOs (Chief Technical Officers) are responsible for supply-side tasks. The results of Korovkin (2019) show that some CDOs have also responsibility for certain supply-side tasks, especially in the context of heavy industry B2B operations.

CURRENT RESEARCH

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a) Agendas and Roles of CDOs

To describe the possible agendas of CDOs a consulting company Strategy& introduced a model of five archetypes (Strategy&, 2017): the progressive thinker, the creative disrupter, the customer advocate, the innovative technologist, and the universalist. According to the model, the *progressive thinker's* mission is to look for opportunities to transform the business through digitalization and to push the company towards the fully digital strategy and operations model. Working with the CEO, progressive thinker focuses on developing a digital strategy and innovation throughout the company. As opposed to the progressive thinker, the *creative disrupter* offers a more hands-on approach geared toward developing new digital technologies and the respective business solutions. They can be especially valuable in companies facing severe and dramatic changes as a result of digitalization in end-consumer-oriented industries, such as retail. He or she will have to work directly with the CEO on revenue growth through competitive differentiation. *The customer advocates* typically report to the Chief Marketing Officer and head of sales — or could even replace them. They are primarily market-driven and customer satisfaction oriented. The customer advocate focuses on developing a convenient, engaging, and seamless customer experience across all channels, digital and physical. *The innovative technologists* are much like a highly innovative and business-focused CIO or chief technology officer (CTO); these CDO promote the use of new digital technologies, such as the Internet of Things (IoT), mobility, social media, and analytics, to transform the company's entire value chain, while improving internal efficiency and cutting costs. *The Universalist's* mission is to manage all aspects and all value-creation levers of a complete digital transformation. The most visionary of the five archetypes, they can succeed only by having a forceful mandate from the CEO and significant power of execution. Reporting directly to the CEO, the universalist can oversee a wide spectrum of digital tasks: strategy development, devising new business models, overseeing digital marketing and the customer experience, implementing digital technologies, boosting operational efficiency, and digitalizing the ways, in which employees do their daily work. He or she should also be in charge of the cultural change management process.

For any top manager, it is important to interact with directors in charge of other functions. A model by Deloitte Digital (2017) describes the CDO's interaction with colleagues as follows:

- *CDO — CEO (Chief Executive Officer)*: be the catalyst of transformation and shape the CEO's innovation agenda;
- *CDO — CFO (Chief Financial Officer)*: to create better financial results; with the right mandate and application, digital technology becomes a powerful driver of cost-cutting or creating new cash flows;
- *CDO — COO (Chief Operations Officer)*: to supply technology for improving operational efficiency by digitalizing internal processes or reducing employee workload through customer self-service;
- *CDO — CMO (Chief Marketing Officer)*: to support the transition from transactional marketing to interactions based on the use of social media, mobility, search technology, and portable digital devices;
- *CDO — CSO (Chief Strategic Officer)*: to support the strategic development of the company through the development of new markets;

- *CDO — CIO (Chief Information Officer)*: to create a team of technical professionals to complement the existing capabilities with a focus on front-end solutions (with the responsibility of back-end operations remaining with the CIO).

Thus, despite the possible differences in the primary focus of the CDO's agenda, some responsibilities are common to every industry and company. CIO magazine (CIO, 2015) named six such responsibilities:

1. Map digital capabilities to strategic priorities. Digital has to prove its capability to lead the company to its goals;
2. Be the sponsor for digital process innovation;
3. Develop and administer the digital project portfolio. Centralized monitoring of often heterogeneous digital initiatives is critical;
4. Measure new efficiencies and ROI. Replacing manual processes with technology drives both cost savings and revenue generation; the CDO's role has great tools to measure success.
5. Develop ways to attract and retain top talent. Companies often have more mature visions for digital than they do skills to implement them.
6. Be the "intermediary" between key functionaries during the implementation, including swaying allies, re-establishing priorities, coaching, or serving as tiebreaker during the roll-out of digital projects.

Thus, regardless of the specific industry or company, the role of CDO, the leader of digital transformation, is defined by diverse and demanding requirements. A perfect CDO is a super-manager with a variety of functions who actively interacts with other executives and has profound knowledge as well as managerial skills. The technical side of the process of digital transformation is not always pivotal to success (Bloomberg, 2018), thus profound knowledge and experience in working with information technologies do not make for a good CDO. Research of CDOs of international corporations (Strategy&, 2017) showed that only 14% had any technological background, more than half were previously employed in marketing or sales.

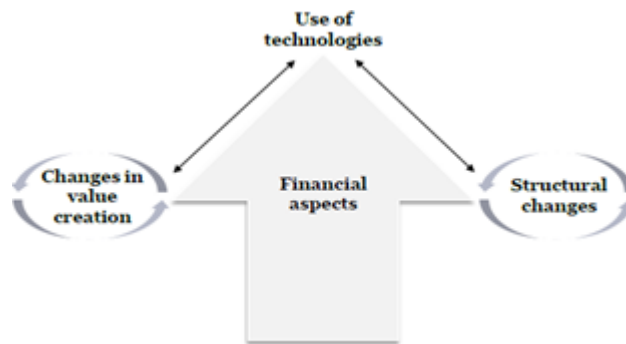
b) Agendas of CDOs Within a Broader Strategic Context

The difference between CDO agendas is largely determined by the difference in approaches to the digital transformation in a large company operating in a traditional industry². As such, digital transformation must be set apart from digitalization. Digital transformation is "consumer-initiated strategic changes to business that require comprehensive structural changes along with introduction of digital technologies" (Bloomberg, 2018), while digitalization is a simpler process of applying digital technology to improve the existing business models³. As a result, digital transformation suggests several alternative strategies.

Matt et. al introduce a model of four dimensions of digital transformation strategies: use of technologies, changes in value creation, structural changes, and financial aspects. (Matt, Hess, & Benlian, 2015), yet they do not elaborate on the impact of this model on the corporate agendas, specifically on the possible roles and skillsets of CDOs. It can be implied from their work that a leader of corporate digital transformation should be proficient in all four dimensions.

Korovkin (2017) suggests a different model of three possible strategic routes of digital transformation, that differentiates between types of businesses based on the nature and environment of their operations: "fully digital", "digitally wrapped", and "digitally spiced".

Figure 2. The digital transformation framework according to Matt et al (Matt, Hess, & Benlian, 2015)



To qualify for the **“fully digital”** strategy, the product must be made of bits, not atoms; the industry must be close to the end consumer and not have significant external (for example, regulatory) constraints. The **“digitally wrapped”** strategy is implemented where the product is made of bits, but the industry is substantially constrained with respect to changing the business models (for example, banks), or if the product made of atoms is close to the end consumer, allowing for a fundamental restructuring of sales channels with the application of digital technologies (airlines). And lastly, the **“digitally spiced”** strategies are best for industrial companies that are quite distant from the end consumer and have a large amount of productive tangible assets.

Some interviews with CDOs (Korovkin, 2019) showed that the choice between these strategies is not fully determined by the industry. Even more significant is the company leadership’s strategic vision and willingness to expand their understanding of the industry and markets. Though oil companies continue producing oil (which is made of atoms), refine it and physically relocate, which imposes the “digitally spiced” strategy (for example, “smart field” technologies), they can at the same time be a successful venture capitalists that strategically expand the existing range of business models and effectively enter fully digital markets. One example is the Shell venture fund⁴, with over 200 projects in its portfolio, including management of family utility expenses, a mobile application for taxi drivers to optimize fuel consumption, and electricity-generating kites.

Different digital transformation strategies set different priorities for top managers. The **“fully digital”** strategy is normally implemented within the digital platform paradigm and the surrounding ecosystem (Schreieck et al., 2018). In this context, the key competition instrument is the creation and development of effective consumer behavior management models that use data analysis to ensure maximum accuracy and performance. A typical example is recommendation engines that bring in significant additional profits for e-commerce platforms (Lee and Hosanagar, 2014; Sivapalan et al., 2014).

The **“digitally wrapped”** strategy requires, above all, that the corporate leadership opts for the right strategic development trajectory, utilizing digital creative disruption in sales and customer interaction channels, as well as organizational support to implement this trajectory (Korovkin, 2017). Revolutions like the transition of airlines to digital customer self-service when buying tickets and checking in for flights, inevitably run into serious resistance within the company. Back-office employees in charge of internal business processes are usually far more conservative than the front office in charge of sales. Overcoming this resistance and uniting the company around the new digital vision requires not only support from top management, but also persistent efforts on the part of the leader, who should insist that profound changes are indispensable and strategically expedient, and who will moderate emerging internal conflicts (Sacolick, 2018).

Finally, when implementing the “**digitally spiced**” strategy, the leadership is focused on developing a long-term program of digital projects that provide business results and are technologically feasible. Selecting and assessing such projects is a challenge given the constantly changing technological landscape, the associated inflated expectations, and high uncertainty about the projects’ actual outcomes⁵. Often, a strategic competitive edge in the industry is gained if the stake on new technology is made during its early development. However, it is during this very period that the likelihood of major implementation errors is greatest. This contradiction can only be resolved with top management’s participation in the selection of key technological projects and their implementation. It also requires the creation and development of a corporate innovation culture that is tolerant of errors and able to turn early failures into successes (McKinsey, 2018).

All three of these strategies require a CDO, a top manager in charge of digital transformation as an important condition to success. However, the range of problems such a manager deals with is profoundly different depending on the strategy. In the “**fully digital**” domain, the CDO virtually becomes the corporation’s key visionary. His responsibilities include ensuring competitiveness with companies “born digital”, which look for the slightest faults in well-established business models to re-direct financial flows through “digital disruption” to their benefit. This opposition requires a constant search for investment opportunities into new business models that maximize the effects of digital technology. The main decision-making factor for investment becomes its ability to win and retain customers, sometimes even at the expense of short-term marginality. This work, among other things, requires the development of new operation tools such as corporate venture funds, which enable the engagement of a substantial number of fairly independent and creative businesses in the enterprise. Culturally, the corporation should be as open as possible to bottom-up initiatives and decentralized implementation of specific projects, including the use of competing and sometimes uncoordinated technological platforms. Despite the obvious inefficiency of such competition from the standpoint of the classic business economics, the company should accept this as a cost it pays for the speed and integrity of experimenting⁶ with the new business models needed to compete in the context of “digital disruption” of markets.

With the “**digitally wrapped**” strategy, the CDO is mostly the top manager in charge of organizational development. Her/his priorities are to create an innovation culture, develop human capital, and arrange for the respective re-structuring. Developing full-fledged digital customer interaction channels often contradicts the company’s existing internal practices. Many employees, particularly in the back office, miss the fact that digital technology today is not just a marketing communication channel like traditional TV or print advertising, with the technical purpose of bringing potential customers to the point of sale, but it is rather a customer self-service system vesting the customer with authority sometimes comparable to that of employees. A common “resistance point” is security, which poses unrealistic requirements for the system’s functionality. Counter-arguments of this kind have hindered the development of business models in industries that adopted “digitally wrapped” approaches, such as airlines and banks⁷. In nearly all cases, the resistance was eventually overcome, while the more conservative players lost market shares. The doubts about transferring authority to the customers are not completely unfounded. The side effect of developing open digital systems is that effective price comparison websites come into play, eliminating the possibility of competition based on the information asymmetry, which was quite common in markets under the classic marketing paradigm. They also erode what was usually called the “power of brands”. Under the “digitally wrapped” strategy, the CDO must be aware of these and similar challenges, offer effective solutions that will be popular with consumers and insist that the customer-centered approach to digital services is the key to winning the competitive rivalry. This work requires tact and diplomacy, the ability to win internal allies and sway opponents’ opinions. In contrast to the fully digital strategy,

this situation requires the creation of strong centralized technology systems and sufficient knowledge and skills to initiate them.

Lastly, with the “**digitally spiced**” strategy, the CDO has the responsibilities of a top manager in charge of developing advanced technologies. The legacy system stack can remain with the Chief Technology Officer or Chief Information Officer upon which the CDO will build and develop solutions with the use of such advanced technologies as the Internet of Things, Artificial Intelligence or cyber-physical systems (McKinsey, 2018). The greatest challenge here is the search for new technologies applicable in a given industry and manufacturing process. As in other cases, the maximum competitiveness effect can be achieved through quicker implementation as compared to other industry players, but such progress always entails inherent risks. In the “digitally spiced” industries, progression to new business approaches is certainly happening much slower than in other industries, but this is offset by the high price of each investment. Therefore, the CDO who works within the “digitally spiced” strategy must incorporate profound technological knowledge, including industry-specific knowledge, with economic analytical skills to make — or recommend — investment decisions based on the cost-benefit ratio. They will often propose digitalization rather than digital transformation projects. That is, they will optimize the existing business models rather than create new ones. Still, even under the “digitally spiced” strategy, the CDO has the responsibility to closely examine the market to find opportunities for creating game-changing business models based on disruptive digital technologies.

c) Skills and Competencies of CDOs

Singh and Hess outline five domains of skills of a CDO based on their research of six corporate cases: IT competency, change management skills, inspiration skills, digital pioneering skills, and resilience. It is clear from the set that “soft” organizational skills are crucially important for the success of a CDO, not less than the “hard” technological skills. They further match the domains of skills with their model of roles of CDO, with the following conclusions: “Digital Evangelists need particularly well-developed inspiration and digital pioneering skills ... Change management skills are valuable for Coordinators... Finally, the Entrepreneur role is easier to fulfill if CDOs have the profound digital pioneering skill” (Singh & Hess, 2017, p. 13).

Figure 3. Most Important Skills and Competencies by CDO Role Type (Singh & Hess, 2017)

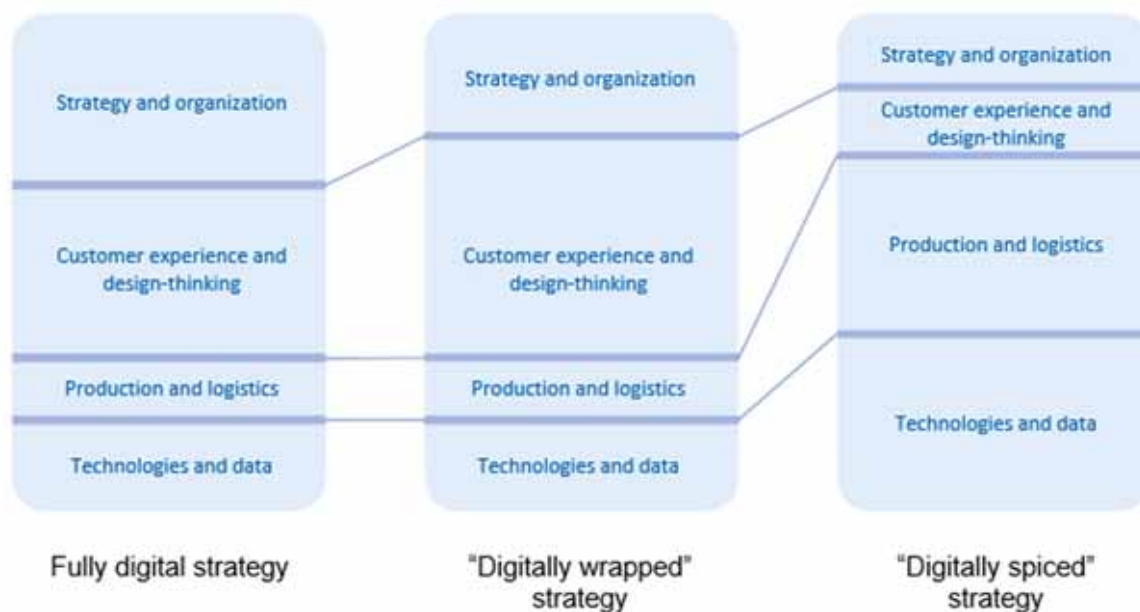
Entrepreneur	Digital Evangelist	Coordinator
Digital Pioneering Skills	- Inspiration Skills - Digital Pioneering Skills	Change Management Skills
IT Competency		
Resilience		

Korovkin (2019) provides a somewhat different perspective, based on a set of in-depth interviews with CDOs, outlining four domains of skills and competencies of a CDO and pointing out that their relevant importance is linked to the type of the strategy of digital transformation:

- (1) Strategy and organization: understanding the approaches to developing a strategy during digital transformation, the economic potential of the created business models, principles of operation of

- platforms and platform-based ecosystems, ability to plan investments and manage investment efficiency, knowledge of organizational design and change management concepts;
- (2) Customer experience and design-thinking: insight into the digital consumers' experience and lifestyle, the ability to analyze the pros and cons of a new product and to turn this analysis into working prototypes, mastered methods of launching new products into markets and receiving market feedback;
 - (3) Production and logistics: knowledge of the industry's value chains, understanding of key company operations, their strengths and weaknesses; business process re-engineering skills;
 - (4) Technology and data: understanding the modern digital stack; knowledge of company data management strategies; ability to analyze data (including big data) for managerial decision-making; deep insight into corporate cybersecurity.

Figure 4. Domains of skills of a CDO and their relative importance for different strategies of digital transformation (Korovkin, 2019)



FURTHER RESEARCH

One of the most important practical issues regarding the role of CDO in business transformation is the time horizon associated with it. There is some debate in the literature as well as among the business practitioners, whether the role of CDO will become a permanent part of the corporate organization or it will get extinct when the current processes of digital transformation are largely over. This question was brought up back in 2016 in the provocative report, *The Rise (and Fall?) of the CDO* (Deloitte Digital, 2016). The document emphasized the importance for a corporation of a dedicated manager in charge of digital transformation, but at the same time, claimed that introducing the CDO position often doesn't move this agenda forward. The report points out that the task of finding and retaining effective CDO is challenging in the real world. These challenges are intrinsically linked with the roles that involve a wide

set of diverse competencies. Mastering all the four domains of competencies introduced in the model above is arguably not common for modern corporate managers; the existing professional education system and hiring practices are aimed at developing functional specialists rather than cross-functional integrators (Dell, 2005).

Moreover, CDOs are no ordinary integrators. Their job is to push other specialists outside their comfort zones. This turns CDOs into easy targets of critique that points out both real and alleged errors and missteps to undermine the entire agenda of digital transformation (Korovkin, 2019). Anyone taking on the responsibility of introducing systemic changes to a company is bound to face such critique, although this fact doesn't make it any easier. While certain strong-minded individuals are perfectly capable of overcoming this resistance, it is debatable whether their experience can be replicated on a wide scale in large companies implementing any sort of digital transformation strategy.

The current situation with CDOs is not unique in the history of corporate governance. In the 1950s and 1960s, the business world had great expectations for brand managers. A brand manager was intended to be a position that united all business processes leading to consumer value creation — a sort of “Mini CEO” of a particular brand. Even though on paper this concept sounded promising in many ways, in reality, it was hardly ever fully implemented: corporate structures defied cross-functional integrators vested with considerable power. As a result, brand managers have now been reduced to mid-ranking marketing management employees with rather technical functions (Low and Fullerton, 1994). To some degree, we can already see the same thing happening to the CDO position: quite often the role of a Chief Digital (Transformation) Officer gets substituted by a Chief Data Officer — a significantly more manageable and understandable link in the management chain, without attempting to revolutionize the structure or re-imagine the established business models.

The issue calls for more research based on the study of actual organizational cases in various contexts. The trajectory of development of the CDO role is, among other things, of significant interest to the general organizational theory; it presents an effective field test of the possibility of complex cross-functional roles in essentially hierarchical organizations.

CONCLUSION

Most of the corporations today agree that the digital transformation of business is inevitable; they actively seek ways to facilitate this transformation and take a maximum of the opportunities that it offers. Introducing the role of a dedicated top manager in charge of the transformation, the Chief Digital Officer, becomes an increasingly popular organizational move. This manager is typically put in charge of the development of new digital lines of business, as well as finding ways to re-design the existing business processes with the use of the new technologies. Thus, the role requires strategic business thinking rather than a set of technical competencies. The challenge for the CDOs lies in the domain of cross-functional integration that requires, among other things, overcoming the resistance of functional specialists that often opt to defend the legacy practices and processes rather than to embrace the necessary change. In the business history, there were some attempts to introduce such cross-functional roles (e. g. a brand manager), with little long-term success.

Describing this challenge and the possible responses can make an important contribution to the understanding of organizational behavior in the context of modern business corporations. It is also important from the practical point of view: companies need clear job descriptions, sets of objectives and KPIs for the new role. The role of CDO is currently somewhat under-researched in academic literature; most of

the body of the empirical findings is provided by business practitioners and consultants. Provided the growing acceptance of the role in modern corporations, one may expect that the issue will soon gain more prominence in business academia.

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KEY TERMS AND DEFINITIONS

Chief Digital Officer: The corporate executive responsible for the development and realization of the strategy of digital transformation of business.

Digital Computing Technologies: Are technologies that have in the foundation electronic circuits processing information in the digital (discrete signals, as opposed to analog, continuous signals) way. Digital computing technologies include hardware (computers that process information) and software (instructions to the computers on how the information should be processed). Increasingly in the modern world the computers are connected to the Internet, being in fact parts of vast distributed computation systems.

Digital Economy: The economy that is based on constant usage of digital computing technologies inter-connected through the Internet. Digital economy includes e-business (business models that were created with the advance of digital technologies, e.g., online commerce) and digitized parts of traditional businesses (e. g. online and mobile interfaces in banking).

Digital Transformation (Corporate): The process of designing and re-designing business models, operational processes, and organizational structure of a company in order to pursue the opportunities and meet the challenges of digital economy.

Internet: Is the global system of interconnected computer networks that use specific communication protocol (TCP/IP) that enables transfer of data between an unlimited number of local networks. Internet is increasingly used, among other things, for automated machine-to-machine connections providing for the Internet of Things (IoT).

ENDNOTES

- ¹ On the issue of the evolution of the role of CIO see Strickland & Theodoulidis (2011).
- ² “Born digital” companies were created to implement business models based on digital technology. They do not need digital transformation. They usually don’t have a Chief Digital Officer on staff, but sometimes have a Chief Data Officer (see the functional differences below).
- ³ “The use of digital technologies to change a business model and provide new income-generating and value-producing opportunities”, Gartner, <https://www.gartner.com/it-glossary/digitalization/>
- ⁴ <https://www.shell.com/energy-and-innovation/innovating-together/shell-ventures/portfolio.html>
- ⁵ The transition from deceived expectations to equally erroneous disappointment in the early period of new technology is described by Gartner’s Hype Cycle model <https://www.gartner.com/en/research/methodologies/gartner-hype-cycle>
- ⁶ By “integrity of the experiment”, we mean confidence that the pilot business model was first implemented with the maximum use of all its capabilities. The decision to alter or abandon the original idea was not made before allowing these capabilities a chance to manifest. This is one common manifestation of the “to commit or to pivot” dilemma. See, for instance: <https://www.innovationgames.com/2011/12/the-entrepreneurs-dilemma-perseverance-or-pivot/>
- ⁷ Cf. the evolution of on-line banking from bulky individual physical “keys” to modern mobile banking with a simple numeric password and the use of text messages to confirm transactions.

Global Project Management: Achieving Sustainability in Diverse Multinational Organizational Development Initiatives

12

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INTRODUCTION

Project management (PM) is a growing field of study that applies a combination of analytical techniques, interpersonal skills, complex problem solving, and advanced leadership skills to address internal and external challenges to complete project objectives. With the advances of technology and the extensive use of resources to complete project objectives, effective and efficient project management provides value to organizations by using appropriate methods and skilled professionals to achieve organizational objectives, with the aim of stewardship for sustainability initiatives.

According to the Project Management Institute (2017), “project management is the application of knowledge, skills, tools, and techniques to project activities to meet project requirements” (p. 86). In the PM framework, practitioners accomplish project objectives through five processes: initiating, planning, executing, monitoring and controlling, and closing. The PM framework is a widely accepted management study used throughout the world to achieve project objectives in numerous industries. Some individuals demonstrate proficiency in PM by taking a project management professional certification exam.

Obtaining certification as a project management professional (PMP) is not an easy task, as demonstrated by the number of certified practitioners. According to the Project Management Institute (PMI), there are currently 932,720 active certified Project Management Professionals (PMP) and 300 chartered chapters across different countries worldwide (PMI, 2019). Fewer than 10,000 hold additional certifications in the subclasses of risk, program management, risk management, and professional scheduling. Despite the use of PM foundations and applications in a vast number of international industries, 95% of all certified individuals are located in the United States.

Organizations that use project management professionals and a project management framework provide exceptional value. Doing so aligns organizational objectives and uses efficient strategic management to solve challenges in managing the project. Used properly, PM provides better efficiency in service delivery, improved customer satisfaction, and effectiveness in service delivery. The PM framework helps an organization attain a higher standing and a competitive edge.

Project management focuses on quality and risk management, which are useful in eliminating excessive waste found during the execution of production. Attention to detail in these areas improves quality outcomes, as teams are dedicated to ensuring that quality measures are followed while meeting the core

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objectives of the deliverables. Detailed attention concerning risk provides cash value savings that could be reinvested back into the organization for additional projects, wages, or capital improvements.

The demand for those who hold advanced PM knowledge is high and projected to stay in demand, in contrast to the limited numbers individuals in the field and academics that hold PM certifications. According to a 2009 estimate by the Project Management Institute, the demand for project management services from 2010 to 2020 was projected to be 11 million jobs in multiple industries, with a projected global revenue stream of \$6.61 trillion. The number of certified personnel will not meet that demand. This deficiency creates significant concern for those heavily involved in project management operations, as risks and cost overruns could increase over time.

The purpose of this research proposal is to examine project management in the global context, i.e., within multinational organizations. We seek to explore the theoretical framework of organizational development. This includes exploring gaps in applications of project management principles, understanding diversity in multinational corporations, and arguing for continuing discussion of project management in global organizations.

BACKGROUND

Project Management in Global Organizations

Many industries are becoming globalized, with significant advances in technology and distribution channels that maintain efficiency benchmarks and support continued, efficient production. The concept of globalization derives from a firm's ability to extend its market reach abroad (Abyad, 2017). Including manufacturing, sales, and a variety of services, globalization has increased competition and revenue. Increased globalization has intensified international competition as well. Globalization provides more opportunities for applying project management principles, both in the United States and abroad. Despite these opportunities, however, projects encounter more challenges due to environmental enterprise factors that are not as common in domestic projects. Furthermore, international projects are more complicated; social, economic, political, and cultural factors may affect the project environment negatively (Abyad, 2017).

International projects must consider cross-cultural management concepts. With a significant number of certified PMPs located in the US, the lack of certified practitioners abroad may not impede the desired results in global markets, affecting the triple bottom line (Martens & Carvahlo, 2017). Cultural differences may also affect the discipline and desire to complete projects efficiently and methodically.

Integration and scope management may differ across cultural boundaries (Abyad, 2017). For example, Asian cultures tend to abstain from confrontations and risks when possible, whereas competing stakeholder voices are not uncommon in domestic interactions. Communication management could encounter difficulty due to the different methods by which diverse cultures express themselves (e.g., body language). A lack of understanding could make integration more difficult, thus threatening the chances of successful projects.

Kostaloya, Libena, and Patak (2017) presented research on the European Union with four objectives: analyze and assess PM familiarity in the Czech Republic; analyze dependence between project organizers' scope familiarity and PM effectiveness; analyze dependencies of the degree of application of PM methods, and recommend approaches to increase utilization of public resources. The researchers evaluated applications of several PM methods to determine their effectiveness and appropriate uses.

Such techniques include financial evaluation, time management and the critical path method, WBS, risk analysis, communication planning, and agile methods. The study concluded that PM methods were not applied sufficiently within the EU.

Within the framework of organizational development lies the quest for sustainable development. The concept of sustainability-related to organizational projects is connected to the triple bottom line of economic, environmental, and social dimensions of performance (Martens & Carvalho, 2017). As evidenced by relatively low certified PMP to the number of projects completed with regularity, a gap exists between the perception and actual use of sustainability in project management applicability (Martens & Carvalho, 2017).

The definition of sustainable development in a broader context comes from the 1987 World Commission on Environment and Economic Development. The importance of project management in meeting sustainability objectives increased from that commission. Companies continue to seek individuals versed in project management knowledge, such as that found in *A Guide to the Project Management Body of Knowledge (PMBOK)*, *International Project Management Association Competence Baseline*, and *APM Body of Knowledge*, among others. Companies seek individuals with demonstrated competencies in the areas of critical processes, management, and knowledge areas, people with demonstrated proficiency in project management. Despite the voluminous amount of information in these books, however, little attention is given to sustainability and achieving sustainable outcomes.

With increased discussion, including global policy discussions concerning the sustainability of climate change, solar energy, wind energy, cryptocurrencies, and the advanced use of technology, it is becoming increasingly critical to assimilate the concepts of sustainability in order to meet the triple bottom line. Organizations continue to move toward achieving the triple bottom line. Thus, an increased emphasis on PM initiatives and education regarding sustainability should continue as areas focus and research. Opportunities for contributing to understanding the topics related to incorporating sustainability aspects into the PM framework do exist (Martens & Carvalho, 2017).

MULTINATIONAL CORPORATE STRUCTURE

Multinational corporate structures both emerged from and further drove globalization in the 20th century. As corporations responded to the need for multinational operations, they also opened markets, expanded opportunities, and expanded capacities, thus promoting the development of technologies and global structures to lower transaction and communication costs (Aharoni, 1993). The multinational corporate structure has thus accelerated globalization. In turn, as that globalization process has expanded, external inputs to corporations have continued to change rapidly. As a result of the globalization and integration of the world's markets, many corporations have found their organizational strategies, structures, designs, and processes to be ineffective or even obsolete, necessitating internal changes. Thus, the rise of multinational corporations and the globalization process have continued to fuel each other.

Globalization is producing dynamic external inputs to multinational corporations that necessitate the effective and efficient implementation of internal changes to structures, strategies, and procedures in order for those corporations to adapt, survive, and remain competitive. Organizational development interventions have been successfully used to facilitate internal changes within many types of organizations (e.g., Maes, 1994; Veich, 1994; Darling, 1995; Tslaf, 1995). In the current climate of globalization, however, corporate attention has shifted to managing the diversity of large multi-country operations. The continued usefulness of organizational development interventions within multinational organizations has been questioned (e.g., Beer, 1988; Golembiewski, 1990; Cole, 1994).

ORGANIZATIONAL DEVELOPMENT

Organizational development has been defined and modified in many ways since its earliest applications by practitioners such as Beckhard (1969) and Bennis (1969); however, the underlying principle has remained the application of sound behavioral science and management principles in the development of organizational effectiveness (Huse, 1985; Chaney, 1994). Organizational development is more of an adaptive strategy for planning and implementing change than a blueprint for how things should be done (Boss, McConkie, Ringer, Polok, & Goodman, p. 13). It is a systematic process for applying behavioral science principles and practices to increase organizational effectiveness through collaborative planning and analysis, for the intent of diagnosing and solving organizational problems (French & Bell, 1999).

Such plans are flexible and are often revised when new information is gathered as the program progresses (Beer, 1988). As such, organizational development involves both the creation and subsequent reinforcement of change. It moves beyond the initial attention to implementing a change program and progresses to a longer-term concern for the stabilization and institutionalization of change within an organization (Boss et al., pp. 15–16).

Some of the goals of organizational development are:

- to help organizations perform tasks more efficiently and effectively,
- to provide the skills and knowledge necessary for establishing internal and external relationships,
- to show organizations how to work effectively in diagnosing complex problems and devising appropriate solutions,
- to help organizational members become committed to solutions, thereby increasing chances for the successful implementation of those solutions, and
- to help open systems cope with environmental changes (Cole, 1991, pp. 8–10).

Organizational development practitioners understand that organizations are open systems operating in complex environments. Each organization consists of many sub-systems, each of which may include groups and individuals. The ability to survive and grow during periods of intense change depends on the organization's ability to learn how to align internal and external systems effectively. Organizational development is a tool to help organizations, as open systems, learn how to manage organizational change. This tool (with its inherent feedback), when utilized during the process of globalization, can also be used to add to our body of knowledge about the process of globalization.

The dominant theme underlying the theory and practice of organizational development is the focus on organizations as total systems, with a holistic emphasis on organizational design, structure, strategies, and culture to achieve planned change. Although organizational development techniques used around the world have featured many different names (e.g., team building, organizational learning, and quality circles), the usefulness of organizational development techniques in diverse multinational organizations has come into question (e.g., Beer, 1988; Golembiewski, 1994; Cole, 1994).

THEORETICAL UNDERPINNINGS

Organizational development is a multidisciplinary field, one that grew out of the work of researchers from many different scientific areas. From the natural sciences came observations of organizations as complex and open systems (e.g., Buckley, 1967, 1968; von Bertalanffy, 1969). From the psychological,

behavioral, and social sciences came the propensity to make observations about human behavior, individual behavior within groups, group behavior, and organizational learning. Recently, social psychology and industrial-organizational psychology have also provided rich background information (e.g., group theory, social facilitation, and social impact theory) on which organizational development researchers have built models of organizational behavior.

Few people have had as profound an impact on the theory and practice of social and organizational psychology as Kurt Lewin. Regarded as the father of organizational development, Lewin wielded his influence based on his theoretical work on action research, group dynamics, field theory, and change theory (Schein, 1999). Lewin's work with groups within organizations built on a diverse body of earlier research by social psychologists such as Le Bon (1903), who recognized that large groups are distinct entities with a collective mind, and Allport (1924), who implied that groups are illusory, existing only in people's minds.

Lewin's contribution to the field of organizational development has been well documented (e.g., French, 1969; Huse & Cummings, 1985; French & Bell, 1990; Burke, 1994), primarily regarding field theory, group dynamics, the T-group, the three stages of change, and action research. His famous Iowa experiments led to the concept that people change when they experience the need for change (Lewin, 1947).

Three major philosophical schools of thought influenced organizational development as management thinking evolved around the world during the 20th century (Miles, 1975). The first was the Classical School, with roots in Social Darwinism and the early work of Frederick Taylor. Taylor's publications fueled Henry Ford's ideas about assembly line production and ushered in the industrial revolution. Second, the Human Relations School concentrated on the organization as a social system. This philosophical school emerged from Elton Mayo's famous work in Hawthorne, Illinois. Third, the Human Resources School emerged from authors such as Abraham Maslow (1954). The core of this school is humanism, which includes a firm belief in human rationality and the ability to learn. This school has continued to evolve through the works of writers such as McGregor, Argyris, Peters and Waterman, Collins and Porras, and Pfeffer.

APPLICATION IN DIVERSE ORGANIZATIONS

Cognitive overload, lack of awareness of others' activities, lack of context about the purpose and history of shared objects, lack of appropriate feedback and acknowledgment of contributions, disorientation, unbalanced participation, divergence, and problems with bringing new team members into an established collaborative space: these impediments to successful organizational efforts are magnified by multinational organizations' geographically fragmented work environments. This leads some researchers to question the sustainability of these efforts in the global environment (e.g., Schmidt & Bannon, 1992; Schrage, 1995; Humphreys, Bannon & McCosh, 1996; Bannon & Bodker, 1997). As the global economy pressures knowledge workers to collaborate, innovate, and make decisions quickly in an uncertain and changing environment, demographic and social changes are forcing diverse team members to work together at a distance through teleconferencing, e-mail, and virtual meetings. While technological capabilities may provide the telecommunications links necessary for these workers to work together, the kinds of technologies currently implemented in many businesses lack the essential tools for creative collaboration and team building at a distance.

Organizational development professionals have recognized and discussed these problems at a series of international conferences on computer-supported cooperative work (e.g., Robinson, Bannon,

& Schmidt, 1991; Schmidt & Bannon, 1992; Bodker, Kyng & Schmidt, 1999). They have led the research toward resolving issues inherent in globalization such as long-distance communication and team building (e.g., Schon, 1984; Schrage, 1995; Bannon & Bodker, 1997). Their research has led to several meaningful conclusions that are currently guiding global industries in the quest for solutions. Organizational development researchers have recognized, for instance, that both creative collaboration and team building involve the creation and sharing of two kinds of information: the object created and process interactions about that object (Schon, 1984; Robinson, Bannon & Schmidt, 1991). For geographically separated teams seeking virtual collaboration, technology is going to have to provide a replacement for a literal shared space, providing either a virtual collaborative space (Schrage, 1995) or a common information space (Bannon & Bodker, 1997; Schmidt & Bannon, 1992). Communication will create more technological challenges of the new millennium for multinational corporations and structures in light of changing external conditions. This is especially critical for multinational corporations operating in a rapidly changing global environment.

INTERNAL AND EXTERNAL VALIDITY

Due to the inherently ambiguous and subjective nature of field research in general (Campbell & Stanley, 1963) and organizational development research in particular (Golembiewski & Munzenrider, 1976), there remain unresolved research issues in the field. Researchers must deal with the problems of internal and external validity when trying to ascertain whether implementation of an intervention or a change program did, in fact, produce the observed effects (i.e., internal validity) and whether observed results can be replicated in other organizational settings (external validity).

Empirical literature in the field suggests that careful research design (Campbell & Stanley, 1963), longitudinal data (Porras & Berg, 1978) and the use of control or comparison groups (e.g., Nicholas, 1982) can add internal validity to observations. When assessing the effectiveness of organizational development interventions, practitioners must ask whether explanations other than the intervention could account for observed effects, especially when multiple changes are involved (Randolph & Edwards, 1978). Demonstrating causal relationships is always a problem in field research and evaluation research experiences in real-world settings where multiple activities are occurring simultaneously (Campbell & Stanley, 1963). The key to overcoming the problem of internal validity in organizational development is the careful design of the research. The research should be structured to rule out as many competing explanations as possible (French & Bell, 1999).

The external validity of research results has been an ongoing challenge for organizational development researchers to assess, especially in the global environment. Recent management theory and scientific management books provide direct and indirect support for the external validity of organization development principles and practices. These studies demonstrate the importance of analyzing the organization's structure and strategies (e.g., Collins & Porras, 1994; Peters & Waterman, 1982) and its design and processes (e.g., Peters and Austin, 1985; Waterman, 1994; Lawler, 1996), as well as the human side of the organization (e.g., Pfeffer, 1994, 1998).

THE CONTENTION OF CULTURAL BIAS

Throughout organizational development literature, there is a tendency to view the discipline as “culture-bound,” thereby assuming a limited application in global settings (Golembiewski, 1994, p. 5). Authors such as Jaeger (1986), who focus on distinguishing organizational development varieties as being distinctly North American, see the discipline as being very narrowly applicable and ill-suited to global companies. However, other authors (e.g., Golembiewski, Proehl, & Sink, 1981 & 1982; Nicholas, 1982) point to the substantial success rates of non-North American cases. Their successes seem to be attributable to early adaptations of interventions for implementation in work cultures that were not particularly accepting of organizational development values (Bowers & Hausser, 1977, pp. 76–94). The adapted process interventions have proven applicable to a more general variety of cultural settings (Golembiewski & Kiepper, pp. 61–94).

It should be noted here that a substantial portion of the background of the field of organizational development stems from pioneering work on productivity and quality of work life developed in England, Ireland, Norway, Sweden, and Japan; thus, the discipline is not uniquely North American. From its earliest stages, organizational development practitioners have conducted research and applied techniques in an ever-increasing variety of settings (Alderfer, 1977). Within the field, apparent and implied cultural limitations such as those discussed above have been seen as positive motivations for change; leading to credibility being tested and gained by practitioners from different cultures around the globe (Golembiewski, 1994, p. 6). Organizational development techniques have been applied successfully in organizations in many countries, including Canada, Sweden, Norway, Germany, Yugoslavia, Mongolia, Japan, Australia, Israel, Mexico, New Zealand, Russia, and the Netherlands.

It is not surprising that the discipline readily crosses cultural boundaries, as the founding work for organizational development occurred with the Connecticut Interracial Commission and the American Jewish Congress. From the beginning, organizational development interventions have been conducted within some cultural context, giving those in the field some advanced practice in dealing with diversity.

Historically, most organizational development practitioners ignored power and control issues (Nord, 1978). This can be partially explained by the fact that early organizational development theorists (e.g., Rice, 1958; Lewin, 1947; Mann, 1962; Schein, 1969) mainly based their theories on Western assumptions of shared power and control, suggesting cross-cultural blindness (Cummings, 1980). While there was some practices that was beneficial for diversity related work, the cultural bias in some of the fundamental theories would indicate limits to the usefulness of organizational development methods in authoritarian settings. Because of its focus on creating and enforcing change, organizational development often strikes at the heart of the political hierarchy within organizations.

Individuals and groups can severely limit the effectiveness of the change process when their power is threatened by the change (Huse & Cummings, pp. 57–58). Modern practice indicates that alternative approaches to the application of conventional theories may prove useful in authoritarian settings. For example, role design interventions, based on Schein’s pioneering work with process interventions, were adapted as an alternative to group-based and confrontational interaction-centered designs for settings in which power sharing is limited. Moreover, job enrichment became one strategy for increasingly responsible freedom in former Communist countries such as Poland, where speaking openly was still considered too dangerous; consequently, anonymous survey feedback constituted a way for participants to test the relative safety of authority figures (Golembiewski, 1994, p. 7).

Power, control, and value issues are closely linked to organizational change. As changes in multinational culture create shifts in these balances, organizational members and other stakeholders gain and lose favor and dominance (Gricar & Brown, 1981). Organizational development practitioners have probably become more cognizant of the related issues of power and control – —issues which, by their very nature, transcend cultural barriers.

FUTURE RESEARCH DIRECTIONS

The lack of development may hinder the real potential of integrating project management principles and organizational development. A more progressive approach is to bridge the foundational aspects of the certification. Despite credentialing being available for risk management in project management, the dedication of risk is limited in scope. This lack of a core understanding of risk in organizational development may result in adverse impacts towards operational management, sustainability initiatives, and missed opportunities to match value-added activities to the organizational vision.

The development of additional research is necessary to address the shortcomings associated with the recognition of cultural bias, sustainability of project management, and improvement of the current project management education system. Providing a more abstract outlook to address the analytically driven nature associated with the existing foundation may improve project success factors, decrease risk, and promote additional value-added efficiencies to organizations seeking to improve their competitive positioning. The proposed growth of such project management principles will help those who provide training and academic learning environments to embrace the uniqueness that exists within multinational organizations that seek to promote diversity and inclusion within their operational missions.

CONCLUSION

Many companies recognized, during the 1960s, that they would have to move beyond national boundaries and consider international operations for continued growth. However, as these early pioneers grew from domestic companies into multinational corporations, they strove to retain structures, strategies, and markets with which they were most familiar. Since then, the global marketplace has required new strategies and structures to regain some predictability and control over the environment. Organizational development exists for organizations that are undergoing growth and change. By lending their expertise to diverse organizations in strategic planning and environmental research in increasingly complex international markets, practitioners can aid diverse organizations in implementing strategic changes more efficiently and effectively.

Global integration of the market poses opportunities for a global community simultaneously as it raises the risk of lessening cultural diversity. Exposure to other cultures creates dichotomous reactions of increased tolerance and stubborn resistance to change. In successful multinational organizations, employees worldwide are encouraged to become internationalized by spending time with people from other countries and cultures. Organizational development practitioners have a long history of developing strategies for building teams and decreasing resistance to change in diverse environments.

The present generation of multinational organizations is putting together new ideas and technologies to form complete global systems. Research and development emphasis is increasingly placed on the practical and efficient use of knowledge. Flexibility and adaptability are essential, because research and

development fuel advances in technology that are crucial for economic development around the world. The attention that organizational development practitioners give to these multinational organizations' strategies, design, and structure is a critical dimension of the success of the practitioners' own organizations.

With proper guidance from organizational development practitioners, diverse organizations in the global industrial revolution may replace older, more violent forms of revolution. As the world becomes ever more closely linked through multinational organizations, technology, and communication, organizational development practitioners will continue to provide the multicultural organizational expertise needed in an integrated global village.

Research states that the three dimensions of economic, environmental, and social sustainability have substantial importance in project management (Martens & Carvalho, 2017). The quantitative analysis performed by Martens and Carvalho (2017) noted that project success exists when sustainability and project management principles converge. Despite an increase in education and training available through certifying bodies and education, there still exists a need to expand the scope of education to meet the rigors of the complex project environments that individuals encounter in ongoing operations. Business schools offer degrees and certificates, but exposure to project management is limited to operational management.

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KEY TERMS AND DEFINITIONS

Global Organizations: Companies that do business internationally, often having multiple offices throughout different countries and utilizing virtual project teams and project managers to lead their organizational projects.

Organizational Development: Known under its acronym OD, is the study of organizational change and performance in different industries.

Project Management Institute: Trade organization that promotes the profession of project management. Known under its acronym PMI, the organization manages professional publications on project management, share best practices in the field, host tradeshow and conferences internationally and manages multiple project management certifications.

Project Management Professional: A professional certification for project managers governed by the Project Management Institute (PMI). Known under its acronym PMP®, is the most sought-after certification by project managers and has been listed in the top 10 credentials to obtain by Global Knowledge, Forbes, CLO Magazine and WIRED Magazine.

Scrum Alliance: Trade organization that promotes the profession of project management. The organization manages professional publications on agile and scrum methods in project management, share best practices in the field, host tradeshow and conferences internationally and manages multiple project management certifications.

Managing Workplace Conflicts Through Self-Mediation



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INTRODUCTION

Workplace conflicts have become a major threat to the achievement of the corporate objectives of organizations (Robyn, 2016). It engenders bitterness, withdrawal, despondency, sabotage and in some extreme cases, suicide and death with grave implications on the overall performance of organizations. In spite of the evidence that there is a deluge of literature on how to manage workplace conflict, managing organizational conflict from the perspective of self-mediation has received little attention. While existing literature (Brokenburr & O'Donnell, 2016; Robyn, 2016; Deepak & Max, 2008; Hayes, 2008; Shay & Margaret, 2008; Marick & Robert, 2002; and Lebedun, 1998) mainly focuses on managing processes, inter-personal and inter-group conflicts within an organization, this study makes a case for mediating the interaction of negative energies within an individual before engaging other actors and issues in the organization.

The importance of this study revolves around the need to contribute to the development of a more robust framework for managing workplace conflict. The thesis propagated by this study centers around the assumption that purging oneself of combustible negative energies is the critical first step in effective management of workplace conflicts. This is so because, although conflict may be externally generated or triggered, its tendency to escalate or deescalate is primarily dependent on the actors' management of their internal negative impulses. The impulse that predisposes an actor to shout, ignore, slap, fight, cry, refuse to attend or contribute at meetings or generally, undermine the corporate objectives of the organization are all internal to the actor. Therefore, if actors are able to mediate these negative impulses, workplace conflicts would be significantly reduced and achievement of the corporate objectives of the organization enhanced.

The study employs the documentary method of data collection, which entails the use of materials from secondary sources. Analyses of issues are based on an objective assessment of relevant literature from where study gaps are identified and issues placed in perspective. Delivery is done with some hypothetical case studies/analysis to offer some practical insights on how to self-mediate within specific contexts. The general objective of the study is to examine how workplace conflicts can be managed to enhance organizational effectiveness, efficiency, growth and stability. The specific objective is to examine how workplace conflicts can be managed through self-mediation. The study attempts to answer the question: How can workplace conflicts be managed through self-mediation? It is hoped that the study would lay a foundation for a new research endeavor and also hopefully provide a background for a much broader future exploration of how workplace conflicts can be managed through self-mediation. The study thus, comprises thirteen sub-topics; an introduction is followed by a background to the study. Other sub-topics focuses respectively on understanding workplace conflict, some myths about conflict, self-mediation, emotions in self-mediation, four types of conflict in the workplace, managing conflicts in the workplace

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through self-mediation 3Rs, cost of conflict, further research directions, conclusion and recommended actions, references and additional readings.

BACKGROUND

Organizations exist essentially to provide goods and services to the public. In achieving this noble objective, human and material resources are often deployed through a complex web of processes which may include; concept design and setting, content and site development, recruitment and staffing, departmentalization and activation. This applies mostly to new business formations, but for existing organizations, processes may include; review of extant policies concerning personnel and human resources as well as general restructuring and rebranding. These processes, whether in emerging or existing organizations are burdened with conflict inducing elements. A piece of land or office space that is bought or acquired for the establishment of a new enterprise, recruitment, staffing, departmentalization and activation are obviously products of negotiation and therefore, assumed to be results of rational thinking and choices. Review of organizational policies and restructuring suggest that some processes and people would be affected. An immediate take away from this scenario is the likelihood, that if these processes are not sensitively managed, they may impact the capacity of the organization to optimally meet its objective.

There is however, a growing consensus that workplace conflict is so pervasive that it can hardly go unnoticed as it has a tendency of negatively impacting the fortune of the organization. Robyn (2016) quoting Hayes (2008) aptly made the point where the following statistics were offered to demonstrate the ubiquity of conflict in the workplace:

- 85 percent of employees deal with conflict on some level
- 29 percent of employees deal with it almost constantly
- 34 percent of conflict occurs among front-line employees
- 12 percent of employees say they frequently witness conflict among the senior team
- 49 percent of conflict is a result of personality clashes and “warring egos”
- 34 percent of conflict is caused by stress in the workplace
- 33 percent of conflict is caused by heavy workloads
- 27 percent of employees have witnessed conflicts lead to personal attacks
- 25 percent of employees have seen conflict result in sickness or absence
- 9 percent have seen workplace conflict cause a project to fail

The ubiquity of workplace conflict as indicated above highlight the need for an appropriate and effective conflict management solution yet, organizations globally, are inanimate contraptions, without life and form and in their inanimate form, can achieve little without the human agency. The human agency therefore, animate organizations giving them life, form and identity. In the course of giving organizations the attributes of ‘living organisms’, the human factor, is often challenged by the interactions of internal negative combustible energies, first within the ‘*self*’ then, between the ‘*self*’ and the ‘*other*’ and also between the ‘*self*’, ‘*others*’ and the organization and its processes. Within this context, this study therefore, examines the management of workplace conflicts through self-mediation - a process of purging oneself of combustible negative energies with the intent of setting the right foundation in dealing with others and organizational processes.

Understanding Workplace Conflict

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Like the air we breathe, one of the most pervasive things in the world is conflict. Irrespective of ones' identify, creed, vocation and status, no one is really immune to conflict. It is found within us, around us and between/amongst us. The only significant difference about conflict is the context in which it occurs. It is therefore, common to hear qualifiers like *political* conflicts, *religious* conflicts, *matrimonial* conflicts and *workplace* conflicts. It could be easily deduced from this categorization that what differentiates one conflict from the other is the context. While some conflict situations are described by the evidence that there occur within the political process, others happen within the context of religion, matrimony and workplace. One defining attribute about these contexts is the fact that there are all populated by human elements. This presupposes that no matter how isolated an individual might be; there are innate deposits of intrapersonal conflict elements within him that may manifest to influence the behaviour of others if not sensitively managed (Obi, 2016). The important thing about conflict is not its occurrence which is inevitable but how it is managed. It should be obvious by now that the various contexts as identified above contain elements of a workplace (people, rules/procedures/norms, hierarchy and a reward system). It is discernible that some of the contexts as outline in the examples above exist in formal settings while others in informal settings. Our task here therefore, is to examine conflict within the formal setting even though discussion also applies to informal settings. To make this more interactive and practical, discussion would revolve around a few hypothetical case studies/analyses.

Case Study 1 clearly depicts a conflict situation between John and Blessing within an organization. It typically provides a sound understanding of conflict and also offers ideas for action. From this case study therefore, workplace conflict can be construed as a struggle between two or more parties who perceive their goals as incompatible within an organization. It is typically, "any workplace disagreement that disrupts the flow of work" (Robyn, 2016).

Case Study 1

John hands over a travel authorization form to Blessing the Administration Officer; he is uncomfortable with the expression on her face.

Oh no! John, you should know better than this, in fact, needless wasting my precious time over this. You are aware that I should get this request at least 14 days before the proposed travel date. But here you are, giving me a request 7 days to the proposed out-country travel date. Sorry to disappoint you John, no sacred cows in this organization, laid down rules must be followed.

What gave you the audacity to talk to me in such a disrespectful tone John retorted; have you forgotten that I am your superior? Besides, the travel was approved late. He gets really frustrated and was shouting while smacking the table thereby attracting the attention of other staff.

The case study holds very useful lessons about workplace conflict. The first part of the definition suggests that conflict has two sides. It may involve two individuals, groups or fundamentally between the self and the environment (workplace). At the workplace, conflict may arise as a result of shifts, between departments, divisions, persons or processes (Lebedun, 1998). Instead of seeing the conflict in the case study as a conflict between John and Blessing it is appropriate to see it as a clash of ideas. This logically brings us to the second part of conflict as a struggle between two people who see their goals as incompatible. It is instructive to identify the incompatible *goal* between John and Blessing in the case study.

- **Blessing's goal:** To have the travel authorization form submitted 14 days before the proposed travel date
- **John's goal:** To get approval for his out-country travel request even though it was submitted late contrary to the policy of the organization.

Recall that the goals are presented as *perceived incompatible goals*. Blessing and John in the case study therefore see their goals as irreconcilable. It is apt to ask at this point if the goals are personal to them or are both directed towards delivering the objective of the organization. It is obvious by this poser that communality exists between the goal pursued by Blessing and John. This common ground revolves around the evidence that both goals are directed towards stabilizing and delivering on the corporate objective of the organization. It is therefore possible for Blessing and John to more appropriately deal with the perceived incompatible goals.

The take away from **Case Study 2** is the evidence that in dealing with conflict, the negative combustible energies within the *self* must first be appropriately managed (Obi, 2017).

Case Study 2

John quickly realizes that he was becoming a nuisance and therefore advises himself. *Why am I shouting and attracting attention* he ask himself and without an answer; he further quips, *I certainly don't have control over what Blessing says to me, but I have control over how I respond to her attitude*. Calm now, he engages Blessing in a more friendly discussion.

As Blessing and John talked about the statutory 14 days needed for processing the travel authorization, both of them were reminded of very important points. John was reminded that the 14 days are needed to process the paperwork and visa and Blessing was reminded that the travel authorization is to an ECOWAS member state where visa is not needed.

Blessing remarks that the 14 days still applies but since the request has the expressed approval of the Country Director, the authorization would be processed and a justification note attached to the processed authorization in order not to set a bad precedent.

Recall, that the conflict situation immediately assumed a more positive win-win dimension when John reflected by reassuring himself that *'he has no control over what Blessing says to him but he has control over how he response to her'*. The workplace which is used here interchangeably with organization by its very nature is a product of conflict. It is often set up to typically address issues that give rise to conflict and, in extreme cases violence. It addresses issues around poverty, unemployment, provision of services etc. In achieving set objectives, organizations set rules and Standard Operating Procedures (SOPs) that logically interferes, conditions and structures the attitudes and behaviors of its employees. As employees grapple with organizational rules they are often faced with certain *perceived incompatibilities*. These may range from the operational norms of the organization and their personal belief system, between one employee and another, between one department/unit and another and between management and employees with implications on the organizations' outcome. All organizations therefore, have conflict and how such conflict is managed determines the outcome. One of such management measure that is yet to be fully explored is self-mediation. A principle associated with managing the combustible negative energies within the *self* before engaging the conflict context and parties. This is because most

conflicts are as a result of our response strategy. This study therefore, gives expression to managing conflict through self-mediation.

Some Myths About Conflict

There are views held by people about conflict that are rather mythical and misleading. It is therefore, instructive to identify and briefly discuss some of these myths with the intent of putting them in perspective before examining the concept of self-mediation.

Conflict is destructive: One of the commonest myths about conflict is the assumption that conflict is always destructive (Simbine & Obi 2018). This assumption automatically negativizes the approach to its management. This perhaps explains why conflict interveners deploy all manner of conflict management mechanisms (Obi, 2015) with the intent of eradicating a particular conflict. Approaches that are structured by the negative perception of conflict often end up escalating the conflict. On the flip side, if conflict is seen as a manifestation of a need that should be addressed and a rare opportunity of knowing and appreciating the actors, contexts and issues within a particular setting, the approach to its management would certainly be different. Lack of potable water within an environment for instance, may result in waterborne diseases. Naturally, a conflict situation is created here. While the interaction of water and the environment may lead to poor water quality, it stimulates a *perceived incompatible desire* between the people's need for potable water and good health care. This conflict logically gives rise to the establishment of government agencies such as Water Boards and provision of health facilities (Health Centers, Clinics and Hospitals). In this example, conflict rather than been seen as destructive, it is constructive and harbinger of development. Relating this to our case studies 1 and 2 above, rather than destroy the working relationship between Blessing and John the conflict further strengthened their knowledge of the workplace. The significant difference as to whether or not a conflict would be destructive depends on its management approach. It is therefore, misleading to assume that conflict is totally destructive.

Conflict is unidirectional: There is a tendency for people to think that conflict is unidirectional. Conflict is in reality a multidirectional phenomenon with no defined pattern of manifestation. The closest pattern of manifestation is reflected in the conflict cycle where conflict is seen as graduating from the stages of latent conflict through the stage of manifestation, escalation, crisis, de-escalation to peacebuilding (Obi, 2018; 2018a). This pattern however, is not cast in steel as conflict manifest in several ways and in several stages. This rather misleading assumption of the uni-directionality of conflict presupposes that a unidirectional approach can be deployed in the management of conflict. What may be considered a constant in the conflict management cycle is the tendency and capacity of a conflict actor to act or not to act and which actions or inactions would better offer a win-win conflict outcome. This logic is located within the principle of self-mediation. Even at the level of the *self*, the actions of an actor cannot be said to be unidirectional since an actor may decide to destructively respond to a conflict situation thereby escalating the conflict and threatening the achievement of the corporate goals of the organization or constructively respond to the conflict thereby strengthening relationship within the workplace and advancing the delivery of the objective of the organization.

Conflict must necessarily be between actors: conflict in an organization though activated by human elements, is often induced by rules and operational procedures of the organization. It is therefore, misleading to assume that conflict must necessarily be between actors. This myth is further punctured when consideration is given to *intra-personal* conflict. In this case, the incompatibility is between an individual (*self*) and internal combustible negative energies within the individual. Clearly from this case therefore, the conflict is between what I would like to refer to as the *self and the self*. Conflict

here happens within an actor rather than between actors. This understanding is necessary to better our understanding of the place of the *self* in managing conflict. This perspective coheres with our attempt to propagate self-mediation in conflict management. It is therefore, mythical and misleading to think that conflict must necessarily be between actors except we consider the negative and impulsive energies within the *self* in the case of intra-personal conflict that eventually gives expression to conflict between actors as inanimate actor.

Conflict can be resolved: It is common to read or hear the cliché ‘conflict resolution’. As a practitioner or scholar can you do a quick reflection about any conflict that has been resolved before? What are your findings? Are the root causes of such conflict resolved? Can conflict be resolved in the practical sense of the word? Are you familiar with a supposedly resolved conflict manifesting in a different form? In most instances where a conflict is said to have been resolved, it is often frozen. Conflict freezing is a situation where some intervening variables in a conflict setting are addressed but the root causes of the conflict are left unattended to. In such contexts, temporary peace may be experienced but a little heat de-freezes the once frozen conflict and the conflict assumes a different and protracted dimension. It is therefore, actually misleading and mythical to talk of conflict resolution when in the technical sense we are managing conflict. It is therefore appropriate to see conflict resolution as conflict management. Conflict management is a broad spectrum of approaches deployed in identifying, preventing, mitigating and addressing conflict. The disadvantage of considering a conflict as having been resolved is located in the reassurances that it has been so resolved. Resolution comes with a spark of finality that literally lures the conflict interveners to sleep. This myth partly account for the various shades of protracted conflicts around the world. A major constant in the conflict management spectrum that has often been neglected is self-mediation which offers a more context friendly approach to conflict management.

Self-Mediation

“People and things don’t just upset us. Rather, we upset ourselves by believing they can upset us” (Albert, n.d). Although, an employee may be described as a liability to the organization, the choice to be angry and fight back resides with the person. The above assumptions clearly points to the overarching evidence that as individuals, we may not have the capacity to determine what someone may say to us but we certainly do not lack the capacity to determine how we react. The principle of self-mediation is a twin concept ‘self’ and ‘mediation’. Mediation in technical sense refers to a conflict situation where a third party neutral is enlisted by conflict parties to facilitate a process of negotiated agreement (ICMC, 2016; NJI 2007). The take away from this definition is the understanding that the facilitator is a *third party* that is considered *neutral* to the conflict. An effective mediator is expected to demonstrate certain attributes that are beyond the scope of this study to examine. Our interest here therefore, is to situate the *self* in the context of mediation. It is obvious by now the difficulties associated with this expectation. Part of the difficulty that immediately leaps to mind is ‘how can I be neutral in a conflict in which I am a primary actor? As confusing as this question may seem, we would try to unpack the associated confusion to enable a better understanding of the *self* in mediation.

An appropriate way of putting issues in perspective in this regard is to first understand that conflict is an inanimate phenomenon that is given expression by the human element. Within the human system are competing combustible negative energies that control the impulses of human actions and inactions. Can you pause and reflect on that seemingly inaudible voice within you that prompts you to respond to a mail now or after, that gives you a reason not to attend a scheduled meeting, that voice that tells you to shout, grab, slap, bite, destroy, mutilate figures, sabotage corporate objectives, divulge official secrets,

and generally be insubordinative. That compelling *voice* that manifest in actions and inactions, is found not in the workplace but within the individual (employer and employee). Though the workplace may influence the tone and direction of this *voice* it is principally the human element that fundamentally determines its actual expression (constructively or destructively). The bedrock of appropriate and effective conflict management is therefore, necessarily situated within the *self*. Managing workplace conflict begins from properly managing the negative impulses within the *self*. Recall that we had mentioned that mediation technically refers to the activities of a third party neutral in facilitating a negotiated settlement. In the context of our discussion *self-mediation* simply means self as a mediator, mediation without a third party, a way of getting others to work with you not against you (Obi, 2018b). Typically, self-mediation has to do with an attitude shift from *me against you to us against the problem* (ICMC (2017)). For this to happen, the actors must be able to moderate their negative energies by redirecting same into peace resources, creating an appropriate mindset that generates incentive for effective win-win communication and outcome.

It would be noticed for instance that John in **Case Study 2** was only able to constructively engage Blessing only when he was able to moderate his negative energies. It should also be noted that the conflict assumed a positive dimension when John realized that he had no control over what Blessing says to him but he is certainly in control of how he response to Blessing. It should be noted also that with this realization by John, the assertive attitude of John (**Case Study 1**) that depicted a conflict between John and Blessing shifted from John against Blessing to *John and Blessing against the problem* thereby fostering a background of team work. The conflict that had the tendency to polarize the actors, strain their existing relationship, pitch John against Blessing in the workplace and fundamentally frustrate attainment of the objective of the organization was inadvertently mitigated by an act of simple self-mediation by John. This study is therefore, making a case for conscious attempts by actors to self-mediate negative energies in all situations in and out of the workplace. The frequent interaction between man and processes that occur daily in the workplace makes conflict between actors and processes inevitable. The critical first step toward managing workplace conflict is therefore located within the self. John's reflection that eventually informed his disposition in **Case Study 2** holds useful lessons for employers and employees generally even though actors often allow emotions to frustrate self-mediation efforts.

Emotions in Self-Mediation

It is important to appreciate the context of self-mediation. Typically, self-mediation has little to do with the external environment and more to do with the moderation of the interaction of negative impulses within the *self*. In doing this, emotions constitute a major obstacle to self-mediation that would need to be appropriately handled. In self-mediating conflict, two concerns are outstanding; *issues and emotions*. The leeway to addressing issues in conflict is moderating emotions. In a conflict situation have you ever used the words?

Calm down

Be patient

Don't be upset

Put yourself together

Display maturity

Be on top of the situation

Put the situation under control and

Manage your emotions etc.?

What these promptings set out to address are not the issues in conflict but the emotions of the actors clearly suggesting that the dimension the conflict would assume is a function of the emotions of the conflict actors and emotions are internal to the actors. **Case Study 2** demonstrates how the management of John's emotions redirected the course of the conflict. Now, let's consider another scenario by reversing the gains recorded in **Case Study 2** to drive home a point.

Case Study 3 demonstrates the impracticability of conflict resolution because all conflicts involve emotions and values. **Case Study 2** indicates that the conflict surrounding the request for travel authorization by John was addressed after he self-mediated his negative impulses. **Case Study 3** however indicates otherwise. Here, it shows that in spite of the fact that the issue in conflict was addressed, the conflict nevertheless assumed the dimension of a 'cold war' between the conflict parties (John and Blessing). What was left unaddressed was the emotions of John and the values the emotions represents. A take away from this Case Study is the evidence that self-mediation can appropriately stabilize an actor and change the direction of a conflict, but a consciousness of the place of self-mediation by parties to a conflict (in our Case Study John and Blessing) makes the management of conflict both at the *issues* and *emotional* perspectives less difficult. What may be responsible for the renewed conflict between John and Blessing after the issue of John's request for travel authorization had been addressed?

Case Study 3

Blessing was surprised by the sudden change of attitude of John when she thought that the misunderstanding about John's request for travel authorization had been conclusively addressed.

She quipped 'I thought the issue with John was over after we agreed and processed his travel authorization. I however, noticed that his attitude towards me had changed. His attitude has made me unproductive because as my supervisor, he has refused approving most of my requests and we have been literally fighting since then with implications on productivity'.

Two things clearly stand out in the conflict between John and Blessing; *issues* and *emotions*. When an individual thinks that a particular conflict has been addressed but it keeps manifesting in different forms, it is possible that both the *issues* and *emotional* dimensions of the conflict are yet to be appropriately addressed to bring sustainable closure to the conflict. The *issue* is the source of the conflict and in our Case Study; the *issue* can be located in John's request for travel authorization and Blessing's disposition in ensuring that the rules of the organization regarding the timeline for approval is strictly adhered to. **Case Study 2** indicate that the *issue* surrounding the travel authorization was addressed, John got authorization to travel and Blessing ensured the rule of the organization regarding travel authorization applied, it was therefore, a win-win for them. While the *issue* was addressed, the associated *emotions*

were not. Recall that Blessing's tone of voice (**Case Study 1**) was injurious to John's emotions and the values the emotions represent. Recall also that it was John's ability to self-mediate his negative impulses (**Case Study 2**) that provided the incentives conducive to the management of the travel authorization issue. Did Blessing notice that her tone of voice was injurious to the emotions of John? Did it appear that Blessing was addressing her boss/supervisor?

If you were to be John, how would you feel even after addressing the issue in conflict to have your subordinate address you in such disrespectful tone? The frosty relation between John and Blessing is because although, the conflict issue has been addressed, the emotions of John that seems to revolve around respect, superiority, ego and relevance were fundamentally left unaddressed. The obvious gap in this context is located in the fact that Blessing did not see the need to self-mediate her negative impulses. To her, it was an opportunity to tell her boss (John) that she was in charge and instead of speaking about her anger she was rather speaking from her anger thereby inadvertently setting the background for the conflict that ensued. It should be noted that conflict will escalate or defuse depending on ones' approach to it. The deterioration of the conflict (**Case Study 3**) that was assumed to have been settled between John and Blessing (**Case Study 2**) was due to Blessing's tone of voice. It was Shay & Margaret (2008:53) who share the view that "whether you defend, attack, retreat, appease, you affect how the other will respond. It is a dynamic moment and you control the direction and the final outcome by the processes you use; by how you use your words and energy".

Self-mediation by Blessing would have logically moderated her responses to John. For effective workplace conflict management, self-mediation should be part of the culture of the organization where both employers and employees are trained on how to moderate the interaction of negative energies within the *self*. Where this is the case, Blessing would logically moderate her impulses by responding to John in such a manner where the ego of John is less threatened while the point of applying relevant workplace rules in all situations would have still been achieved. In conflict, people usually feel under threat of losing something which is important to them. It is this perceived threat that puts them on the defensive and there is little chance of getting collaboration while it remains. A joint solution is more likely to be achieved if the threat, real or imaginary, is removed (Shay & Margaret, 2008:54). To achieve this, focus on the other person with the intent to meet their needs. Attending to what you want, regardless of the other, can create and further entrench this threat. In a situation as this, actors are to realize that emotions are innate to all parties and appropriate steps can be deployed in addressing emotions. These steps may involve actors:

- First, identifying and moderating their personal emotions
- Listening to identify the emotions of others
- Allowing enough time for such emotions to be appropriately expressed
- Fundamentally separating conflict issues from emotions
- Asking self-mediating questions that would create conditions conducive for effective communication

Self-mediation therefore, enable actors look beyond the conflict issues(s) to understand its emotional dimension by recognizing and appreciating the feelings of conflict actors and supporting them in creating conditions conducive for effective conflict management within the workplace.

Four Types of Conflicts in the Workplace

The very nature of the workplace makes conflict inevitable and doing nothing about it is the least advisable course of action. An appropriate starting point is to identify some of the likely conflicts in the workplace with the intent of informing intervention. Generically, four broad types of conflicts are common to the workplace. There are identified to include:

- Conflict over facts or data
- Conflict over processes and methods
- Conflict over purpose
- Conflict over emotions/values

Conflict Over Facts or Data

Most conflicts in the workplace happen as a result of insufficient or conflicting facts or data. In the workplace, it is possible for people to have different interpretation of the same data that may lead to different understanding and application. In **Case Study 1**, Blessing is noted as saying;

Oh no! John, you should know better than this, in fact, needless wasting my precious time over this. You are aware that I should get this request at least 14 days before the proposed travel date. But here you are, giving me a request 7 days to the proposed out-country travel date. Sorry to disappoint you John, no sacred cows in this organization, laid down rules must be followed

Note that in the above declaration by Blessing, there are certain expressions that are subject to misinterpretation and misapplication even though there are statements of fact. For instance,

14 days – are they inclusive of weekends?

Out-country – is this inclusive of the sub region where visa is not required?

A conflict is likely to occur here especially, when actors hold different interpretation of the same data. Workplace conflict emanating from misunderstanding, misinterpretation and misapplication of data is common in the organization but often taken for granted due to the assumption that all parties (employers and employees) are reading from the same page. Self-mediation as demonstrated in **Case Study 2** can help strengthen effective workplace communication thereby addressing conflict emanating from this process.

Conflict Over Processes and Methods

This is a very common conflict trigger in the workplace. This is because Standard Operating Procedures (SOPs) that spell out processes and methods of delivering results in the organization, though, directed toward the same outcome are subject to misapplication. There is therefore, a tendency for actors to clash regarding the best process/method to deliver corporate objective of the organization. It should be noted for instance, that John and Blessing in **Case Study 1** were both working toward delivering the following objective:

John's objective – travel authorization to further the corporate goal of the organization

Blessing's objective – ensure that rules are followed to further the standard of the organization

It is obvious from the above that the objective of John and Blessing though driven by them are both directed at delivering the same outcome – *furtherance of the goals of the organization*. Self-mediation would enable them moderate their negative energies controlled by emotions and allow them create conditions conducive for effective communication that would enhance teamwork and delivery of the goal of the organization.

Conflict Over Purpose

This is equally a common conflict in the workplace. It is possible to see colleagues engaged in the same project with different or conflicting purposes for doing the same thing. It is not uncommon therefore, to see employees whose main purpose in the organization is to draw their salaries without cognizance of the fact that their primary responsibility is to support the organization deliver specific services to the public. Again, the case of John and Blessing in **Case Study 1** may help our understanding here. The purpose of John and Blessing in the Case Study can be looked at from a different perspective. John was to get travel authorization to attend to the demands of the organization and Blessing's purpose was to ensure strict compliance with extant relevant rules. Without reflection and self-mediation, both actors would be thinking in the context that there are pursuing different purposes. It is advisable therefore, for employers and employees to often stop and ask the question, why are we doing this? The essence is to given room for self-mediation.

Conflict Over Emotions/Values

In the workplace, conflict about emotions and values are probably the most frequent and difficult to manage. Emotions are often hidden and held deep down by all actors to different degrees. The tendency for a conflict to escalate or deescalate depends on the level of emotions and values involved and held by the conflict parties. Lessons could be drawn from **Case Study 3** where Blessing noted thus:

I thought the issue with John was over after we agreed and processed his travel authorization. I however, noticed that his attitude towards me had changed. His attitude has made me unproductive because as my supervisor, he has refused approving most of my requests and we have been literally fighting since then with implications on productivity

This example clearly demonstrates that the emotional dimension of the conflict between John and Blessing was not appropriately addressed. Beyond conflict issues in the workplace, (conflict over facts or data, processes/methods and purpose) emotions and values portends the most protracted sources of workplace conflict. Emotions are often driven and sustained by ego and for those who hold values like honesty, respect, dedication and reciprocity may feel offended and generate workplace conflict when such values are not identified and properly addressed. Self-mediation by conflict parties would logically help create conditions conducive to the identification, expression and management of issues relating to emotions and values of people in the workplace.

Managing Conflicts in the Workplace Through Self-Mediation 3Rs

It is obvious by now that self-mediation prepares our minds towards the effective and appropriate management of conflicts at the intra and interpersonal levels. Part of this preparation revolves around the 3Rs of *Responsibility, Relationship and Real problem*.

Taking Responsibility

Conflict at the workplace is not a matter of “if” but “when” because the interaction of persons and processes would certainly generate conflict. What then happens when conflict is generated? In the workplace, it is common to see a party to a conflict freely discuss the conflict with everyone in the workplace except the other party in conflict. A typical context is the conflict between *John and Blessing in Case Study 1*. In this context, Blessing shares the conflict with employee A, A shares with D and D with R. This means talking about the conflict rather than talking to the conflict party. Through this means, the conflict gets bigger, protracted and issues become proliferated. Taking responsibility here means engaging the conflict party (ies) in a direct communication about the conflict rather than seeking for sympathy by discussing the conflict with secondary parties. Self-mediation suggests that moderation of negative impulses would create condition conducive to taking responsibility in addressing the conflict in a non-threatening way. An extract from **Case Study 1** can help further this point.

Oh no! John, you should know better than this, in fact, needless wasting my precious time over this. You are aware that I should get this request at least 14 days before the proposed travel date. But here you are, giving me a request 7 days to the proposed out-country travel date. Sorry to disappoint you John, no sacred cows in this organization, laid down rules must be followed

The extract above presents Blessing’s approach to the conflict in a threatening and irresponsible way that was not a product of self-mediation. A more responsible approach in this context would be something such as:

Mr. John, I would like to talk to you about the challenges with your request for travel authorization. May I know when it’s convenient?

Responsibility here connotes that you are part of the solution not the problem. It means your actions and inactions are able to create a background for responsible communication. This is because when you speak responsibly, you inadvertently set the tone for other actors (Lebedun, 1998). The bedrock of taking responsibility is self-mediation, a process through which the negative energies are transformed into peace resources.

Ensuring Effective Relationship in the Workplace

The workplace is a product of relationship through team work. Self-mediation within the workplace stimulates appropriate behaviour that strengthens relationship. It is not uncommon to see people in the organization that are very assertive and always right. People with this extreme kind of tendencies trade relationship for personal recognition and relevance. In **Case Study 3**, John allowed his ego threatened his relationship with Blessing and the productivity of the organization was affected as a result. Relation-

ship is fundamental to achieving workplace goals because people cooperate with you when they want your success and against you when they want your failure. It is therefore, instructive to develop healthy relationship within the workplace before conflict and preserve relationship during and after conflict. Self-mediation would structure people's tendencies by creating and sustaining responsible communication that guarantees effective relationship in the workplace.

Making the Real Problem the Focus

The workplace is made up of people with different personality types. When a conflict ensues, it is common to have conflict parties raising secondary issues rather than the real issue (s) in conflict. This often happens when a conflict party finds it difficult to freely talk about an issue and in lieu of the real conflict issue (s), other issues are raised to sustain the tempo of the conflict and mislead appropriate intervention. Self-mediation in this context therefore, creates conditions that are conducive to responsibly stating and addressing the real issue (s) in conflict without hurting feelings. It is appropriate therefore, that the workplace is conscious of the relative strength of self-mediation and create incentives that supports its propagation.

Cost of Conflict

Irrespective of the anatomy of a conflict, it has a cost on the individual (conflict actor) and the organization. One of the most manifest costs of conflict on the individual including the organization revolves around *relationship*. It is obvious by now that the workplace is populated by individuals from different background with different personality types. Conflict in the workplace therefore, entrenches a feeling of inferiority, withdrawal, and sabotage in the minds of people and fundamentally strain relationship. When relationship between employees is strained, teamwork and cooperation is sacrificed on the altar of sabotage. When conflict in the workplace is left unaddressed, it may create the ambience for emotional and health cost on the conflict party (ies). Conflict parties in the workplace may engage in a 'cold war' of some sort and such tendency can result in loss of trust in the workplace, unhappiness, stress, hostility, aloofness, illness and even suicide/death.

Shay & Margaret (2008:17) aptly declares that conflict not only has a high personal cost but it is expensive for the organization. They made the point when it was revealed that "research indicates that a typical manager loses 25% of the day responding to unhelpful conflict. This is time lost to creative, productive work". To drive home the point, the impact of the cost to the organization can be measured when consideration is given to a medium sized organization with one hundred managers. "Let's assume the average annual salary per manager is £40,000. With managers losing 25% of their time on conflict, the cost will be £1,000,000. This only accounts for management time. The true cost will include wasted employee time, higher staff turnover, missed opportunities, absenteeism, inefficiency, low morale and poor teamwork (p.17). The workplace conflict cost was further corroborated when it was found (McGuire 2014, Lawler 2010 and Hayes 2008) that in 2008; U.S. employees spent 2.8 hours per week dealing with conflict. This amounts to approximately \$359 billion in paid hours (based on average hourly earnings of \$17.95), or the equivalent of 385 million working days.

Overall, the cost of workplace conflict has both direct and indirect implications. The direct costs according to Brokenburr, & O'Donnell (2016:10-11) are identified to include:

Direct Costs

- Labor
- Overhead
- Litigation
- Replacement
- Workers' Compensation
- Healthcare
- Security

Indirect Costs

- Lost productivity
- Lost revenue
- High turnover
- Morale
- Energy and effort managing conflict

Conflict negatively affects the reputation of the organization by threatening its capability to win new businesses and attract experienced hires and also upsets employee turnover. This means that employees who feel insecure as a result of workplace conflict may decide to leave even without an alternate job (Namie (2007). Workplace conflict can also chase away subject matter experts who would rather seek for organizations where they are appreciated (Hoel & Einarsen, 2009). Generally, unmanaged conflict is the largest reducible cost for many organizations and it is usually the least recognized. To reduce the conflict management cost for organizations, it is instructive to invest in self-mediation.

FURTHER RESEARCH DIRECTIONS

Workplace mediation constitutes an obvious direction for further research endeavor. The justification for this declaration revolves around the evidence that organizations hardly commit to creating conditions conducive for professional third party intervention in workplace conflicts. What seem to exist are internal mechanisms put in place by management for dealing with workplace conflicts. The downside of such internal processes is that there are often subjective and influenced by biases. Further research directions under the broad theme of workplace mediation can therefore, cover such sub-theme as

- How mediation can be used within organizations
- Workplace mediation for teams
- Team mediation and group dynamics

CONCLUSION AND RECOMMENDED ACTIONS

This study has established that workplace conflict cannot be wished away. This is because the workplace is populated by people and as people interact with policies and processes in the quest to deliver the goals

of the organization; conflict becomes an inevitable element of the process. Again, it is established that conflict is not a completely destructive phenomenon that should be avoided but what is important in the conflict cycle is the management approach deployed. We can however, respond to workplace conflict with choices that could lead to destructive outcomes. These may include escalating “battles” and ill feelings that might lead to hurt, bitterness, withdrawal and suppressed frustration that eats away at employees’ comfort. We can also respond to conflict in a manner that leads to constructive outcomes that builds the confidence of the employee, engender happiness and strengthen teamwork. When managed appropriately, conflict can stimulate progress, deepen trust and reinforce relationships all of which enhance productivity and optimize bottom line results. The point has been made that the bedrock of all conflicts is the *self*. The workplace conflict that result from misinterpretation and misapplication of rules fundamentally has a human dimension that gives life to the process. This simply presupposes that it is appropriate to deploy a conflict management mechanism that would effectively address the substratum of conflict. Since conflict begins from the within, it is therefore logical for its management to also begin from within. While many employees would like a constructive approach to managing workplace conflict, we often do not know how to achieve such feat, and so may not even believe that it is possible. Drawn from the above, it is therefore, safe to declare that the most appropriate, effective, efficient and context specific approach to managing workplace conflict is through self-mediation.

As recommended actions, it should be noted that conflict management is seldom part of our school curricula; as a result most employees enter the workplace with little experience of managing conflict. In the light of this gap, it is instructive for organizations to commit to the training and retraining of their employees in conflict management. This is because training is the single most important driver for high-quality outcomes to conflict. Organizations should specifically adopt and deploy trainings on self-mediation specifically tailored to address how to manage the interaction of negative energies by turning such into peace resources in order to create conditions conducive to effective win-win communication and relationship in the workplace. For, if organizations invest in building the awareness of self and others on which better relationships depend, they will see the energy created by interpersonal friction generate sparks of creativity, rather than consuming flames. Would you like to reduce the cost of conflict in your workplace? Then invest in a robust self-mediation training solution in order to enjoy the benefits of a conflict free workplace.

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KEY TERMS AND DEFINITIONS

Conflict: A struggle between two or more parties who perceive their goals as incompatible within a specific context.

Conflict Freezing: A situation where some intervening variables in a conflict setting are addressed but the root causes of the conflict are left unattended to. In such contexts, temporary peace may be experienced but a little heat de-freezes the once frozen conflict and the conflict assumes a different and protracted dimension.

Conflict Management: A broad spectrum of approaches deployed in identifying, preventing, mitigating and addressing conflict.

Mediation: A conflict situation where a third-party neutral is enlisted by conflict parties to facilitate a process of negotiated agreement.

Self-Mediation: Simply means self as a mediator, mediation without a third party, a way of getting others to work with you not against you. Typically, self-mediation has to do with an attitude shift from *me against you to us against the problem*.

Workplace Conflict: A struggle between two or more parties who perceive their goals as incompatible within an organization. It is typically, “any workplace disagreement that disrupts the flow of work” (Robyn, 2016).

Modern Downsizing

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INTRODUCTION

The turbulent character and dynamics of modern business environment is nowadays indisputable, leading to the paradox of ‘constant change’ to be a widely accepted also in practice. Companies are forced to operate not only in the world of continuous progress, incessant new technological solutions and process enhancements but also in the reality of unpredictable behavior of their competitors. The automotive industry, as a sector that evokes a lot of emotions, may serve as an interesting example here. Its future is no longer shaped exclusively by automotive companies but also by technological companies such as Google and Uber, which base their strength on the model of sharing economy. Additionally, the dynamic environment has an impact on industry cooperation, including international cooperation, and is further supported by improved logistics, economic infrastructure, advanced legal solutions, and organizational experience of the enterprises themselves.

Merely embracing these phenomena, including a more efficient collaboration as part of a business network, faster pace of work and a growing specialization of the organization’s profile, may not always be sufficient to draw the right conclusions and adapt to constant changes. This applies particularly to organizations focused on achieving a linear, one-way growth, which insist on emphasizing the value of size and primacy of possession, and which are at the same time driven by the fear to admit defeat and their general reluctance to withdraw from a certain course of action.

Yet modern organizational solutions and coherent business models provide for multiple dynamic solutions. Accelerated flow of money, goods and information, growing automation and increased use of external resources – while all of them contribute to a greater flexibility, they also have an effect on the organizational structure pushing it more towards project work. However, in such conditions it is just as important to grow accustomed to constant growth, direction changes, new projects piling on and to seizing every opportunity as soon as it arises, as it is to learn how to withdraw, change course of action and resign. This seems to confirm the need to modernize many current restructuring solutions such as downsizing. Even more so that if one is to take full advantage of emerging opportunities and implement yet another paradox of ‘creative destruction’ in practice, one needs to develop a set of competences that will cover the both possible directions (competence of growth and withdrawal).

The chapter discusses the concept of downsizing as a strategic option and a management tool. **There are three detailed goals: to present nowadays definition of downsizing, to show the importance of the problem (showing the scale and effect of downsizing) and to present basic implementation challenges.** It starts with presenting the evolution of the term and its definitions, showing it from the point of view of an organization’s strategy, capital and HR, or treating it as a phenomenon. A basic classification of downsizing is offered (voluntary vs. forced, short-term vs. long-term). Its scale and possible outcomes are described and discussed based on literature review and author’s research. While pointing

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to a wide range of tools that may be used during its implementation, the paper raises also the issue of good practices that need to be developed in this field¹.

BACKGROUND

When analyzing the origins and evolution of downsizing, one should step beyond the original narrow definition and extend one's view to accommodate for such related solutions and methods as restructuring, exit strategies and strategic renewal.

Downsizing originated in the 1980s in the US, where most major American companies opted for downsizing activities when struggling with over-employment, inefficiency, low flexibility (Cameron, Freeman and Mishra, 1993, pp. 20, 22), growing competition (also at the international level) and rising debts (Appelbaum, Everard and Hung, 1999, p. 537; Mishra and Mishra, 1994).

Originally, it denoted a type of activities focused on reducing the scale of employment; hence (even today), it mainly refers to human resources and is defined as a deliberate practice of job-cutting aimed at increasing efficiency (Nixon, Hitt, Lee and Jeong, 2004, p. 1121; Freeman and Cameron, 1993; Krupski 1998, p. 263). However, nowadays it is more often believed that reducing employment should no longer be perceived as a goal in itself but as a way of adapting the company to changes imposed by the environment. As it attracted increasingly more interest, downsizing turned out to enforce organizational (Budros, 1999, p. 71) and management changes (Cameron, Freeman and Mishra, 1993, p. 24). With the gradual extension of the scope of changes, downsizing was redefined as a strategy to reduce costs of core business activity in order to minimize inefficiency (Appelbaum, Delage, Labibb and Gault 1997, p. 4; Wilkinson, 2005, p. 1080), or as a strategic option (De Egaña Espinosa De Los Monteros and Bravo, 2012, p. 75), connected with a wide set of interrelated organizational tools and solutions.

Thus, one can easily notice how downsizing has evolved from a mere reaction to an economic downturn or protecting the company against bankruptcy in the 1980s to a coherent strategy covering all resources of the organization. It was implemented in response to overstaffing, technological changes, the need to reduce the company's size and due to changes related to mergers (see Gandolfi, 2014, p. 4).

As more knowledge was available on downsizing, many researchers began to distinguish different types of downsizing activities (DeWitt, 1998, pp. 59-60, Freeman and Cameron 1993, pp. 13-15; Lim, Celly, Morse and Rowe, 2013, p. 43):

- Retrenchment strategy – reducing the scale of employment by means of temporary job-cutting in certain departments; optionally, withdrawing from certain markets, products or services, and focusing on savings;
- Downscaling – reducing the company's scale, mainly for the purposes of permanent reduction of resources (including human and physical), but without diminishing entirely the company's position in the market (changes aimed at matching the company's offer to the actual demand and ensuring a greater flexibility);
- Downscoping – eliminating some of the company's resources to reduce its assets and human resources, and to simplify its structure, resulting in its less significant market or technological position, implemented with respect to either the entire company or its parts (corporate refocusing);
- Decline (organizational decline, non-adoption) – the company's fading and downfall due to market decline, budget cuts, lack of adaptation, change in the market niche, economic stagnation, loss of permits, licences, etc.;

- Growth-in-reverse – reducing the scale of the company's operations without improving its efficiency;
- Resourcing – changing and optimization of resources owned by the organization;
- Divestiture – deliberate disposal of an investment, intangible assets, fixed assets or long-term financial assets.

One can easily notice the abundance of words and phrases used to describe downsizing, with a variety of them related to restructuring and organizational changes (e.g. delayering – reducing the number of management levels; streamlining – increasing efficiency through simplification; redeploying – resource shifting and re-assigning to a new task), human resources (e.g. de-hiring, rationalizing of workforce), business activity (e.g. refocusing, de-diversification), company design (e.g. dismantling, compressing, reallocating, redirecting, spin-off), scale (e.g. building-down, declining, rightsizing) (based on Cameron, Freeman and Mishra, 1993, p. 25; Cameron, 1994; Taylor, 2005; DeWitt, 1998; Johnson, 1996, p. 440).

While such a great diversity of terms and areas of interest is appreciated by specialists, it may be a reason for confusion among practitioners and researchers from other fields.

DOWNSIZING NOWADAYS

Based on a careful analysis of available sources, two main approaches seem to come to the foreground in the present-day discussion on downsizing and its development: one focused on downsizing as a source of detailed and highly refined solutions, and another one that tends to perceive it in broader, more general terms. While the former studies tools intended specifically for HR or asset reductions, the latter stresses the relationship between the company's downsizing, for example, in technology and its intellectual capital or work-flow processes.

The author of this paper places himself among the supporters of the latter approach who prefer to see downsizing as a practical solution that offers a number of useful instruments. Following the writings of researchers already cited here, a definition of downsizing may be suggested in which downsizing is perceived as deliberate choice (evolutionary, anticipatory, adaptive or remedial) to reduce the scale of the entire organization or its parts in selected areas (e.g. infrastructure, assets, finances, HR) through implementing changes (e.g. in internal and external organization, technology) with the aim to increase its efficiency and protect or increase its value. It is a broad definition that nevertheless does not cover all phenomena related to downsizing and its applications. Based on a review of research, downsizing is interpreted differently but is generally categorized as:

- a method: a set of tools to reduce the scale of the company's activity;
- a strategic option: a direction adopted in the company's development;
- a phenomenon: an occurrence characteristic of modern enterprises;
- a direction in product development.

The first two approaches (method and strategic option) refer to management, accounting for the scale and purpose of downsizing. The third approach (phenomenon) focuses on economic phenomena. It describes the situation when a company reduces its scale unintentionally and without being aware of it, or when it limits its resources regardless of its growth. Examples may include intentional activities, such as outsourcing, and less intentional ones that come with a more effective cooperation or technological

changes resulting in reducing the resources that need to be involved in product development (e.g. modified technology of production requires less labour). The last of the four approaches is directly related to product development strategy and consequently, to marketing. It occurs when a certain quality of the product changes while its functionality is preserved, e.g. size, volume or any other dimension of the product is reduced while all its features and values remain intact (see Hales, 1994, pp. 35-43).

Due to such a variety of interpretations, downsizing, whether approached as a method or strategy of management, offers many possibilities when it comes to systematization, and may therefore be discussed in terms of:

- Reasons behind it: downsizing as part of a recovery plan, a response to something, forced vs. downsizing as part of the company's development, proactive, voluntary;
- Time and manner of implementation: short-term vs. long-term, gradual and slow-paced vs. rapid and radical;
- Coverage: partial (one area of activity) vs. comprehensive (the entire organization), with each area further divided in parts related to HR, work organization, assets, finances, external relations, etc.

THE SCALE AND THE EFFECTS

Initial downsizing activities were mainly focused on labor resources and limited to a reduction in the number of employees, however many researchers from 1980s and 1990s were not satisfied. It was estimated that less than 50% of downsized companies have achieved their goals (Marciniak, 2016, p. 195; Cascio 1993, p. 97), and only 10% of companies in recession have a chance for future development (Nunes & Breene, 2011-2012, p. 52). Also more recent studies confirm unsatisfactory data: depending on the market studies, the authors prove that downsized companies achieve only short-term effects (Magán-Díaz & Céspedes-Lorente, 2012, pp. 5, 17; Carriger, 2018, p. 456), and find a lot of disadvantages of this process like costs or losing good image (Saeed, Arshad, Fareed, Shahzad & Nawaz Lodhi, 2013, p. 608; Kowske, Lundby & Rasch, 2009, p. 48-56). At the same time there are some researchers proving also positive effects (or at least inconclusive), like achieving results for deliberate downsizing (Eckbo & Thorburn, 2012, p. 161) or achieving results in longer period (Sheaffer, Carmeli, Steiner-Revivo & Zionit, 2009).

In order to present the contemporary scale and issues related to downsizing, a study was carried out on selected stock exchange companies listed on London Stock Exchange, NYSE, Oslo Børs and La Bourse de Bruxelles. **The purpose of the study** is to present the scope of current downsizing proving the importance and topicality of the problem. Moreover the study shows basic effects of downsizing.

Table 1. Structure of companies included in the study

Stock exchange	No of companies per sample	Companies meeting the revenues criterion	Companies meeting the assets criterion
Brussels	18	33%	28%
Oslo	30	37%	10%
London	31	26%	23%
NY	36	28%	14%
TOTAL	115	30%	17%

There was a basic statistic method used: the collected financial data was analyzed for relationships and values characteristic for companies undergoing downsizing in the period subject to the analysis.

The analysis was performed with respect to companies that met specific criteria. Companies that officially filed for bankruptcy or were undergoing restructuring were excluded from the study. The remaining declining companies were divided into two groups based on the criterion of:

- Revenues: companies whose revenues were in decline, i.e. those with a drop in revenues of over 20% for two years in the studied period (2008-2017);
- Assets: companies whose fixed tangible assets were in decline, i.e. those with a drop in fixed tangible assets of over 20% for two years in the studied period (2008-2017).

In total, 115 randomly selected companies were included in the study, of which 30% met the criterion of revenues and 17% the criterion of assets. The structure of the studied enterprises may be found in Table 1.

For a further, detailed analysis of the studied populations complying with the pre-defined criteria, information included in the financial statements of the analyzed companies was used, together with the following indices (index changes in the period of decline):

- Change of ROS (return on sales; net profit/sales) in percentage points;
- Change of sales in %;
- Change of fixed assets in %;
- Change of EBIT (earnings before interests and tax) in %;
- Change of net profit in %;
- Change of debt level (total debt/total assets) in %;
- Change of total assets in %;
- Change of EBITDA (earnings before interests, tax, depreciation and amortization) in %.

The period for which the respective index changes were calculated could be different for each of the companies (within the range of 2008-2017). The base year, i.e. the one from which the index changes were calculated, was defined as the year after which the index of (chain) dynamics in sales revenues or fixed tangible assets fell below 100%. The last year in the analysis of the given company was, in turn, the year in which the dynamics in sales revenues or fixed tangible assets (depending on the population) was below 100% (uninterruptedly, ever since the year marked as the base year) for the last time.

Table 2. Regression analysis results for the population of companies with declining sales revenues

Specification	Δ EBIT	Δ EBITDA	Δ Net profit	Δ Total balance	Δ Debt level
R multiple	0.20	0.04	0.05	0.14	0.27
R-square	0.04	0.00	0.00	0.02	0.07
adjusted R-square	0.01	-0.03	-0.02	-0.01	0.05
standard error	188.64	192.22	192.15	190.44	185.07
Coefficient	30.29	-8.42	2.04	77.93	-113.37
t-statistic	1.22	-0.27	0.31	0.88	-1.73
p-value	0.23	0.79	0.76	0.39	0.09

The data for the analysis was obtained from the electronic database Equity RT. The financial information (individual reports) was compiled in a spreadsheet and then analyzed with the use of Excel and Statistica analytics software.

First, an attempt was made to determine the regression models: the relationship between the level of changes in revenues (for the first sample) and fixed assets (for the second sample) and the indices. In addition, an analysis of the relationship between ROS and other indices was tested. The study was repeated for the samples from each of the stock exchanges separately and for all the studied companies together. The last case: the results of the regression analysis for the population of companies with declining sales revenues are presented in Table 2. The analysis of the companies listed on London Stock Exchange, NYSE, Oslo Børs and La Bourse de Bruxelles, with their scale of sales revenues reduced, revealed no statistically significant variables that could explain the net profit ratio. Neither did the models calculated for the remaining samples allow to draw coherent and statistically significant conclusions. In a few cases, significant relationships were found, for example for London Stock Exchange (the revenues group) only the debt level was observed to be a statistically significant variable. In the model with this variable a relationship was revealed, indicating that the net profit ratio grew when the debt level went down (such model explained 60% of the changes in the net profit ratio).

Despite the lack of statistical effect, the results still allow us to draw important conclusions. The number of companies undergoing downsizing (defined as companies with a significant decline in revenues or fixed tangible assets) in the studied samples reveals that activities aimed at reducing business activity are a widespread phenomenon.

Based on the results of this analysis, a few assumptions may be made. Firstly, individual cases differ significantly from one another and therefore any statistical analysis carried out with respect to them should refer not only to their respective markets but to groups of companies that are similar in terms of sector, methods of operation and size. Secondly, the applied methods and forms of downsizing may differ significantly even when implemented in similar companies.

As the search for statistical models produced no satisfactory effect, in the course of further empirical research the measures of dispersion were defined for the results presented above in order to determine the effects of downsizing. A fuller description lies outside the purview of this article which therefore presents only selected figures. Detailed results are shown for the sample of companies undergoing downsizing in terms of revenues. For those downsized in the area of fixed tangible assets, the percentage ratio is provided only for the group in which the given index went up. The improved index was also recognized as an increase in ROS, sales, EBIT and EBITDA, and a decrease in total debt level. The results are presented in Table 3.

The results cannot be generalized due to the scale and sample selection composed only of stock listed companies, and extreme values (outliers). However, the indices allow for the identification of certain characteristics. The studied samples of companies showed a poorer performance on all stock exchanges when assessed from the perspective of EBITDA, while a drop in ROS and EBIT seemed to have no effect on their performance only on the New York Stock Exchange (where the net profit assessment was extremely varied). The companies selected for the decline in revenues significantly reduced the level of their fixed assets, while, with the exception of the Brussels Stock Exchange, their total debt level rose. As decrease of assets could be expected, increasing of total debt level suggest that implemented downsizing was rather a rescue method, and basis on EBIT drop, it was not as efficient.

When evaluating the structure of companies, a distinctive case was noted for the London Stock Exchange sample in which most of the companies improved their indices. However, in the remaining cases

Table 3. Measures of dispersion for the population of companies with declining sales revenues

Stock Exchange	Downsizing in terms of revenues*	ROS	Sales	Fixed assets	EBIT	Net profit	Total debt level	Total Assets	EBITDA
New York	Average	3.1	-38%	-14%	14%	-88%	1%	-12%	-14%
	Median	0.5	-33%	-19%	-30%	-40%	9%	-5%	-20%
	Standard deviation	23.4	17%	44%	174%	176%	27%	26%	70%
	% in index improvement	64%	0%		36%	36%	36%		36%
	% in improvement for fixed assets*	40%	40%		40%	40%	20%		40%
London	Average	-59.1	-41%	-7%	-61%	203%	49%	-24%	-6%
	Median	-23.5	-36%	-30%	-54%	-46%	62%	-32%	-48%
	Standard deviation	94.0	20%	76%	78%	869%	44%	49%	132%
	% in index improvement	13%	0%		13%	38%	25%		25%
	% in improvement for fixed assets*	71%	57%		57%	57%	43%		57%
Oslo	Average	-51.9	-43%	-36%	-20%	8%	29%	-22%	-55%
	Median	-8.3	-42%	-38%	-62%	-76%	23%	-30%	-62%
	Standard deviation	152.5	12%	59%	107%	369%	50%	33%	114%
	% in index improvement	43%	0%		29%	36%	21%		14%
	% in improvement for fixed assets*	33%	33%		33%	100%	0%		33%
Brussels	Average	-133.9	-50%	-19%	-92%	-128%	-18%	-10%	-67%
	Median	-2.1	-50%	-6%	-74%	-65%	-11%	7%	-56%
	Standard deviation	430.4	28%	46%	80%	409%	31%	37%	57%
	% in index improvement	50%	0%		0%	33%	67%		0%
	% in improvement for fixed assets*	67%	33%		50%	17%	50%		50%
* Additional information on % of cases in which the index went up for the sample downsized in terms of assets.									

the indices improved only for less than a half of companies per sample. Also, one of the most important indices, EBITDA, grew for less than a half of the companies in all cases (similarly to total debt level).

Above results may suggest that the results of downsizing seem to be generally unsatisfactory; however, a more individual approach is needed to respective cases and individual companies.

Moreover, a purely financial and quantitative assessment of downsizing processes does not seem to paint their actual picture. Firstly, results of analysis may be affected by the specificity of the respective industry and unique situation of every business. Secondly, as it has been mentioned before, downsizing is an extremely complex process the effects of which may not necessarily be only of financial kind. Therefore, it seems necessary to systematize first the reasons behind and aims of downsizing, and then to indicate the conditions and tools necessary for its implementation.

REASONS, AIMS AND IMPLEMENTATION TOOLS

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In the previously outlined scale of downsizing, financial indices were adopted as a criterion to identify its occurrence. Indeed, many other activities in business also focus on aims of financial nature. In the case of downsizing, they will primarily include the company's growth and protection of its value, whereby specific objectives will depend on reasons behind the adoption of such strategy.

The reasons can be divided into those that enforce a change, which are necessary if the company is to maintain its position or survive, and those that encourage a change, which give the opportunity to gain competitive advantage based on the anticipated situation. Examples may further be divided into internal and external reasons. The former include the company's financial situation (e.g. excessive debts), assets, HR (e.g. overstaffing) and current investments (e.g. increased automation), while the latter may refer to: competitors' activity, changing structure of demand (e.g. customer behaviour resulting in a drop in the number of orders), changes in the condition of the industry, changes in access to funding, technological changes, as well as changes in legal and political conditions.

The perspective of reasons may also prove useful in the evaluation of the company's aims connected with downsizing. The financial ones may be expressed and assessed directly in terms of maximized profitability or free cash flows. However, in the case of remedial actions, downsizing may for example aim at reducing the value of assets (fixed and current) and debt reduction. One should also take into account indirect aims related to improving the company's value or profitability. They may refer to the respective areas of the company's activity: HR (e.g. improved productivity and/or efficiency of employees), organizational (e.g. shorter production process), technological (e.g. reduced energy consumption), product or client portfolio (e.g. resignation from less profitable products and/or clients that demand high involvement in sales financing).

Moreover, one cannot forget about general aims related to decisions regarding ownership. They may include such courses of action as reduced personal involvement of the entrepreneur, release of the currently invested capital (e.g. for other investment projects), risk reduction (often associated with the scale of operations) and agreeing to less satisfactory results in certain areas of operation.

Such a picture of aims, in particular if applied across multiple areas of operation, confirms the strategic nature of downsizing, proving the depth and scope of introduced changes.

Depending on the reasons behind downsizing as well as its aims and objectives, managers have at their disposal an extremely wide range of tools. Presenting them, one should bear in mind the previously discussed evolution and definition of downsizing which in practice systematically expanded to accommodate for new methods of its implementation. Generally speaking, the majority of downsizing activities fall within the scope of personnel cuts (as the original object of downsizing) and reduction of the scale of revenues and assets used for business operation (a distinguishing feature of the groups of enterprises studied here). Moreover, methods, techniques and tools used in downsizing may also be extended to include a much wider list of activities applied in the area of broadly understood change management and restructuring.

Based on source literature (Hallock, Strain and Webber, 2012, p. 17; Isaksson and Johansson, 2000; McGrath, 2011-2012, p. 66; Ray and Maheshwari, 2017, pp. 291-292; Shunko, Yunes, Fenu, Scheller-Wolf, Tardif, 2018, p. 100; Staats and Upton, 2012, pp. 83-95, Sutherland, 2018) and my own research, the following groups of changes may be distinguished: changes pertaining to HR, assets and technology, scope of business activity, external relationships and finance. In terms of HR, the following tools may be applied:

- Staff reduction, including both forced and natural dismissals (e.g. termination of employment or early retirement), employee leasing, using groups of external low-skilled workers;
- Changing the form of employment (in terms of formal and legal solutions) and reducing working time and labour costs (e.g. part-time work, forced leave or freezing bonuses);
- Organizational changes, including changes related to company structure (e.g. reducing the number of career levels or organization's size) and work organization (e.g. elimination of tasks, consolidation of responsibilities, changes in specialization and in knowledge management), and changes related to outsourcing, re-engineering or lean management;
- Actions aimed at mitigating the impact of other changes on employees' commitment and performance.

Alterations to work organization are often connected with technological changes, in particular in terms of work automation or production systems. These transformations are related to operations on assets, such as:

- Divestiture, i.e. getting rid of unnecessary fixed assets, e.g. leasing, rental or management buy-out;
- Actions on organized parts of assets or subsidiaries, e.g. spin-offs, split-offs, split-ups, sell-offs, divestitures, equity carve-outs;
- Actions undertaken in order to reduce the current assets, in particular the size of the necessary stock and the manner of settlements with clients.

In particular, the latter often require for the scope of the company's activity to be modified, e.g. by implementing changes in:

- The portfolio of products and services, e.g. simplified list of available products, partial elimination of sales;
- The value added development process, e.g. modified structure of deliveries, withdrawal from certain stages of production in favour of prefabricated products (outsourcing), simplification (also technical) of processes, elimination of auxiliary processes;
- The sales process, including reduced intensity of marketing activities and additional expenses, withdrawal from some of the markets.

These may often translate into changes in relations with clients (e.g. reduced number or types of clients, resignation from high-risk business, over-demanding or less profitable clients) and suppliers (e.g. reduced stock, new terms and conditions of payment).

All of these are essentially dependent on the company's financial tools and measures. Downsizing activities in the area of finance may include for example:

- Changes in the structure of the capital, e.g. consolidation of liabilities, debt reduction (e.g. through conversion into shares);
- Changes in the structure of assets aimed at improving liquidity, e.g. the already mentioned divestitures, reducing the need for net working capital, leaseback.

It is worth noting that all these tools are interrelated across their respective areas, and their selection for application in practice is never linear but rather resembles a toolbox for managers' use. Therefore, it

is also important to consider the conditions that determine the implementation of downsizing, instruments to be used and their sequence. Among these determining factors one may find the following:

- Market conditions (e.g. the situation in the industry, competition);
- Technology used by company and technological development of market;
- Legal conditions;
- The organization's financial situation and the structure of its assets;
- Impact of external and internal stakeholders;
- Behavioural aspects affecting managerial decisions.

Certainly, the list presented above does not exhaust the topic. However, it allows to place downsizing within the plethora of knowledge on management and its relationships, with a very wide range of methods and techniques used not only for the purposes of the company's restructuring but also of its development.

SOLUTIONS AND RECOMMENDATIONS

Although addressed here as a separate area of interest, downsizing should not be treated as a stand-alone management concept. The reasons, aims and tools of downsizing compiled and briefly discussed here point rather to its interdisciplinary nature and multiple connections with other well-known concepts and methods used in management, both in terms of strategy and restructuring, and in operational management.

The most important practical recommendation for using downsizing would be focusing on decision making process. It is also a theme widely discussed by researchers, who emphasize phase of evaluation, planning and result anticipation (Appelbaum, Everard i Hung, 1999, p. 548) but also pointing out motives and types of downsizing, implementation methods, and survivors behavior (Datta, Guthrie, Basuil i Pandey, 2010, p. 285).

Downsizing is a highly complex process. Although actions undertaken as part of it primarily focus on improving the organization's financial situation while reducing its human resources or assets, effectiveness of downsizing is evaluated with respect to its outcomes in the organizational and social area, and in external relations. Ambiguity of financial results achieved by companies which opt for downsizing seems to confirm this. This should encourage individual observation of strategic choices, in which attention should be paid not only to reasons behind downsizing or the initial condition of downsized companies, but also to organizational solutions and ways of implementing changes, as well as to entrepreneurs and managers responsible for making plans and taking decisions.

FUTURE RESEARCH DIRECTIONS

In the future, the practice of downsizing will most certainly be developing in the three following fundamental directions:

- Classical – as a response to crisis situations, both internal (organization) and external (business environment);
- Progressive – as a method to reach competitive advantage, e.g. through reduced costs, increased flexibility;

- Attributive – with focus on features and phenomena that contribute to the development of technology and internal processes.

A broader definition and wider application of downsizing in practice, which has evolved significantly since the 1980s, is also of importance. Despite the seemingly well-established knowledge about it, it is necessary to extend downsizing research and analyze groups of companies by industry in order to find the best practices for specific types of business activity. It will also be valuable to explore tools, opportunities, barriers and risks related to activities typical of the respective areas, not only with the aim to discover new solutions but also to modernize the already existing methods. This implies that it is recommended to observe and learn to recognize the multiple determinants that may have an impact on downsizing in terms of decision-making and behaviour of people involved in it.

Furthermore, in order to better understand this phenomenon it will also be of great value, for both researchers and practitioners, to search for relationships between the financial situation of downsized companies and their actions in this regard, and thus confront their financial results with the respective determinants, time of the decision to downsize and solutions implemented towards its fulfillment.

CONCLUSION

Two phenomena seem to particularly stand out in the practice of downsizing. Firstly, the number of reasons (not only the negative ones but also others that enforce changes) why companies decide to downsize in terms of resources is high and continues to grow. Secondly, many enterprises reduce their scale of operation for a certain period of time – too often to a negative effect.

Therefore, it is necessary to aim at a better understanding of the methods, tools and techniques that enable the implementation of downsizing strategies. Effective practices need to be sought and studied, while managers should be educated not only in downsizing methods and procedures but first and foremost in accepting downsizing as a possible solution that does not necessarily have to mean failure.

As more knowledge is acquired on the respective areas of business activity and its dynamics, it is worth making practitioners aware of (and therefore include them in research) the correlations and mutual influence between the organizational, HR, technological and asset changes, as well as changes in relations with external entities.

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KEY TERMS AND DEFINITIONS

Anti-Crisis Management: Actions aimed at preventing and/or mitigating effects of an internal or external crisis.

Downsizing: A deliberate choice (evolutionary, anticipatory, adaptive or remedial) to reduce the scale of the entire organization or its parts in selected areas (e.g. infrastructure, assets, finances, HR) through implementing changes (e.g., in internal and external organization, technology) with the aim to increase its efficiency and protect or increase its value.

Exit Strategy: Defensive actions aimed at protecting the value of a company at a risk of internal or external problems.

Restructuring: Introduction of significant and comprehensive changes in many areas of activity as a reaction to the existing or expected significant changes in the internal situation of an organization or the conditions in which it operates.

Strategic Renewal: Relevant actions aimed at redesigning an organization and changing its business model based on radical changes and progress in the environment that lead to a strategic opening (a discrepancy between an organization's capacity and potential to grow).

ENDNOTE

- ¹ Downsizing has been one of the points of interest in the author's research and publications for many years, with this paper offering a compilation of the most important indications and trends in modern downsizing and its development. The definition, some discussion and conclusions presented here have already been published before, however only in Polish (e.g. Wojtkowiak, 2019; Sobolewski & Wojtkowiak, 2013).

Challenges of the Repatriation Process

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INTRODUCTION

The globalization process has brought the importance of human resources in international contexts, namely within multinational enterprises (MNEs). As such, organizations face many challenges because of the globalization. As a result, MNEs have witnessed an increase of human resources in international missions, which has led to the analysis of expatriation (Vidal, Valle & Aragón, 2007). Most MNEs understand that sending managers to other countries and cultures is crucial to developing global competencies, implementing successful business strategies, and maintaining competitive advantage (Knocke & Schuster (2017). Likewise, most MNEs that resort to international charters seek to transfer specific technological skills and operational knowledge (Jassawalla & Sashittal, 2009; 2011).

At corporate level, expatriation represents a process in which employees live temporarily abroad, for a period exceeding one year (Caligiuri, 2000). Additionally, the term repatriation encompasses the process upon which the managers/employees return to their home country. Moreover, although expatriation and repatriation has been studied thoroughly among MNEs, among more than 500 firms analyzed, has repatriation has not been studied at all (Ribau, Moreira, & Raposo, 2018)

Companies seeking to conquer international markets by sending leaders/managers that are able to develop international executive activities normally aimed at gaining market share or technology transfers that promote the international expansion of the company are the main cause for expatriation. While there are various stages during the expatriation process, depending on the complexity of international assignments, repatriation has been traditionally regarded as simply another stage of the expatriation assignment. However, repatriates play an important part for the company, since their international experience can be capitalized as relational/social capital allowing them to pursue international expansion strategies. Repatriates also have important knowledge regarding the cultural context of potential international target markets that they might have been involved in (Knocke and Schuster, 2017). This provides the company with unique competitive advantages, allowing them to explore international markets, and to explore the

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relationship with international branches, whether that is for exploring specific markets, or for transferring technology to those branches.

Repatriates experienced the company's performance in other countries and, as a result, they become part of a global social network that allows the company to pursue international strategies. They can help establish and expand the company's business at international level, since they have knowledge of the cultural context and specific information regarding market and customers. Hence, repatriates have an important role in the organization, since they are able to speed up the transfer of knowledge from subsidiaries to the parent company and vice versa. For these reasons, repatriates represent an important human capital investment. Moreover, the repatriation process represents an important research avenue, since the stay of an employee on an organization depends on the success of the repatriation process. Also, repatriation issues are often more challenging, more insidious and widely underestimated when compared to those experienced during expatriation (Knocke and Schuster, 2017).

However, most MNEs seem to neglect to transfer knowledge of their expatriates to other human resources of the organization in order to improve their response in global markets. With the increase of expatriate managers, an increase in the number of managers who go through the repatriation process is observed. Another important fact is that expatriates, after an international experience, become more committed to the development of their career (Lazarova & Caligiuri, 2001), which means that repatriates have high career expectancy when they return their careers in the company after international mission.

In an organizational context, repatriation is very important since this process involves a reverse cultural shock, as most of the executives feel forgotten after they return to the original organization they worked for (Deresky, 2004). Although the first article published on managers' repatriation process dates back to 1973, compared to research on the expatriation process, research on repatriation is much more limited in depth and quantity (Knocke & Shuster, 2017).

As such, the main purpose of this chapter is to fulfil a gap in the academic literature of repatriation. Bearing this in mind, the aim of this chapter is to broaden the knowledge on repatriation exploring previous studies. For this, we seek to answer the tow following research questions:

- Why the process of expatriation is regarded as more relevant than the repatriation process?
- What do organizations need to improve to assure a good repatriation process?

This chapter is divided in seven sections. After this introduction, section two involves the literature review where different articles regarding the repatriation of international managers are explored. Section three addresses the research method used to analyze repatriation. Section four presents the main results. Section five discusses critically the results. Section six presents the conclusion. Section seven puts forward future research directions.

BACKGROUND

Organizations are facing several challenges arising from the globalization that is taking place in the business world. This globalization led to a greater need for the internationalization of companies, which then resulted in an increase of the number of expatriates and an increased complexity of the human resource management (Vidal, Valle, & Aragón, 2007). A great number of companies understand that sending managers to other countries and cultures is essential for the development of core competencies, implementation of successful business strategies, and preservation of the competitive advantage in in-

ternational environments (Kraimer, Shaffer, & Bolino, 2009; Ren, Yunlu, Shaffer, & Fodchuk, 2015). It is often necessary for the majority of multinational companies to send some of their best managers to overseas operations in order to transfer specific technological competencies and operating knowledge (Jassawalla & Sashittal, 2009; 2011). The expatriation process is a way of transferring these specific competencies. However, many MNEs neglect the transfer of knowledge from their expatriates to elements of the organization itself as a way of improving their performance in global markets. Thus, this increase of expatriate managers involves a subsequent growth in the number of managers that go through the repatriation process.

Repatriation Process

According to Cambridge Dictionary, repatriation means “send or bring someone, or something, back to the country that person or thing came from” (Cambridge Dictionary, 2018). In an organizational context, the process of returning home is called “repatriation” and the employees who complete a service abroad are called “repatriates” by the employing organization (Lazarova & Caliguri, 2001). Repatriation continues to be a challenge for many international companies. However, there is little research regarding repatriation (Knocke & Schuster, 2017). The first article on the repatriation of managers was published in 1973, and the topic only started to receive more attention as of the 2000s (Knocke & Schuster, 2017). Compared to research on expatriation, research on repatriation issues is far more limited in scope and abundance (Furuya, Stevens, Bird, Oddou, & Menenhall, 2009).

Repatriation is seen by many organizations as the final stage of the expatriation process, and as a result this process is not given the attention it deserves. However, repatriation issues are usually more challenging and underestimated than issues experienced during expatriation (O’Sullivan, 2013). In order to bring proper attention to the process of repatriation of managers, it is important to take into consideration a few concepts that distinguish between two types of managers: the international manager and the repatriate manager.

An international manager is someone who works outside of their home country for a period exceeding six months (Linehan & Scullion, 2002). These managers are regarded as cosmopolitan, multilingual, and versatile individuals who have a stable family environment, and are able to work under pressure both from the company where they work and from the culture of the host country (Hurn, 2014). On the other hand, a repatriate manager is a manager who returns to their home country after more than six months working abroad (Linehan & Scullion, 2002). Repatriate managers are very important elements of international companies, since the knowledge, experience, and competencies that they acquired during expatriation are fundamental in order to achieve and manage a competitive advantage in a global environment (Vidal et al., 2007).

Repatriates Leaving the Organizations

If, on one hand, expatriation is a challenge for many international managers that see this process as an international career opportunity, repatriation may lead to unexpected issues for companies. The main problem in the process of repatriation is that it often ends with repatriate employees leaving the organizations to seek other job opportunities – and taking with them part of the intellectual capital acquired during the expatriation. It is argued that over 50% of these employees quit during the first two years following their return to their home country (Kraimer et al., 2012; Szkudlarek & Sumpter, 2015; Brookfield Global Relocation Services, 2015). Furthermore, 25% to 35% of repatriate employees eventually leave

their current organization in order to work for the competition (Suutari & Brewster, 2000). Nevertheless, a high percentage of those who stay in the organization have seriously considered changing their job (Suutari & Brewster, 2003).

According to different authors, there are several factors that explain why these employees deliberately leave their jobs. Repatriates end up leaving the organization because they feel that they have been given less challenging positions with fewer responsibilities upon their return, which is often due to the organizations not being able to assign positions or understand what they can do for their repatriated managers (Knocke & Schuster, 2017). After their return, repatriates feel that their new positions do not fulfil their competencies and experiences since they are unable to exercise competencies they developed in other cultures (Naito, 2016).

Female managers experience even more difficulties in the repatriation process since not only are there less female managers than male managers going through the repatriation process, but those that do go through expatriation processes are viewed as pioneers by other elements of the organization (Linehan & Scullion, 2002). However, when these female managers returned from their international assignments, they felt that they were once again placed in positions with fewer responsibilities, thereby increasing the possibility of leaving the organization.

In addition to the aspects that contribute to personal frustration regarding organizational work, managers who go through an expatriation experience develop new competencies that appeal to the competition. On one hand, companies expect repatriates to undertake a leadership role and contribute to the increase of the organization's global talent (Collings, 2014). On the other hand, companies also need to be aware of their competition since many repatriates receive new job offers from competitors upon their return (Lazarova & Tarique, 2005).

Although there are aspects outside of the organization that influence repatriation, there are also elements intrinsic to the organization that can have a negative impact, such as: inadequate support from the human resource management team; lack of information on the repatriation process; and lack of knowledge regarding responsibilities that the human resource department should have in this process. These faults lead to insufficient support and, as a result, repatriates do not feel integrated in the organisation (Howe-Walsh & Torka, 2017). However, it is not only the human resource department, as the formal support department, that can negatively influence the repatriation of managers. For instance, colleagues can be a strong emotional support system, but can also be a source of concern (Van Gorp, Boroş, Bracke, & Stevens, 2017). Moreover, the cultural diversity of the emotional support network of a repatriate also has an impact. This network, composed by friends and family, is not ready to face the difficulties associated with a repatriation process (Martin, 1984).

The repatriation process can be influenced by repatriates themselves, by circumstances unrelated to the organization, or by the organization's inability to manage this process. However, there is one common feature of the literature analyzed: the negative analysis of the repatriation process, which points us to the fact that there still is little research on this topic in comparison with the expatriation process, and the fact that, in general, repatriates end up leaving the organizations after returning to their home country.

Considering that it takes between six to twelve months to fully reintegrate someone into an organization (Linehan & Scullion, 2002), companies must manage the repatriation process as more than just a simple completion of the expatriation process. Moreover, if expatriates express any abandonment feelings deeply related to the idea of "out of sight, out of mind" by feeling that during their expatriation their connection to the organization tends to fade, thereby affecting relationships with colleagues, repatriates can still carry this abandonment feeling when they return to their home country (O'Sullivan, 2013).

Improvement of the Repatriation Process

Although there are various situations that may negatively influence repatriation, it is possible for organizations not to lose these valuable employees. Nowadays, companies can resort to a vast amount of social media available to us in order to increase repatriates' participation in different elements of the organization, thereby reducing the risk of feeling disconnected from the organization during the expatriation (O'Sullivan, 2013). Linehan and Scullion (2002) and Jassawalla, Asgary, and Sashittal (2006) propose the development of mentoring programs for managers, starting from their expatriation and until they feel fully reintegrated in the organization after repatriation. Thirdly, due to their great importance and major influence in the repatriation process, the organization must see family as a stakeholder that can have either a positive or negative influence in the process (Howe-Walsh & Torka, 2017). Consequently, companies should try to provide the manager with a set of offers that increase their fulfilment, such as, for example, assistance with repatriation of the whole family. If the family is involved in the expatriation process, offering tickets to visit the home country is a good way of promoting the re-adaptation of everyone in the family, while also making the repatriation experience less complicated (Hurn, 2014).

Companies should try to develop internal training programs on how to handle different scenarios, providing employees with more support regarding cultural shock (Osman-Gani & Hyder, 2008). Furthermore, when they return to the company, managers feel that the organizations should provide more support regarding quality of life, for them and for their families. For this reason, preparation workshops on how the repatriation process works and what managers can expect from the organization during such process would be highly significant, giving the repatriate more realistic expectations on their career development (Osman-Gani & Hyder, 2008).

RESEARCH METHOD

The Scopus database was used for the development of this chapter. Nine articles regarding the repatriation topic were analyzed. For this purpose, we decided to focus on the TOPIC: ("managers") and excluded all articles prior to 2000. Also, articles were limited by the area of investigation, in this case, business and management, only articles in English were included, and the called "grey literature" was excluded.

The nine articles analyzed use three main methodological approaches. Questionnaire surveys (Vidal et al., 2007; Naito, 2016; Osman-Gani & Hyder, 2008) focusing repatriates in several firms in several countries. Howe-Walsh and Torka (2017), Van Gorp et al. (2017) and Linehan and Scullion (2002) chose the interviewing technique, which was carried out with repatriate employees and manager teams. Finally, Knocke and Schuster (2017) carried out a Systematic Literature Review (SLR), based on the following four questions:

1. What is the general level of emphasis on repatriation in management journals?
2. What is the primary content of the relevant articles?
3. Which theories are applied to analyze repatriation?
4. What is the general methodological background and what analytical approaches are employed?

This SLR, covering research from 1973 to 2016, is very important as it covers different points of view and provides a sense of what has already been developed on this topic within the academic world. These authors identified, assessed, and described the literature, creating knowledge about repatriation.

Hurn (2014) chose to study thoroughly a case study on repatriation, providing important information regarding the organizations' Human Resources in a globalized environment as we live in today. Finally, in her article, Sussman (2001) proposes an analysis of North-American managers that return to their home country after an expatriation period from six months to four years.

RESULTS

This section includes a brief summary of results found by different authors. This section is highly important, allowing us to briefly analyze what has been achieved over time, based on a critical assessment regarding how the different researches were carried out. Moreover, it helps us answer some of our own research questions based on previous research.

Sussman (2001) found that there is no actual connection between job dissatisfaction and a difficult repatriation experience. Furthermore, there is a significant connection between a complicated experience abroad and feelings of angst during the repatriation process, which is also the case regarding the proportionality between the repatriates' detachment from the cultural identity of the host country in comparison with their home country, and their feelings of distress; when one of such factors grows, the other one follows. In short, repatriates who had less preparation were diagnosed with greater feelings of angst and concern related to the repatriation process.

Linehan and Scullion (2002) focused on studying the repatriation process of top female managers, at a time when there were still very few female managers able to achieve these international positions in organizations. Linehan and Scullion (2002) reached the conclusion that the majority of these managers were placed in positions with less responsibility upon their return, thereby decreasing their overall job satisfaction and causing them to leave the organizations.

Vidal et al. (2007) tried to understand how job satisfaction influenced the repatriate managers' intention of leaving their companies. In other words, they tried to understand the extent to which managers are or are not, upon their return, satisfied with the job that was waiting for them in their home country and what type of impact said satisfaction has when deciding whether to leave or stay in the company. Vidal et al. (2007) reached the conclusion that the repatriate managers' satisfaction is usually negative, taking the following three aspects into account: work content that is adjusted to the employee; whether managers are given a promotion after repatriation; and having specific expectations regarding the task managers will take up after repatriation.

Osman-Gani and Hyder (2008) addressed the topic of manager repatriation from a human resource point of view, i.e. how human resources can train and develop the international managers in repatriation. The authors concluded that the majority of companies do not provide the necessary support during the repatriation process. Feedback from repatriates is negative, since they mention that they wished they had training or had attended a workshop on how to handle cultural shock when they returned, and they also think it is necessary to provide more support regarding quality of life. Organizations should also invest in giving employees realistic expectations regarding the career progression of their repatriates.

Hurn (2014) carried out a critical evaluation of the challenges faced by the human resource management in an increasingly globalized world. He concluded that MNEs are trying more and more to decrease the failure in assignments abroad, making it one of their main goals. The increased competition regarding the recruitment of high quality international managers makes it necessary for the companies' human resource management to provide the best preparation and training for their expatriates and operate in

various ways. For example, providing a careful and efficient repatriation program aimed at ensuring that repatriates stay in the company.

Naito (2016) studied the core aspects of the readjustment of expatriates, giving MNEs the opportunity to use this knowledge for talent management. Naito (2016) concluded that repatriates who report having a better readjustment and job satisfaction are those with less household stress and family issues, who are more eager to return while abroad, with realistic expectations, experiencing a short-term repatriation process, whose company benefits from their skills, and that have a good relationship with their superiors.

Howe-Walsh and Torka (2017) explored the influence that repatriates' supporters have during the repatriation process. They concluded that both family and top and line managers are important for the repatriation process; however, human resource managers have a greater role. In addition, they conclude that a poor support from the HR department to the repatriate is mostly caused by lack of information on how to provide this support throughout the process.

Van Gorp et al. (2017) studied the influence of emotional support during the repatriation process. They conclude that, in most cases, lack of support from the company in the home country leads to reintegration difficulties. On the other hand, family support eases this process, as well as previous experiences abroad. In order to improve the repatriation process, they believe that social and training activities with both the repatriate and their family should be implemented, along with visits from colleagues of the home country, thereby improving the repatriation adaptation.

Lastly, Knocke and Schuster (2017) reached the conclusion that companies, similarly to scholars, give more importance to expatriation since they see repatriation as the final stage of the expatriation process. These conclude that it is necessary to include contextual factors, so that researchers are able to carry out more realistic micro, meso, exo and macro environment analysis, as well as the temporal aspects of the repatriation process. With this, they wish for future researchers to step out of their comfort zone and use alternative research approaches, which can help broaden horizons on this process. The main conclusion of this article points to the lack of understanding of repatriation as an isolated process.

DISCUSSION

By analyzing these articles and their results, it is possible to understand that different authors use different research methods. However, all researches used only one research method, instead of a mixed approach, for example. Thus, new authors who wish to address the repatriation process need to go much further when carrying out their research, so that it becomes richer and more in-depth, obtaining increasingly complementary results (Knocke and Schuster, 2017).

After considering all the articles mentioned in this work, and in light of what it has been analyzed herein, it is now possible to present a critical opinion. Firstly, it is clear that due to the globalization and internationalization of companies, expatriation has earned an increasingly important role in the communication with different cultures, while also helping companies achieve a competitive advantage over their competitors (Hurn, 2014). We believe that this is a very significant item, because if this process is given greater importance, the repatriation process should also follow its lead, so that organizations are able to keep managers who return with a new set management and communication competencies instead of losing them to competitors.

Secondly, Human Resource Management has a fundamental role in the repatriation process, not only regarding the planning of the repatriation of employees, but also by ensuring that repatriates stay in the organization afterwards. Planning, i.e. the preparation of managers for the repatriation process is still

an undervalued stage in many organizations. However, this process plays an increasingly key role in keeping repatriate managers from leaving the companies, which is one of the reasons why we propose a growth in the study of this topic by the scientific community (Hurn, 2014).

Hence, the repatriation process begins before the employee returns to their home country. The company's Human Resource Management should prepare their managers well before the expatriation process, through psychological support for the expatriate manager and their family, as well as preparing the manager to ease their adjustment to the cultural identity of the host country, by attending trainings and workshops (Sussman, 2001). Moreover, we consider that these practices carried out by the company, associated with the implementation of support strategies for the manager during the expatriation process, are essential in order to foster the best possible expatriation experience. These strategies could be, for example, frequent contact between the company and the expatriate in order to monitor the whole process closely; to offer visit trips in cases where the family stayed in the home country; to provide support for the spouse and support regarding both education and health insurance and specialized medical support not only for the expatriate manager, but also for their families. In view of what was highlighted by the author, we believe that this article is a positive contribution for the academic study of the repatriation process, since it focuses on the department that is responsible for the organizations' human resources. This focus in a specific department can contribute to minimizing the negating impact that repatriate managers experience throughout the whole process. There is a significant connection between a good expatriation experience and the existence of a successful repatriation process leading to the stay of the repatriate manager, making it extremely important for organizations to implement these practices (Sussman, 2001).

Due to the growing globalization, these expatriation and repatriation events have earned great importance within organizations, leading to an increase in the competition for the recruitment of top quality international managers (Hurn, 2014). If, on one hand, it is evident that the preparation of managers on how to handle the repatriation process has clearly failed (Osman-Gani & Hyder, 2008; Sussman 2001; Hurn, 2014), on the other hand, the human resources management department has an important role for the implementation of strategies that minimize this failure and keep managers in the company after their repatriation.

In addition to the preparation carried out by the human resources management department regarding what repatriates should expect when returning to their home country, this preparation should be undertaken in accordance with the gender of expatriated/repatriated manager as female top managers face greater difficulties throughout this whole process (Linehan & Scullion, 2002). The importance of the female repatriation process does not arise from the little attention that it has been given, but rather because it arises from the fight for gender equality in the highest hierarchical positions at corporate level. Moreover, a multicultural perspective is on high demand, especially involving female expatriates from developing nations where women play more traditional roles *vis-à-vis* male managers.

Emotional support provided throughout the whole process, and the preparation of the network of contacts from family and friends are matters that deserve further development. Third parties significantly influence the repatriate manager and are often responsible for whether they stay or leave the organization, depending on the preparation they must deal with the situation, or on the support provided by the organization itself. Also, repatriates with lower family stress levels present higher job satisfaction levels as well as better readjustment at work. Another interesting result is that repatriates who expressed a greater desire to return to their home country had better readjustment levels (Naito, 2016).

Expatriates with more appropriate expectations regarding leisure time have higher readjustment levels. It is concluded that repatriates who value time and the family that accompany them in the expatriation process report spending more time with family during the experience abroad than upon their return. This

is because there are usually more daily tasks in the home country, which means less spare time to spend with family than during the experience abroad. This situation often leads to negative return experiences (Van Gorp et al., 2017).

CONCLUSION

The starting point of this section was based in two research questions. Regarding the first question (Why the process of expatriation is regarded as more relevant than the repatriation process?), one can put forward three different reasons. Firstly, organizations address the repatriation process simply as the final stage of the expatriation process, instead of perceiving them as two separate, different and complex processes. And, in today's world, organizations need to look at the different stages of international assignments and distinguish how to manage each one. Secondly, companies are still very focused on work submitted during the expatriation process and that allows them to achieve the desired results, neglecting the adaptation needs of repatriate managers and their contribution to the future of the company. Thirdly, organizations focus a lot more in the results from the expatriation process than in the aspects that influence them. Since the repatriation process is far more connected to influencing factors (personal factors, such as a manager wanting to go back home; external factors, such as the adjustment to the country's culture; and organizational factors, such as the integration of the skills acquired by the repatriate manager within the company's business) than to organizational results, companies often undervalue the analysis of the repatriation process.

Considering the second research question (What do MNEs need to improve to assure a good repatriation process?), it is possible to put forward the following four dimensions to effectively assess the repatriation process: feedback of the manager, network of contacts, human resources management and organization.

Firstly, regarding the feedback of the manager, it is necessary to introduce an analysis of the repatriation of the manager, with respect to their presence abroad and the monitoring of the manager for a certain period of time following their return. This feedback must be as complete and elaborate as possible, so that organizations are able to increase the success of the repatriation process. Thus, companies have to manage future work expectations of the expatriate and repatriate managers, as well as the supports that they would like to receive upon their return. Such feedback should combine personal expectations of repatriate managers with the expectations of the organization, leading to cooperation between them so that neither of the parties feels unsupported.

Secondly, regarding the network of contacts consisting of friends, colleagues, and family of the managers, it is important that organizations promote the existence of contacts between the repatriate and their emotional support systems. For that, organizations need to be prepared to explore this network of contacts in order to help repatriates in their integration. These networks should be created before the international assignment and be kept during and after the experience to accompany the individual and the choices he/she makes overtime.

Thirdly, organizations need to prepare managers for their future roles/positions so that they can have real expectations regarding their future careers. Another issue worth considering is the fact that repatriate managers fear they will lose their workplace when they return, since it is taken by another element of the organization during the expatriation. Besides being afraid of losing their workplace, managers also feel that, when they return, organizations give them jobs with fewer responsibilities, thereby reducing the challenges that motivate them. This claimed reduction may make them choose careers in competing companies, that benefit from the skills and competencies they acquired abroad, in order to create

and achieve new competitive advantages. It is important for organizations to understand that they can achieve a favorable position compared with competitors due to what repatriates learned during expatriation. Repatriates' feelings of importance and loyalty to the organization increase, since they do not feel like they are being set aside. In connection with this approach, colleagues are a fundamental factor for the reintegration of repatriate managers. If, on one hand, they can help create a family-like environment for managers, on the other hand, they can also leave them behind due to the lack of contact during the expatriation process, thereby increasing the odds of having managers leave the company.

Lastly, the human resources department plays the main role regarding the management of this whole process within the organization. Thus, the human resources department should be duly informed about the feelings of repatriate managers, their future career expectations, and the support they expect to receive from the organization. In short, this department will put all that has been said into action. We consider the development of mentoring programs extremely interesting, providing managers with organizational support throughout the whole process.

In a world of developing change and internationalization processes, and by analyzing some of the literature regarding the repatriation of managers, it is possible to understand that organizations need to train specialists who focus on repatriation in order to increase and improve their human resources and not lose important assets to the competition after they return from an expatriation service. Organizations who wish to compete in a global world must begin to understand that repatriation and expatriation processes are not part of an isolated process, but rather interdependent processes that, in order to succeed, require the analysis of the different stages associated therein and meeting their different needs. Organizations aside, it is also necessary to undertake more research on this topic at an academic level, especially in what concerns the process of repatriation of managers, since this field has the highest dropout rate in organizations.

FUTURE RESEARCH DIRECTIONS

Our first suggestion is to investigate the aspects that influence the repatriation process within the managers' context, considering cultural, organizational, family and personal aspects. If domestic culture is important in international businesses, it is important to know how ethnocentric or geocentric-oriented structures can compromise the repatriation of managers. Likewise, organizational culture may have some influence in the expatriation and repatriation of managers, which proves the need to explore this perspective in the future. Complementarily, if family and personal aspects are important, it is necessary to investigate the extent to which they uphold solely the managers' experience within the organizations or are more influential in the repatriation process, and the extent to which they complement organizational measures.

It is equally important to explore gender issues in the repatriation process, since they affect women and men differently. These situations are important since it would be useful to analyze how expatriation to countries with cultural and religious standards that are similar to the host country can influence the repatriation of female managers.

Since the network of contacts of the expatriate manager is a key element in the repatriation process, future research should be expanded mainly to family, friends, and colleagues in order to better understand their opinion regarding the entire repatriation process. Although this network of contacts is not able to solve internal matters of the organization, it is important to know how it eases the repatriation of managers. Lastly, it is relevant to analyze repatriation from the point of view of the parent company and the company where the expatriation was carried out, recognizing the role each of them plays in the

repatriation process, which can be revealing regarding the relation between attachment and organizational success concerning two independent yet interconnected entities.

If expatriation/repatriation has been analyzed among MNEs, it would be of added value to analyze how smaller firms address these unique processes as the globalization process brought about new forms of expansion among SMEs as is the case of born global firms and new international ventures that demand a rapid internationalization process. As such, the study of expatriation and repatriation among SMEs can bring new light to the repatriation phenomena, as can involve high tech small firms as well as family firms, which have been extensively ignored.

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KEY TERMS AND DEFINITIONS

Company-Assigned Expatriates: Are individuals expatriated through the organizations they represent and for which they will perform a particular function outside their country of origin. Normally, their assignments are clearly defined in terms of managerial tasks to be performed abroad and time horizon of the assignment.

Expatriate: A person who lives outside her/his native country. Is an individual/manager that is transferred from one country to another one during a period that may last for three years.

Expatriation: The process by which an individual/manager is transferred from one country to another to exercise corporate responsibilities.

International Charter: Formal document or instrument that creates a legal entity or privilege. In case of an organization, or multinational company, a charter defines or mandates its function(s) and lays down rules for its conduct or governance. Certain multinational companies mandate an expatriate to exercise/lead the company in a certain country/region.

Repatriates: It is the individual/manager that returns to the home organization after a mandate abroad.

Repatriation: It is normally the inverse process of expatriation. It corresponds to the first job of an individual/manager after returning from an international assignment, that normally does not last more than two years.

Maturity Models in Healthcare IS/IT Investments: Challenges and Trends

12

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INTRODUCTION

Healthcare systems play an important role in the European Union and are key to achieving stronger growth and creating highly qualified jobs in a dynamic knowledge-based economy. Improving the health of the population is the defining goal of healthcare systems. The performance of the health systems should therefore be viewed primarily from the perspective of how to improve the overall average level of population health and reduce inequalities in healthcare. The major evolution that is underway in healthcare is mainly driven by demographic changes, which included the increase of the aging population, chronic diseases, cultural changes, progress in sciences and technologies and the recognition of the need for greatly improved quality and safety in the delivery of healthcare. The exponential increase in computer capabilities, the broadening of the reach of the Internet, and the increasing ability to capture and make available the knowledge in a digital form constitute the main technological bases for the electronic conduction of current health care. Information Systems and Information Technology (IS/IT) are providing important opportunities for health stakeholders, providing services as well as ways of accessing information that consumers need. IS/IT are spread and adopted worldwide and used in many sectors, including the health sector.

According to several studies, there is a growing use of IS/IT by citizens and their families regarding the search for health information (Andreassen, 2007; Fox, 2011). Essentially, the purpose of investment in IS/IT is to improve the operational efficiency the organizations, reducing costs and improving levels of performance. Organizations in almost every industry rely on investments in IS/IT to realize benefits after their successful implementation (Gomes and Romão 2015).

The move toward computer information systems began from the 1970s that ultimate goal of these systems is access to Electronic Health Record (EHR) (Shortliffe and Baenett, 2014). EHR implementation results in the improved quality of care, cost effectiveness, customer-orientation and timely access to complete and precise information (Gagnon, 2014; Oderkirk, 2017). Despite the potential benefits of EHR, its implementation is a difficult and complex task whose success and productivity depends on many factors (Yusof et al., 2008; Terry et al., 2008).

The use of IS/IT provides an important support for specialized services, increasing efficiency, quality, safety, and reducing medical errors (Low and Chen, 2012). Despite remarkable technical progress,

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failures have still been reported when integrating technically sound systems into processes of healthcare (Lorenzi and Riley, 2003).

Academic literature has paid a considerable attention to the concept of MM (e.g. Crawford, 2002; Kerzner, 2005; Kwak and Ibbs, 2002; Pennypacker and Grant, 2003). MM have become an essential tool in assessing organizations' current capabilities and helping them to implement change and improvement in a structured way (Jia et al., 2011). Maturity model is a set of characteristics, attributes, indicators, or patterns that represent progression and achievement in a specific domain or discipline (Caralli et al., 2012). The purpose of the MM is to provide a framework for improving an organization's business result by assessing the strengths and weaknesses, enabling comparisons with similar organizations (Combe, 1998; Gomes and Romão 2014; Hartman, 1997; Ibbs and Kwak, 2000; Hillson, 2001). Organizations can use MM to compare their capabilities with the recommended *best practices* for the sector, identifying areas for improvement and development (Jugdev and Thomas, 2002). The proposition behind most MM is that organizations develop capabilities by achieving each level of capability in a sequence across a range of capability dimensions (Crawford, 2006). MM in IS/IT are understood as tools that facilitate internal and/or external benchmarking while also showcasing future improvement and providing guidelines through the evolutionary process of organizational development and growth (Mettler et al., 2010).

BACKGROUND

Maturity Models for IS/IT Investments

Overall, MM reflect the characteristics of an organization as they move through different stages in a change cycle, providing conceptual guidelines on essential requirements and components at each stage, including key success drivers and indicators (Duffy, 2001; Kim and Grant, 2010). Proper management of human resources is critical in providing a high quality of health care (Kabene et al., 2006). MM provide to health professionals, managers and organizations with an important framework for identifying the capability status of an IS/IT, and to plan and implement actions that allow them to advance to a higher maturity stage and thus achieve the proposed objectives. MM are a means to support effective management and continuous improvement for initiatives that are complex and have multiple components (Ahern et al., 2003; Crawford, 2006). A hospital with mature IS/IT infrastructure can reflect higher degree of IS/IT planning and control processes (Liu et al., 2011). Health care institutions and governmental organizations are starting to understand that the reasons underlying a certain inadequacy in the management of health processes directly relates to infrastructural limitations and their inefficient management (Sharma, 2008). Several models have been developed to help assess or describe the current level of IS/IT adoption in the healthcare sector (e.g. HIMSS Analytics Electronic Medical Record Adoption Model, Electronic Healthcare Maturity Model or Interoperability Maturity Model). These are useful benchmarks when looking at patient information systems. Many studies in IS/IT have indicated that system integration is another important challenge for the development of IS/IT within healthcare organizations (Grimson et al., 2000; Hasselbring, 2000). Several standards have been developed to cope with the problem of interoperability and integration for healthcare providers, particularly regarding the exchange of data between health organizations (Liu et al., 2011). Their ability to interoperate will significantly influence their capability to deliver safe, reliable, efficient and convenient healthcare services (NeHTA, 2007). The value of a generic methodology like the MM lies on the ability to develop a model which is char-

acterized by a high generalizability and standardization, rather than in a specific stage-model (De Bruin and Rosemann, 2005).

CONVENIENT IDENTIFICATION OF STUDIES

Capability maturity models guide organizations in continuous process improvement, ensuring increasing levels of capability delivery to fully realize their business objectives. The starting point for the follow up of this research work will be reviewed from the available literature in the field under study. The documental research is an essential step in any research project, to the extent that it provides the researcher a solid basis to make a knowledge progression. The research goals are:

- Identify the main MM adopted in Healthcare sector.
- Review the state of the art of the identified MM.
- Identify the benefits and the limitations of the MM.

The process selected a set of 10 MM that match with the objectives of the present paper.

Capability Maturity Model Integration (CMMI)

CMMI is used to rate an organization's process maturity and have been broadly used for assessing organizational maturity and process capability worldwide (Zubrow, 2003). CMMI is a process improvement maturity model for the development of products and services, with its roots in software development. The model includes a self-assessment that presents the organization's best practices in key process areas (e.g. capabilities) and then shows how the organization can redefine its capabilities as it evolves into a more mature state (Paulk, 2009)

CMMI for Services (CMMI-SVC) extends the coverage of the CMMI Product Suite to cover the establishment, management, and delivery of services. The model focuses on activities for providing quality services to the customer and end users. It consists of best practices that address development and maintenance activities that cover the product lifecycle from conception through delivery and maintenance (CMMI-SVC, 2010). CMMI is available in two representations: staged or continuous. Each representation organizes process areas and the application of the generics to them differently. These two representations are really just different views into the same content.

Organizations that have adopted CMMI reported increased productivity and quality, improved cycle time, and more accurate and predictable schedules and budgets (Gibson 2006).

Strengths and Weaknesses

- Substantial reduction on systems integration with greater probability of success.
- Increasing focus and consistency in the requirements development and management
- Systems design and development
- Systems integration and risk management.
- Measurement and analysis.

CMMI-SVC is may not be suitable for every organization. Require additional resources and knowledge in smaller organizations to initiate CMMI-based process improvement, considerable amount of time and effort for implementation and a major shift in organizational culture and attitude.

HIMSS Analytics Electronic Medical Record Adoption Model (EMRAM)

The Electronic Medical Record (EMR) is a multifaceted, electronic patient records system and is often adopted in a model of hierarchical and increasingly complex stages (Smith et al., 2013). The model describes how data storage, transmission, decision support and communication gradually become facilitated by electronic means and available at point-of-care as long a clinic progresses through the stages.

Through EMR adoption, patient records become electronic and accessible across inpatient and outpatient environments, and healthcare practitioners can document, monitor, and manage healthcare more effectively (HIMSS, 2006).

HIMSS Analytics has created an EMR Adoption Model that identifies the levels of EMR capabilities ranging from the initial environment through a paperless EMR environment. The EMRAM is an international standard to measure Electronic Medical Records (EMR) Adoption and is used by over 9,000 hospitals across the globe. It incorporates a methodology and algorithms to automatically score hospitals relative to their EMR capabilities.

This eight-stage (0-7) model measures the adoption and utilization of the EMR functions (Garets and Davis, 2006).

Strengths and Weaknesses

Ability to benchmark against other health services, locally, nationally and internationally. Ability to adjust assessment scope to suit a particular health service. Improve quality and effectiveness. EMR implementation improves hospital competitiveness and the executive consensus on expected outcomes.

Hospitals with advanced EMRs report achieving a broad range of benefits from their implementations, including both clinical quality, patient safety and operational efficiencies.

Evaluation does not include interconnections of patient data from the various modules. Organisations can have part of the adoption model in place in one ward only and can pass EMRAM stage. Does not discriminate if stages are implemented out of order. Potentially this could be problematic for speciality services. EMRAM does not assess: The time to perform a particular task, ease of use, productivity, ROI – Cost, physician satisfaction, number of key strokes, time to execute a set of instructions, training efficacy and impact and the number of screens visited to complete a specific workflow scenario.

Electronic Healthcare Maturity Model (eHMM)

The eHMM defines an electronically mature organization as:

- Having an organization-wide ability for managing healthcare quality and cost-effectiveness.
- Consistent and reliable healthcare processes.
- Improvements developed through controlled pilot-tests and/or cost-benefit analysis.
- Managers monitor the quality of the healthcare product and customer satisfaction.

The eHMM illustrates a transformation of the healthcare enterprise electronic process from an immature level to a national state and provides the following benefits (Sharma, 2008):

- A reference model that can be used to define business capabilities associated with business processes.
- A guidebook for hospitals, associated service providers, regional healthcare bodies and governments in the development of e-Healthcare capabilities.
- Providing a framework for a common definition of each level and model qualities for traceability of progression.
- Adjusting the business capabilities and maintain alignment with the mission and goals.

For eHMM maturity moves from an immature stage, with no implementation at local levels, to a national stage, with full implementation across all players and levels within the health care system.

Strengths and Weaknesses

Serves as a guidebook for hospitals, associated service providers, regional healthcare bodies and governments in the development of eHealthcare capabilities. Provides the framework for a common definition of each level and model qualities for traceability of progression. Provides consistency for baselining. Healthcare constituents can use the eHMM to adjust the business capabilities and maintain alignment with the mission and goals. eHMM can empower sustainable development and productivity for cooperative healthcare operations. At the highest level of maturity (Level 7 – National Level), the benefits extend to all four core constituents of the process - Patients, Doctors, Hospitals and Government.

IDC MaturityScapes (IDC-MS)

The IDC MaturityScape examines a technology area or a technology process using a five-stage maturity model, with detailed descriptions of each of the five stages (ad hoc, opportunistic, repeatable, managed, and optimized). The five stages are described within three to five overarching dimensions and their more detailed subdimensions. Further, the IDC-MS describes areas of challenge in the given technology area and provides essential guidance for progressing from one stage to the next.

IDC-MS are designed to be used assuming change in the IT ecosystem - as a result of new technological advances, the maturation of existing technology use, or the integration of technologies, like social and mobile applications, that were previously considered to be separate platforms (e.g. Holland et al. 2008). The IDC-MS framework incorporates all levels of models, aligned to all kinds of IT functions and services. It is not a one-size-fits-all approach but recognizes that IT managers can benefit from a similar methodology that has many ends uses (IDC, 2016).

IDC-MS uses a “second dimension”. Each model is built around several dimensions. These are specific attributes of the model that must be addressed to improve performance and achieve excellence. The dimensions of the maturity model are often associated with issues that arise from having to implement change to people, technology, and processes, but they can be even more specific. IDC-MS can be used in the following ways (IDC, 2016):

- As a simple-to-use methodology to enable the alignment of the business value goals with IT strategy.

- As a tool to identify where investments in people, process, and technology may or may not be consistent with what the business requires.
- As an input to a variety of business-IT dashboards that monitor and measure IT capabilities against changing of best practices.
- As a roadmap for overall improvement of IT processes, communications, and business integration.

Strengths and Weaknesses

Identifies the business benefits that providers can realize in each of the stages and guides the envisioning and developing the next-generation systems that leverage key emerging technologies, including big data and analytics, mobile, and social. Addresses the key changes that must occur in people, process, and technology, expanded as eight core measures — IT roles, business roles, vendor management, service management, architecture, security and integration, infrastructure and software. Shows that each stage requires increasing investment and increasing value. It will not always be advantageous or feasible for a given organization to progress to the optimized stage, but the document enables executives to begin to lay out the business case for deciding where, why, and how much to focus on increasing maturity in a particular area of technology or technology governance.

Continuity of Care Maturity Model (CCMM)

What is “Continuity of Care”?

Citizens’ perspective - Non-disruption of care provided to a patient throughout his/her care journey, across care settings and care givers.

Industry perspective - Alignment of healthcare resources across care settings orchestrated in a way that delivers the best healthcare services and value possible for a defined population under your care.

CCMM is a strategic framework to guide continuity of care implementations. Continuity between care settings are increasingly crucial to clinical and financial success. HIMSS Analytics created the international oriented Continuity of Care Maturity Model (CCMM) to promote coordinated care across the continuum of care served by a health provider or the responsibility of a health authority. With these eight stages (0-7) model, a healthcare unit can measure and understand its ability to provide continuity of care across types, settings and populations. With CCMM one can manage with a clear strategy for coordinated care, measuring and understanding the ability to provide continuity of care across care types, settings, and populations (CCMM, 2017). CCMM is a model that demonstrates the evolution of communication between clinicians in different settings with limited or no electronic communication to an advanced, multiorganizational, knowledge driven community of care.

Strengths and Weaknesses

A multidimensional maturity model promoting the key factors of continuity of care.

- Define scope and contract - Understand overall needs, breadth and depth of engagement, prepare and sign contract for engagement.
- Identify population and care settings - Profiling “care community” of patients and what care settings are we looking at primary care, acute, urgent care, long term care, home care.

- Survey – On-site survey, discussion with leadership teams for each care setting, survey questions completed.
- Findings review and presentation – Review findings results.

In order to make significant progress to improve continuity of care, it is recommended that the “client” pursue tighter relationships with organizations that control other care settings, and these relationships must foster health information exchange, shared best practice care plans, as well as care team communication and coordination. Governance stakeholders pave the way for information technology stakeholders and their associated capabilities which are the foundation for clinical stakeholders to facilitate coordinated care.

Interoperability Maturity Model (IMM)

This MM leverages a generic and widely used Capability Maturity Model Integration (CMMI) approach as a reference model for expressing levels of e-health organization capability on their path towards delivering better interoperability outcomes. Each capability level represents a process improvement, referred to as an organizational maturity level. Consequently, each maturity level requires attaining the previous maturity levels, while incrementally adding new capability and bringing new benefits. There are five maturity levels identified, namely, Initial, Managed, Defined, Measured and Optimized.

IMM identifies several interoperability goals, classified in terms of organizational, information and technical perspectives. These goals were identified through analyzing interoperability in the context of the national e-health community as well as other IS/IT domains. Effectively, the IMM provides a set of guidelines for setting organizational process improvement goals in delivery of interoperable e-health solutions and a point of reference for appraising an e-health organization’s interoperability through the respective interoperability systems or work products.

Strengths and Weaknesses

The use of IMM delivers several benefits to e-health organizations (NeHTA, 2007):

- Provides a managed and repeatable approach for guiding organizations in incrementally improving their interoperability.
- Allows e-health organizations to use it in combination with various benefit realization approaches so optimum interoperability adoption targets can be selected based on the relative importance of each interoperability goal in the context of organizational requirements
- Identifies which activities, processes and efforts are required by an organization when a certain maturity level has been attained and future levels are desired.
- Allows benefit flow-on from interoperability learning within community and organizations scopes.

It is important to note that interoperability always involves two or more entities, engaged in some form of interaction, whether supported by a business or technical transaction. Further, entity interoperability can be considered from different perspectives (organisational, information and technical) and from different domains that define a context for interoperability (community, enterprise and local).

Business Process Orientation Maturity Model (BPO-MM)

The BPO-MM was developed to measure the process orientation maturity of employees within a large hospital facility (Gemmel et al., 2007). The BPO-MM measurement tool provides hospitals with a means to evaluate their involvement towards process orientation maturity. The BPO-MM construct describes a four-step pathway for systematically advancing business processes along the maturity continuum (Ad hoc, defined, linked, and integrated level). Each step builds on the work of the previous steps to apply improvement strategies that are appropriate to the current maturity level (Škrinjar et al., 2007). BPO construct is composed of the following individual dimensions:

- Process view - involves a focus on the workflows and processes across the organization.
- Process jobs - functional roles and titles reflecting the traditional hierarchical structure are replaced by process owners – leaders who are responsible and accountable for the operation and improvement of the core.
- Process management and measurement - is as much to do with changing the culture and the way of thinking, as it is to do with changing the organizational structure. It is this most fundamental aspect of the transition that most of organizations have failed to appreciate.

Strengths and Weaknesses

- People are allowed to specialize within their field of expertise.
- Lower costs from centralizing various functions.
- Everyone know where they belong and which tasks they are supposed to perform.
- Well-defined structure.

Mapping of the healthcare-specific processes to the MM process areas was the most challenging yet critical step of the assessment. These challenges are mainly related to domains specificity and to the skills and resources required (Tarhan et al., 2015).

Process Management Maturity Model (PMMM)

A lack of consensus regarding the capabilities and development stages of hospitals required to become process-oriented. Successful process management within hospital settings require a much stronger focus on both cultural and structural capability areas than it does in other organizations, where the focus is rather on IT-support and process automation (Liu et al., 2011). The conceptual basis for the PMMM consists of five capability dimensions, including: Culture, strategy, structure, practices and IT. The stages of PMMM are the following (Paulk et al., 1993):

- Performed - The project management (PM) process is largely reactive in nature with no control mechanisms and as such are unpredictable
- Managed - The PM process has defined structure but again is largely reactive
- Defined - The PM process is well defined and is proactively engaged
- Quantitatively Managed - The defined process is proactively engaged and there are measurement techniques applied to establish effectiveness giving control
- Optimized - The entire PM process is fully engaged and integrated with the business strategy and

- process improvement of the organization.

Strengths and Weaknesses

There are several advantages to adopting the PMMM, and they include:

- Understanding the activities that launch and sustain a process improvement program.
- Characterizing the maturity of an organization's existing processes and identifying strengths and weaknesses.
- Identifying critical issues for improving their processes, products, and services, and guiding them in defining and improving their processes.
- Selecting qualified suppliers and monitoring the performance of suppliers. and
- Introducing process improvements in stages.

Many organizations can find these models complicated and difficult to implement. One of the biggest hurdles is found when evaluating process maturity is the process maturity gap or process management gap. In essence, organizations are often difficulty to make the transition between maturity levels. This occurs because an organization has failed to garner the senior management support required to move processes to an enterprise-wide concern

NHS Infrastructure Maturity Model (NIMM)

NIMM is an IT infrastructure maturity model developed by the National Health Service (NHS) Technology Office, together with several different NHS IT Organizations in the United Kingdom. The NIMM framework helps NHS IT organizations to carry out an objective assessment of their IT infrastructure to determine how developed specific IT services are, and to identify infrastructure maturity improvement projects.

The two main tools within the NIMM framework are the:

- Capability Assessment documents - That contains the key performance indicators (KPIs) that each capability is assessed against, resulting in a maturity score.
- Key Capabilities Self-Assessment spread sheet - This dashboard spread sheet records the scores from the Capability Assessments and gives an overview of assessment progress.

The NIMM framework is split into 13 categories, 74 capabilities, 5 perspectives and several KPIs, each of which is scored out of five. Not all capabilities have to be completed at once. Review the capability list, decide the priorities for your IT organization today and concentrate your efforts on completing this subset.

NHS Infrastructure Maturity Model provides guidance and helps trusts objectively benchmark for their "as-is" infrastructure capabilities, then is an important tool to:

- Build a plan for coordinated capability improvement in a systematic way.
- Set investment priorities and create a benefits plan to understand desired outcomes.
- Create infrastructure solutions that NHS needs in collaboration with NHS suppliers.

Strengths and Weaknesses

- Intuitive and easy to use IT management tool.
- Can be used in either Descriptive and/or Prescriptive modes.
- Provides the big picture - knowledge driven self-assessment approach, calibrated for the NHS.
- Technology & vendor independent, focus is on capabilities, standards and NHS needs.
- Holistic approach covering both the technology and management aspects of IT Infrastructure.

Informatics Capability Maturity Model (ICMM)

ICMM was developed as part of the Department of Health, Informatics Directorate's work to influence senior business leadership attitudes and behaviors towards informatics. The aim is to encourage leaders to develop organizations that:

- Appreciate the potential role of informatics in providing business advantage.
- Treat informatics as a strategic resource.
- Make informatics investments aligned with business strategy.
- Deliver informatics enabled change effectively to optimize the business value.

Informatics plays an integral role in an effective healthcare organization. It should be considered a strategic resource alongside finance, human resources and estates – and not viewed as a 'back office' function. Well planned informatics can help your organization:

- Provide quality information and analytics to inform business and clinical decision making.
- Streamline and automate processes and services.
- Provide safe and open access to information to educate, inform and empower patients and the public.

The ICMM is a qualitative self-assessment tool that will help you determine how capable or mature your organization is from an informatics perspective. Using the tool can help identify actions to improve your business performance enabled by informatics. ICMM evaluate the organizations through five different capability dimensions. For each capability dimension there are five associated levels of maturity, they range from 'basic' (least mature) to 'innovative' (most mature). ICMM is the required knowledge, skills and tools you need to get the right information, to the right person at the right time to improve health care and promote health. ICMM plays an integral role in an effective healthcare organization.

Strengths and Weaknesses

Well planned ICMM can help your organization in:

- Provide quality information and analytics to inform business and clinical decision making.
- Streamline and automate processes and services.
- Provide safe and open access to information to educate, inform and empower patients and the public.

- Improved customer service through leaner service processes supported by more timely and accessible information.
- Reduces cost by eliminating activities that do not support the current business strategy or policy direction.

DISCUSSION

It was found that the MM for healthcare IS/ITT are developed by different types of entities, including national and international healthcare companies, research organizations, as well as academic experts in this domain. It was also found that there are two main approaches in the MM to Healthcare. One, with highly specialized models that have resulted in a health subsystem and a second, with more comprehensive models (e.g. eHMM, IDC-MS, CCMM). It should be noted that not all maturity models identified with various dimensions or influence factors explicitly identify the characteristics of each stage of maturity.

In the case of the adoption of a tool to evaluate the maturity system, it is verified that most of the models focus on the evaluation of the maturity of the system. Yet, not all have a properly systematized process to move to a higher level of maturity.

The study that none of the identified MM is broad enough to cover all areas and subsystems health organizations. Most of the MM has their roots in the CMM and the literature describes a specific MM developed for a specific domain. Although, several benefits appear to be common to all MM, including:

- Identifying areas of improvement, comparing best practices and enabling benchmarking.
- Improve productivity and patient outcomes by reducing duplication of effort.
- Increased information quality, sharing, security, reducing risk through effective information governance.
- Enables the corporate culture, processes, capabilities and competencies to be aligned to organizational strategy.
- Improves the infrastructure of change providing consistent frameworks and processes which are understood by all levels within the organization.
- Increased realization of business benefits aligned with strategic objectives.
- Increases the capacity and capability of the organization to deal with complex and or multiple change programmes.
- Improves organizational readiness for change by understanding current capacity and capability within the workforce.

Following we summarize the main features of the MM approaches (Table 1).

FUTURE RESEARCH DIRECTIONS

Today's digital technology plays a significant role, permitting the storage and rapid retrieval of patient records and other important information. At the same time, patients expect their sensitive personal information to be handled appropriately, to ensure accuracy and confidentiality (Hall, 2014). Privacy and security are big concerns for a hospital's network infrastructure. Implementing security systems to prevent data breaches and leaks, keep patient health information secure, and managing the secure transmission of electronic medical record data are all major issues in the industry. Management must continue addressing ethical and legal issues about control of information.

Table 1. Main characteristics of maturity models for Healthcare

Capability Maturity Model Integration for Services (CMMI - SVC)
Focus: Improving processes for developing better products and services. Main characteristics: Contains practices that cover work management, process management, service establishment, service delivery and support, and supporting processes and focus its efforts around three core strategies: Satisfying providers, improving the service is delivered, and increasing the availability of information to guide decision-making. Levels: CMMI-SVC offers 5 maturity levels in the staged representation.
HIMSS Analytics Electronic Medical Record Adoption Model (EMRAM)
Focus: A progressively sophisticated roadmap enabling quality, safety, and operational efficiency for healthcare providers. Main characteristics: The EMRAM incorporates methodology and algorithms to automatically score hospitals around the world relative to their Electronic Medical Records (EMR) capabilities. Offer a tailor-made service, tied to the digitisation of health and care delivery, collecting and analysing data and turning them into actionable results. Include classic benchmarking, custom health information technology research, as well as advisory services for regional or national health authorities. Levels: The eight-stage (0-7) that measures the adoption and utilization of EMR functions required to achieve a near paperless environment that harnesses technology to support optimized patient care.
Electronic Healthcare Maturity Model (eHMM)
Focus: The eHMM provides a reference model to define business capabilities associated with business processes. Main characteristics: eHMM provides the framework for a common definition of each level and model qualities for traceability of progression. eHMM adjust the business capabilities and maintain alignment with the mission and goals. Levels: 7-level maturity model.
IDC MaturityScapes (IDC-MS)
Focus: Guide organizations progressively in the significant changes to be made to best-known practices. Main characteristics: The IDC-MS provide a snapshot in time of the results that can be expected at each significant stage along the way. Because the model has multiple dimensions, it is possible to view progress from different angles. Levels: IDC-MS follow a five-stage format.
Continuity of Care Maturity Model (CCMM)
Focus: Non-disruption of care provided to a patient throughout his/her care journey, across care settings and care givers. Alignment of healthcare resources across care settings orchestrated in a way that delivers the best healthcare services and value possible for a defined population under your care Main characteristics: A multidimensional maturity model promoting the key tenants of continuity of care: Effective HIE, coordinated patient care, advance analytics and patient engagement. Levels: The CCMM provide an eight-stage (0-7) assessment
Interoperability Maturity Model (IMM)
Focus: Helping e-health organisations improve their ability to use or deliver interoperable e-health systems, with the goal of increased healthcare benefits. Main characteristics: The IMM consists of three main components: 5 maturity levels; A set of interoperability goals, based on e-health and IS/IT requirements and an assessment framework. Levels: Five maturity levels inspired by the widely used CMMI framework
Business Process Orientation Maturity Model (BPO-MM)
Focus: The BPO-MM describes the pathway for systematically advancing business processes along the maturity continuum. Main characteristics: BPO-MM defined three basic components: • Process view - The care processes are defined, documented with the input of the patient. • Process jobs - The employee's job is multidimensional, includes frequent problem solving and constantly learns new things on the job. • Process management and measurement –The efficiency and effectiveness of the care processes is measured, and the results used to change the care processes. Levels: four maturity steps (ad hoc, defined, linked, and integrated level).
Process management maturity model (PMMM)
Focus: PMMM in healthcare focus mainly on the cultural and structural capability areas rather on IT-support or process automation. Main characteristics: The relevant elements are: Capability dimensions and maturity stages. Levels: A full maturation path of 5 stages.
NHS Infrastructure Maturity Model (NIMM)
Focus: Helping NHS IT organisations to carry out an objective assessment of their IT infrastructure and to identify infrastructure maturity improvement projects. Main characteristics: NIMM presents two main tools: Capability Assessment documents - contain KPIs to assess each capability and Key Capabilities Self-Assessment - a dashboard that records the scores from the capability assessments and gives an overview of progress. Levels: 5 maturity levels through changes in behaviour, culture and attitudes.
Informatics Capability Maturity Model (ICMM)
Focus: Helping healthcare leaders assess the role informatics plays in their organisation to deliver business value. Main characteristics: Evaluation of five key areas of your business: Managing information, using business intelligence, using information technology, aligning business and informatics, managing change. Levels: Each area has five levels of maturity ranging from basic to innovative.

IS/IT processes have the potential to significantly reduce the rate of these medical errors by providing relevant information in real time to all who need it (Bates et al., 2001; Chaudhry et al., 2006). Healthcare organizations require interdisciplinary cooperation and coordination. It needs to be highlighted that insufficient communication and missing information are among the major issues that have contributed to unintentional injury caused by medical mismanagement (Lenz and Reichert, 2007).

An important challenge for the future is to seek for a real clinical integration of systems. Clinical integration between providers and hospitals has historically been a goal which is continually sought, but rarely achieved. It will become crucial that the design of future applications be integrated easier into existing systems, through open communication interface (Geissbuhler et al., 2001).

CONCLUSION

The IS/IT has been recognized as an essential tool in transforming healthcare to control costs, improving the efficiency, quality, and safety of medical care delivery. The IS/IT implementations are part of the continuous quality improvement of healthcare and there are three key success factors in a robust IS/IT implementation: Reliable information, engagement of all stakeholders and proper infrastructure involving multidisciplinary teams.

In this article, we present the results of a research on the current state of the art of MM in the health sector. The results present a comparison between the different models, their main characteristics, areas of application, benefits and limitations. In general, MM provide an assessment framework that enables a healthcare organization to compare, for instance, its projects delivery with best practice criteria. The use of MM provides a framework for continuous improvement on the outcomes of IS/IT investments in many hospitals and other healthcare units. They drive strategically-linked continuous improvement and require a prior thorough understanding of an organization's current position and an idea of where it aims to be in the future.

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KEY TERMS AND DEFINITIONS

Electronic Health Record (EHR): A digital version of a patient's paper chart. EHRs are real-time, patient-centered records that make information available instantly and securely to authorized users.

HIMSS: Healthcare Information and Management Systems Society.

Information Systems and Information Technology (IS/IT): Any tool or framework that enhances the communication, processing or transmission of information by electronic means for improving human health.

Interoperability: Is a feature of IT that refers to the capacity and existence of diverse elements, health provider nodes, of the health care system to exchange and act upon shared information.

Knowledge-Technology Transfer: Processes by which relevant research information is made available for practice, planning, and policy-making through interactive engagement with audiences and supported by user-friendly materials and a communications strategy.

Maturity Models: A framework for improving an organization's business result by assessing the organization's strengths and weaknesses, enabling comparisons with similar organizations, and a measure of the correlation between organizations.

Patient-Centered Approach: Emerged as a primary approach to health care. This approach emphasizes partnerships in health between patients and healthcare professionals, acknowledges patients' preferences and values, promotes flexibility in the provision of health care and seeks to move beyond the traditional paternalistic approach to healthcare.

Impact of Employees' Empowerment on Perceived Quality of Service Delivery in the Tertiary Health Institutions

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INTRODUCTION

The tertiary healthcare institution, being the most sought-after acute care service providers, requires quality assurance in order to ensure that duties of care provided by health workers are safe, secured and not a detriment to the quality of life of people in a country (Al-Shdaifat, 2015; Agarwal & Singh, 2016). According to Haq and Ashraf (2015) and Yousef and Yousef (2017), the state of health of people in a country significantly determines the rate of economic growth and development. As the saying goes “Health is Wealth”, hence, improving quality of life of people through quality healthcare activities enhances their wellbeing and social wellness in contributing actively in business activities that promote national economic growth and development (Kumar, Bera & Chakraborty, 2018). However, the studies conducted by Ikorok, Akapbio and Ogunjimi (2012), Yaya, Asunmo, Abolarinwa and Onyenekwe (2015) and Ogbeide and Ejechi (2016) have revealed that employees of health organizations have failed in sustaining the standard of quality in service delivery. This unfortunate approach of the Nigeria health workers in sustaining the standard of quality in the sector has led to series of observed medical injuries, technical and man errors, and high morbidity and mortality rates in the country.

As a central channel to national growth, healthcare management is not limited to providing adequate treatment for care needs but also include quality assurance of continuous safety and effectiveness of service quality delivery processes in the sector (Ikorok et al., 2012). However, the Nigerian healthcare sector has faced diverse challenges limiting its ability in meeting over 200 million population healthcare needs, thereby, frustrating quality achievement of improved performance in the sector (Adeoti, 2011; Gbadeyan et al., 2017). Notably, insensitivity of hospital management in empowering healthcare workers with required training, quality healthcare facilities and motivation suitable in improving their performances is one major impediment restraining quality of service delivery in the sector (Ikorok et al., 2012). As revealed by Ikorok et al. (2012), Ogbeide and Ejechi (2016), and Gbadeyan et al. (2017), inability of the healthcare service providers to access high quality healthcare resources in delivering their expected duty of care has undeniably increased morbidity and mortality rate in the Nigeria health sector. In the light of these challenges, there is a need to weigh the perceived quality of service delivery of the Nigerian healthcare employees in order to identify and understand factors responsible for poor quality performance in the sector at large. Notably, this is necessary as practitioners in the health sector are the mainstream of service quality delivery, and also, play the intermediary role between healthcare organizations and service users. Therefore, the specific objectives of this chapter are to; (i) evaluate the

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significant impact of employees' empowerment on perceived quality of service delivery in the tertiary health institution (ii) identify critical elements of quality of service delivery and their effects on quality assurance and performance of Nigerian healthcare workers, and (iii) develop constructive framework for workable solution in sustaining future relevance of quality assurance in the Nigerian healthcare sector. Notably, these identified objectives will be achieved through empirical qualitative literature review.

BACKGROUND

History of Healthcare Sector in Nigeria

Traditional medical care through the intervention of herbal mixture, administered by spiritual herbalists and specialists in bone-settings and mental care was the most effective healthcare services in Nigeria during the 16th and 17th century (Olayinka, 2017). Notably, the advent of the Christian missionaries in Nigeria led to the emergence and expansion of mission-owned hospitals that brought about the introduction of the western-like healthcare services prior to independence. At independence in 1960, numbers of hospitals built by Roman Catholic, Seventh Day Adventist, Baptist church, Anglican Church, and other orthodox churches outweighed numbers of government-owned hospitals at the ratio of 180 to 101 respectively (Ajoyi, 2010). The inversion of the Christian missionaries brought about the establishment of renowned mission-owned hospitals like Sacred Heart Hospital, Seventh Day Adventist Hospital, Church missionary Society, Baptist Hospital, and Wesley Guild Hospital in Abeokuta, Ilesha, Obosi, Ogbomoso, and Ile-Ife respectively (Ajoyi, 2010).

However, in the quest of pursuing the primary mission of soul evangelism in the country, the missionaries handed over management of these hospitals as mentioned above to the Nigerian government. Meanwhile, despite quality health facilities and standard of quality healthcare delivery left by the missionaries, Nigeria is still categorised as a developing country on the hierarchy of quality healthcare provision (Ajoyi, 2010; Yaya et al. 2015; Olayinka, 2017). As identified by Adeoti (2011), Abah and Ohimain (2011) Ikorok et al. (2012), and Olayinka (2017), decadence in the Nigerian healthcare sector since independence is highly associated with leadership insensitivity to continuous quality improvement, poor maintenance culture, and corruption, coupled with poor empowerment and engagement of health practitioners.

Employees' Empowerment

No business organization survives competitively without collective commitment and involvement of people in the business operational processes (Peiffer, et al, 2016). Hence, every employee plays a significant role in ensuring effective process management of operations through individual contribution to the production processes (Bose, 2018). As postulated by Johnson (2017) and Kumar et al. (2015), the primary aim of health institutions is to provide quality, reliable and safe healthcare services that promote quality of life and wellbeing of people. Providing these expected duties of care, therefore, requires an appreciation of quality management system that empowers health workers towards delivering a result-oriented quality of healthcare service (Pradhan, Kamlanabhan, Thulasiraj & Muraleedharan, 2014). More importantly, this makes the implementation of employees' empowerment a functional strategic measure in continuously improving productivity and performance of people providing the healthcare services (Demirkiran & Taskaya, 2016; Bose, 2018). Therefore, according to Mohapatral and Sundaray (2018),

employee empowerment is a 'long-term process of providing the tools, training and motivate the workers to perform at the optimum level' (p.59). From Islam (2016) perspective, employee empowerment is a managerial function that allows autonomy and self-reliance of employees in taking responsibilities instrumental in promoting their competencies in carrying out their expected tasks effectively. Similarly, as contributed by Rashed and Fekry (2015) and Olayinka (2017) empowering organizational workforce promotes job satisfaction and enhances their commitment to strategic corporate goals of the organization. As empowered employees are highly productive, committed to their assigned tasks and ready to take challenging roles and calculated risks that will improve their collective performance and enhance the competitive advantage of their organization.

From the perspective of the health sector, Pradhan et al. (2014) defined employees' empowerment as management functional activity that entails provision of quality healthcare facilities and other tangible and emotional resources required by the health workers. Meanwhile, this provision is suitable for enhancing effectiveness and proficiency in delivering their expected duty of care successfully. As further contributed by Elarabi and Johari (2014) and Nayak, Sahoo and Mohanty (2018), employees' empowerment is a strategic approach that boosts independence, confidence and capabilities of caregivers in delivering their duty of care compassionately and competently. In light of this, Olayinka (2017) and Bose (2018) posited that employees' empowerment is a managerial practice that enhances, enables and engages workers through adequate training, education and reward system (motivation) towards developing their skills and abilities in taking autonomy decision and responsibility. Therefore, this implies that ability of the health organization management team to delegate responsibilities, provide sufficient and adequate resources, and motivate performance through dynamic reward system will inevitably promote and improve workers' performance, productivity, quality of work-life, and commitment to quality assurance in all spheres of their services delivery. To this extent, Jalali and Shaemi (2015) and Mutiso (2017) postulated that effective management of employee' empowerment strategy directly enhances positive perception of workers in quality of service delivery in the healthcare sector.

Perceived Quality of Service Delivery

Quality of service or service quality is the mainstream of the service industry and an effective strategy in gaining a competitive edge in this 21st-century global marketplace (Arora & Narula, 2018). Meanwhile, taking advantage of this vast competitive and evolving global market demands commitment of service-based organizations to offer quality service(s) with great potential benefits suitable in meeting and exceeding stakeholders' expectations (Ghotbabadi, Baharun & Feiz, 2012; Baki & Peker, 2015). As identified by Yusof, Noorashid, Muis, Nazir and Sivabalan (2018), quality of service is characterised by its inherent nature of intangibility whose worth of quality cannot be separated from its content; hence, its measurability is relatively difficult. However, as postulated in the service quality theories propounded by Gronroos (1984), Parasuraman, Zeithaml and Bery (1985), Rust and Oliver (1994), and Dabhilkar, Thorpe and Rentz (1996), the inherent quality of service can be measured from the viewpoint of people using the services. According to Arora and Narula (2018), this is achievable by weighing individual perception on the expected quality of service delivery compared to actual service experienced; as redefined in Parasuraman's 'Expectation-Disconfirmation Model'.

As defined by Ismail and Yunan (2016), quality of service is an intangible offering in the service industry that can only be experienced and perceived once delivered, which is highly dependent on individual perception. Similarly, Agarwal and Singh (2016) defined it as economic offering that provides benefit of values to its users and has the tendency to influence positive change in behaviour of the user

after delivery. For instance, there is an expected healthcare outcome after the duty of care has been delivered, and this outcome has a significant influence in determining the quality of value attached to the service from both the service providers and users collectively (Meesala & Paul, 2018). This outcome, on the other hand, is measured based on the characteristics and benefits associated with the service experienced. Therefore, Baki and Peker (2015), Kamra, Singh and Kumar De, (2016), Peiffer, Story and Duffy (2016), Arora and Narula (2018) identified conformation to purpose, worth of value, gratification of customer satisfaction needs, market standardisation, convenience of service delivery, expertise of personnel, and safety use of services as significant characteristics that define service qualities in the healthcare sector in particular.

However, as identified in the work of Chan, Wong, Cheung and Lam (2018), it is worthy of note that perception is individualistic; hence, people weigh the quality of service consumed or delivered differently. Therefore, perceived quality of service delivery (PQSD) is an individual psychological view, opinion, feelings, discernment or judgement based on the conceived value attached to service delivered in comparison to the expected value to be delivered (Wickramasinghe & Perera, 2014; Nayak et al., 2018). Notably, this expected value underpins principles, ethics and code of conduct guiding the healthcare practices (Pradhan et al., 2014; Rashed & Fekry, 2015). Unlike other service-based sectors like banking, transportation, insurance, consulting, retailing, to mention but a few, where the quality of their services is weighed from the customers' point of view, quality of care-service provision is best measured from the perspective of both clients and employees of the health sector. Services provided in the tertiary health institutions are highly complex, sensitive and guided by fundamental principles which must be strictly adhered to (Rashed & Fekry, 2015). Whereas, failure to uphold fundamental ethics of the profession may trigger medical administration error and misconduct of health practitioners, which in turn poses a significant threat to the quality of life and wellbeing of people using the services (Yousef and Yousef, 2017). Therefore, perception of quality of service delivery is best valued and weighed from the viewpoint of professional personnel delivering the healthcare services, as their perception is highly objective (Rashed & Fekry, 2015; Roharjo, Guglielmetti, Pirtro & Toni, 2016).

FOCUS OF THE CHAPTER

Quality Assurance in Service Delivery of the Healthcare Sector

Health, according to Haq and Ashraf (2015) is defined as 'state of complete physical, mental and social wellbeing and not merely an absence of disease or infirmity that leads to the ability to lead a socially and economically productive life' (p. 426). Hence, its full potential is delivered through effective quality control, quality assurance and quality management of activities in the health sector (Haq & Ashraf, 2015; Kamra et al., 2016; Yousef & Yousef, 2017). As opined by Agarwal and Singh (2016), the concept of quality assurance cannot be overemphasised in the health sector. Quality assurance boosts reliance, confidence, and trust of service users in the safety of services provided by workers in the sector (Kristensen, Hammer, Bartels & Sunol, 2015; Ludwiczak, 2016). Quality assurance in the healthcare sector is a managerial approach in stimulating continuous improvement of quality and performance in accordance to professional ethics guiding duty of care delivery (Ikorok et al., 2012; Paraschivescu & Radu, 2015). In the same view, Haq and Ashraf (2015) contributed further that quality assurance is a fundamental element of total quality management (TQM) that promotes and guarantees continuous im-

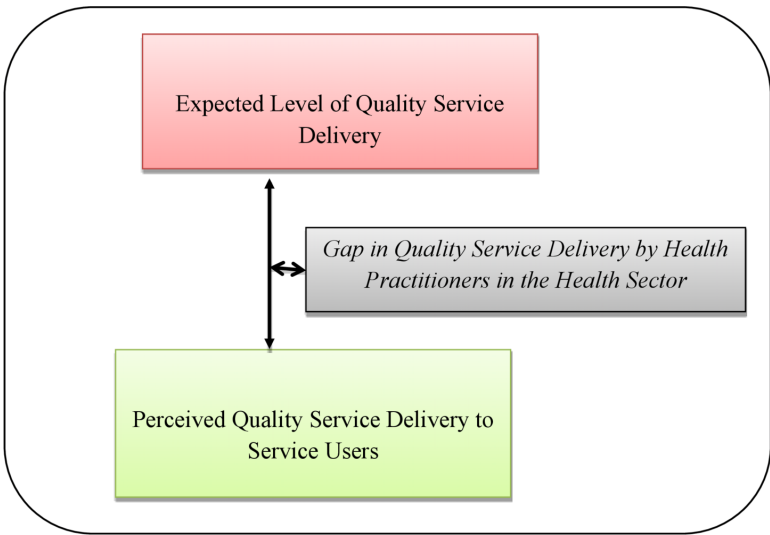
provement towards the achievement of quality in all facets of the healthcare system. More significantly, quality assurance ensures service delivery processes are safe, secured and not a detriment to quality life and wellness of people using the services, and also, protection of the environment where such services are being carried out (Arora and Narula, 2018).

As further contributed by Pradhan et al. (2014), Islam (2016), and Nayak et al. (2018), quality assurance promotes effectiveness, productivity and performance of health workers in delivering their expected duty of care compassionately in a way to increase the positive outcome of healthcare services in the sector. From the perspective of Paraschivescu and Radu (2015), assurance of quality in the health sector is best sustained when provisions of care services are affordable, accessible, timely and impactful on the quality of life of people using services provided in the sector. In the same vein, the Japan International Cooperation Agency (JIPA, 2016) added that in promoting quality performance of healthcare workers and improving their quality of service delivery through quality assurance, there is need to appreciate and implement the 5S-Kaizen-TQM model in all facets of operational processes. As 5S-Kaizen instils standard practice in accordance to the ethical code of the healthcare profession; where health practitioners are conscious of their duty of care and ensure maximum satisfaction of care users (Take et al., 2015). Furthermore, Al-Shdaifat (2015), Paraschivescu and Radu (2015), and Karma et al. (2016) opined that quality management concept of quality assurance strengthens and re-engineers both the internal and external aspects of the healthcare environment for optimal performance. Engagement of qualified health personnel; provision of state-of-the-art health facilities; prevention of epidemics outbreak, avoidance of medical errors, teamwork effectiveness, and maintenance of ethical practice fortify the internal quality environment. While on the other hand, effective management of the supply chain, serenity and safety of the hospital environment, and environmental protection in the collective interest of all stakeholders of the health sector sustain the external quality environment.

PQSD of Employees in the Tertiary Health Institutions

Every individual is guided by self-interest, experience and need, which influence individual decision and responsiveness differently (Georgantzas & Katsaamakas, 2016). As what one person perceives as morally right might be morally unfair to another. It is therefore difficult and complex to weigh perception generally due to factors surrounding its judgement (Chan et al., 2018). Some of these factors are culturally based and are influenced by personal background, experience, ethnical norms, religion, education, profession and inherent individualism (Grant, 2016). In the healthcare sector, perceptions are multi-dimensional from the viewpoint of different stakeholders. According to Chaabouni and Abednader (2014), there are different stakeholders in the health business environment however perceptions of (i) healthcare management, (ii) healthcare workers, and (iii) service users are considered relevant in measuring the effectiveness of service delivery in the sector. However, Pradhan et al. (2014), Rashed and Fekry (2015), Roharjo et al. (2016), and Gbedeyan et al. (2017) argued that perception of the health workers is the most significant in defining service quality in the care profession. As further emphasised by Elarabi and Johari (2014), Grant (2016), Bose (2018), and Olaoluwa and Essien (2018), the quality of workforce is the critical success factor of any performing business organization. This workforce is a group of people responsible for delivering expected service quality and relate directly to service users in the business environment. Therefore, weighing perception of this group of people is highly instrumental in identifying associated gaps that may likely impede the quality of service delivery in the health sector as illustrated in **Figure 1**.

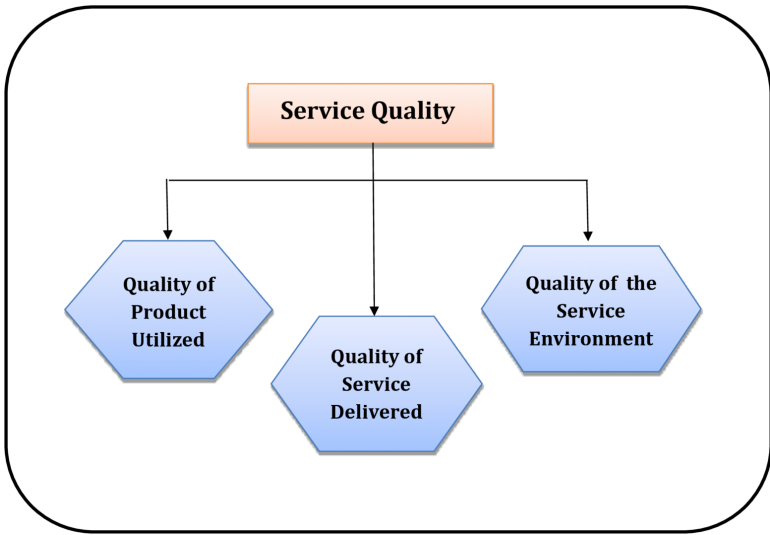
Figure 1.



Three-Component Model of Employees' PQSD in the Health Sector

From the extract of Three-Component model developed by Rust and Oliver (1994), key factors that define PQSD of healthcare workers are divided into three categories as illustrated in **Figure 2**;

Figure 2.



Quality of Product

Quality of product is the tangible and technical aspect of healthcare resources that can be seen, touched and easily evaluated by people using them. Availability of these resources in the right quantity with a

quality standard is highly significant in influencing the effective performance of caregivers while handling healthcare needs of people (Pradhan et al., 2014; Jalali & Shaemi, 2015; Mutiso, 2017; Yousef & Yousef, 2017). Failure to install and continuously provide adequate high-quality healthcare facilities has an adverse effect on impacting efficiency and competency of health workers in delivering their duty of care satisfactorily. The inability of employees in the sector to access required resources in carrying out their duty of care will undeniably trigger life-threatening incidents within the clinical ward. As contributed further by Ikorok et al. (2012) and Haq and Ashraf (2015), and Yousef and Yousef (2017), this may give rise to medical administration and technical errors, outbreak of epidemic, wrong diagnosis and administration of drugs, high morbidity and mortality rate, poor documentation and misplacement of patients' data, unsafe care practices, health risks and environmental injuries. Therefore, product quality of healthcare facilities, equipment, and other tangible resources like hygienic water, hand gloves, sanitizers, infusion pump, medical imaging machine, incubator, ventilator, electrocardiography, laboratory blood, urine and gene text equipment, to mention but a few, go a long way in building confidence, trust and reliability of health workers in delivery their expected duty of care in accordance to the ethical professional practice.

Quality of Service Delivery

Quality of service delivery is the pattern and process undertaken by caregivers in administering healthcare services towards improving the state of health of people using their services (Islam, 2016). More often than not, service quality is measured by the attitude, empathy, compassion, competence, commitment, and confidence demonstrated by healthcare service providers in delivery their duty of care (Elarabi & Johari, 2014; Mohapatral & Sundaray, 2018). However, these notable qualities can only be displayed when the health workers are consistently empowered with adequate training and development programmes in contemporary issues in the global healthcare profession. Similarly, motivating and rewarding health workers equitably and consistently improves their quality of service delivery and active commitment towards quick health recovery of service users (Ikorok et al., 2012; Mutiso, 2017). As acknowledged by Rashed and Fekry (2015), Amin, Wahid and Ismail (2016). Islam (2016), Olayinka (2017), and Meesala and Paul (2018), empowering employees in the health sector with contemporary skills in the sector, and also, rewarding them equitably will improve their job satisfaction, commitment and performance towards delivering exceptional duty of care with a positive impact on healthcare outcome.

Quality of the Physical Health Environment

What constitutes quality of physical health environment according to Rust and Oliver (1994) and Arora and Narula (2018) include but not limited to the structure, design, convenience, serenity, safety and security of the place where healthcare services are being carried out. Primarily, as opined by Haq and Ashraf (2015), safety, convenience and conduciveness of the healthcare environment boost psychological perception, reliance and confidence of service users in quality of service provided by the health organization. As this in turn, enhances the quality of service delivery by the caregivers (Rashed and Fekry, 2015). Therefore, it is axiomatic for management of health organization to ensure that the healthcare working environment is safe, conducive, and also, void of environmental hazard that may post significant threat to employees' perceived quality of service delivery.

Significant Impact of Employees' Empowerment on PQSD in the Nigerian Health Sector

Employees' empowerment serves as an instrumental tool suitable in building competency, effectiveness and efficiency of workers as a quality assurance long-term goal for future relevance in the health sector (Elarabi & Johari, 2014; Demirkiran & Taskaya, 2016). Therefore, as contributed by Jalali and Shaemi (2015), Islam (2016), Olayinka (2017), Bose (2018), and Nayak et al. (2018), hereunder listed are possible significant benefits of employees' empowerment in enhancing positive health workers' PQSD if effectively managed in the Nigerian healthcare sector;

- i. Quality performance of the health workers through the provision of quality healthcare facilities and resources will be significantly improved in a way that sustains quality assurance and standard in the sector.
- ii. Efficiency, effectiveness, and capability of workers in taking decisive decisions and responsibilities that meet current and future healthcare needs will be enhanced.
- iii. The outbreak of possible epidemic and hazardous impact on the environment will be significantly reduced; as health practitioners are conscious of their work environment and collectively promote the mandate of health and safety in the workplace.
- iv. Adverse effects of capital flight associated to people travelling out of the country for better medical care will be drastically reduced; as the quality of services in the public health sector is enhanced towards meeting care needs of its populace satisfactorily.
- v. It will increase competitiveness, productivity, profitability and standard of healthcare in Nigeria with comparison others across the globe.
- vi. Quality-oriented mandate of the value chain system from suppliers to the end-users will be highly sustained in ensuring facilities, equipment and other resources supplied meet required standard and expectations of the healthcare market.

Identified Factors Inhibiting Effective Employees' PQSD in the Nigerian Health Sector

As postulated by Wickramasinghe and Perera (2014) and Lasrado (2016), no business organization can successfully attain high level of quality assurance in its production line without direct effort and commitment of its human factor. Hence, they remain the most sensitive and typical element in achieving continuous improvement of quality performance in any sector of the economy. However, despite the quality value of employees in promoting quality of service delivery, workers in the Nigerian health sector have suffered series of challenges that have limited their maximum impact in sustaining standard of quality in the sector. Therefore, here identified are typical factors impeding the effectiveness of Nigeria health workers in successfully delivering their expected quality duty of care:

Weak leadership commitment: Insensitiveness of healthcare managers to effective implementation of quality assurance is a major inhibiting factor limiting the quality of service delivery by workers in the Nigerian public health sector (Abah & Ohimain, 2011; Yaya, et al., 2015; Olayinka, 2017). More significantly, as identified by Ogbeide and Ejechi (2016), the Nigerian public hospitals are characterised with an increasing rate of management-related challenges due to weak commitment in funding and providing required facilities necessary for effective delivery of service quality.

Poor quality of health facilities: Inability of employees in the Nigerian health sector to access quality and contemporary health facilities and other resources is another notable impediment in delivering result-oriented healthcare services (Gbadeyan et al., 2017). From the perspective of high rate of population, unemployment, poverty, and environmental pollution as prevalent in the country, adequate provision of standardized healthcare facilities is highly inevitable to meet and cater for the needs of people satisfactorily. Notably, due to the engagement of obsolete healthcare facilities and equipment in meeting care needs, the Nigerian tertiary health institutions are far becoming death traps to unsuspecting service users (Ikorok et al., 2012; Yaya et al., 2015). To a large extent, inadequate provision of required resources has impeded quality approach of health workers in promoting health and wellness of people using their services in Nigeria.

Poor Reward System: Many health workers in Nigeria are not adequately and equitably rewarded, hence leading to incessant industrial actions, high employee turnover rate, nonchalant attitude towards the wellbeing of patients, and uncoordinated professional behaviours (Yaya et al., 2015; Peiffer et al., 2016). According to Jaca and Psomas (2015), Madanat and Khasawneh (2017), and Prashanth (2017), unmotivated employees resist constructive change and frustrate performance outcome of their organizations. As acknowledged by Olayinka (2017), out of 71,740 certified and registered medical practitioners in Nigeria, only 37% practice their profession in the country, while the remaining 63% have migrated to another developed world where their services can be adequately rewarded. This healthcare worker migration has increased professional flight in the Nigeria medical practice, thereby reducing the availability of competent and resourceful health workers in the country (Osian, 2011; Ikorok et al., 2012; Yaya et al., 2015).

Lack of Regular Training and Development Programmes: Notably, as the world evolves, discovery of new diseases and sicknesses emerges; hence there is a need for regular and consistent training of the health workforce in meeting the emerging healthcare needs (Jalali & Shaemi, 2015; Islam, 2016; Gbadeyan et al., 2017). However, leadership failure in promoting quality of skills health workers in Nigeria through contemporary training and development programmes has undeniably weakened effectiveness of the medical practitioners in delivering the quality of care as required by their code of practice.

Bureaucratic Culture: Bureaucratic culture of the Nigerian public tertiary health institutions is another long-age factor limiting the effectiveness of workers in the sector. Notably, the increase in paper works and documentation has directly increased patients' waiting time and limited quick access to responsive quality healthcare (Chung & Yu, 2015; Take et al., 2015).

Interrupted Process Management: As posited by Ikorok et al. (2012), Yaya et al. (2015), and Olayinka (2017), management of the healthcare sector in Nigeria is characterised with frequent interruption in power and water supply, poor documentation and recording system, poor time management in handling emergencies, and insufficient healthcare workers to meet the unprecedented care needs of service users.

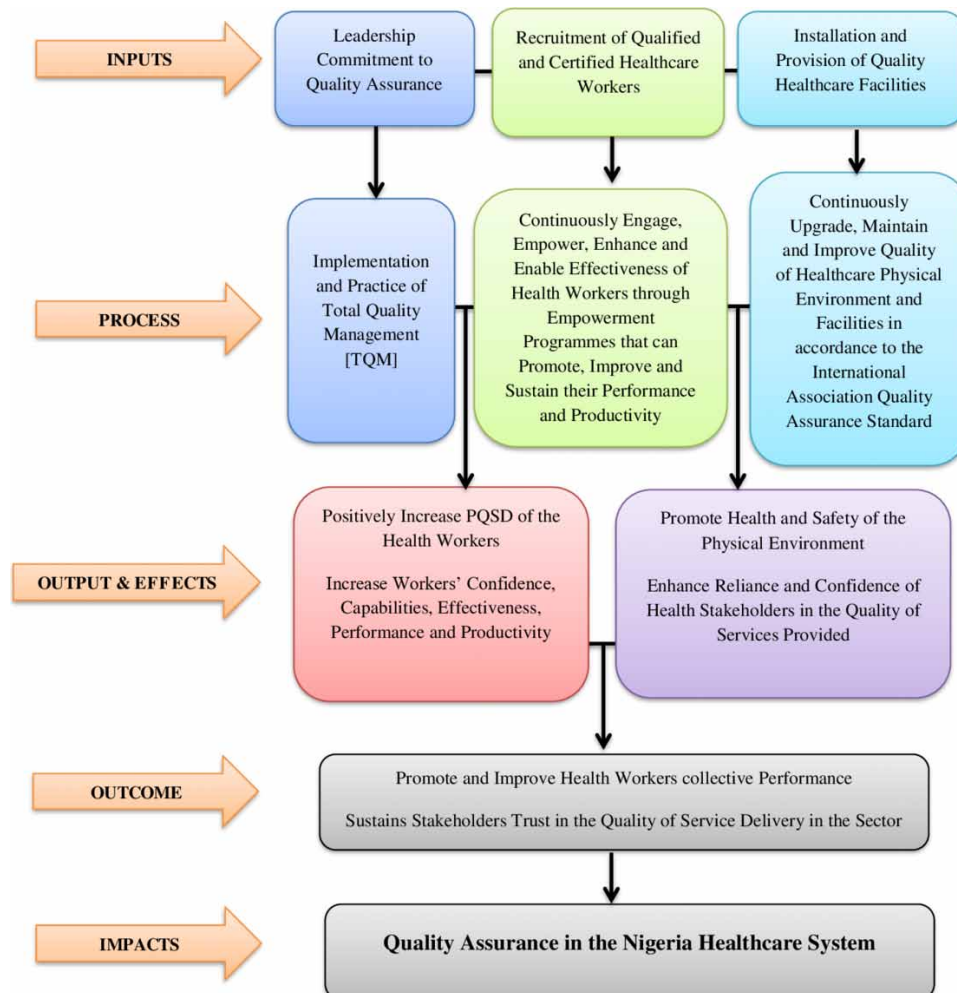
SOLUTIONS AND RECOMMENDATIONS

Prospects for Constructive Solutions in the Nigeria Health Sector

Based on the identified challenges impeding continuous improvement in the quality of service delivery in the Nigerian public health institutions through empirical literature review, there is a need for constructive framework development in sustaining relevance of the sector. The essence of this framework is to provide sustainable and achievable solution-oriented intervention for effective quality assurance

outcome in the collective interest of all stakeholders in the Nigeria health sector. Therefore, **Figure 3** presents constructive framework in providing goal-oriented solutions in sustaining future relevance of quality assurance in the Nigerian tertiary health institutions;

Figure 3.



Recommendations

In utilizing the constructive framework illustrated in Figure 3 effectively, here provided are recommendations as extracted from the reviewed literature that will enhance improvement of employees' empowerment and PQSD in promoting quality assurance in the Nigeria health sector;

- i. ***Uphold and Adhere to International Standards Guiding Quality Delivery of Healthcare Services:*** Healthcare profession is guided by series of standards that communicate expectations for how quality duty of care should be delivered; hence, these standards should be adhered to for optimum quality outcome.

- ii. ***Leadership Commitment to Quality Assurance:*** Since leadership is a principal-agent to effective implementation of TQM in the workplace, therefore, management of the Nigerian health organizations should be consciously committed to promoting an effectiveness of quality outcome in the sector. Commitment to quality assurance should be done through the installation and provision of adequate and resourceful healthcare facilities that promote and improve performances. Also, an effective management control system for the continuous improvement of health workers should be installed. This can be achieved by collecting data from clients and workers on quality of service delivery, and also, reviewing results generated from this data to promote the seamless flow of quality in all facets of the healthcare system regularly.
- iii. ***Continuously Improve Productivity of Employees:*** Health workers are the brain and agents of sustainable quality healthcare development; hence, their performance and productivity should be consciously improved and sustained through effective and equitable reward packages, delegation of authority, autonomy responsibility, training and development, active participation in critical decision making, compensation, promotion, and recognition awards. This can be achieved through the provision of motivating and comprehensive reward system in the HRM strategic planning.
- iv. ***Recruitment of Qualified and Certified Health workers at Entry Level:*** Future relevance of the Nigerian healthcare sector can be sustained and enhanced by ensuring that only tested and qualified practitioners are engaged at the entry-level of recruitment and selection processes. This helps to absorb and nurture only quality assurance driven health practitioners in the system from inception. Similarly, quality of cultural diversity in the deployment of workers in the sector should be highly appreciated in order to effectively control prevalent cultural conflicts hindering effective communication and relationship between health service providers and users in the clinical ward.
- v. ***Well-Structured and Uninterrupted Process Management System:*** Since acute health issues are handled at the tertiary level of the healthcare system, hence, any form of interruption in healthcare administration processes will pose a significant threat to the quality of life and wellness of the patients. Therefore, the organization of the healthcare procedural stages from registration to the point of healthcare delivery should be seamless and well-structured in a way that promotes safe, convenient, and reliable quality healthcare delivery.

FUTURE RESEARCH DIRECTIONS

From empirical literature conducted in the context of the Nigerian Healthcare Sector, most researchers emphasised on healthcare quality assurance and its delivery from the perceptive of customers (service users), meanwhile, weighing same from the perception of healthcare workers has not been thoroughly examined in the academia. This identified gap in knowledge is suitable for future research purpose. However, since evidence-based research (quantitative) study remains the vocal point in promoting best care practices in the healthcare profession, the researcher, therefore, suggests future research investigations on the impact of employee empowerment on perceived quality of service delivery in the Nigerian tertiary healthcare institutions; through cross-sectional research survey. Noteworthy, this will help in providing evidence-based models, theories and practices most appropriate in improving sustainable quality assurance outcome from the viewpoint of employees in the Nigerian Healthcare sector.

CONCLUSION

The study has revealed that employee' empowerment is the best long-term strategic approach in promoting and sustaining positive perceived quality of service delivery of workers in the healthcare sector. No doubt, the most effective empowerment in the healthcare setting is achieved through management effort in delegating authorities, granting autonomy responsibility, adequately funding and providing quality healthcare facilities, and measuring result-oriented reward system to health workers, which in turn significantly improve the outcome of their service delivery. The Nigerian tertiary health institution is faced with diverse challenges of poor quality performance due to the insensitivity of leadership in empowering their engaged workforce. To a large extent, this has negatively impacted the health workers' PQSD in discharging their expected duty of care in accordance with the guiding clinical standard of the profession. Development of a constructive framework for quality assurance was suggested towards providing a sustainable long-term solution in the collective interest of all stakeholders in the sector. Meanwhile, for effective management of employees' empowerment in the Nigerian tertiary health institutions, it was recommended that leadership must be committed to the standard of quality assurance, effective engagement of workers through training and all-inclusive reward packages, and recruitment of qualified health practitioners at entry levels.

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KEY TERMS AND DEFINITIONS

Employees Empowerment: Autonomy of the health practitioners to carry out their expected duty of care with provision of required health facilities, equipment and other resources for effectiveness of their performance.

Engagement: Activities put together by management of the health organizations in form of training, formal education, and development towards achieving optimal resourcefulness, productivity, and effectiveness of their workers.

Health Stakeholders: Group of people like health management, employees, clients, suppliers, service users, government, and the public with direct and indirect influence/interest on the quality of service delivery in the health sector.

Healthcare Standard: Generally acceptable ethical provisions that guide code and practice of the healthcare profession.

Perceived Quality of Service Delivery: Perception of health workers on the quality of services they provide in the clinical wards with respect to the ethical principles guiding code of practice of their profession.

Performance: Quality of work employees in the health settings deliver to impact and improve quality of healthcare outcome.

Quality Assurance: Sustenance of quality standard at all levels of operational processes and activities of the health organization to improve and promote quality of life and safety of all healthcare stakeholders.

Quality Management: Effective implementation of strategic measure to consistently and continuously improve quality performance of the health organization in the best interest of all its stakeholders.

Reward System: Collective monetary and non-monetary packages designed by health management board (HRM) in measuring equitable payment, compensation, and motivation for health workers' committed effort to the goals of the health organisation.

Tertiary Health Institutions: Specialized public healthcare centers that provide comprehensive and sensitive healthcare services, procedures, and intervention strategies through engagement of state-of-the-art healthcare facilities suitable in improving and promoting quality of life and wellness of the Nigeria populace.

Women at Leadership Positions in Bangladesh Civil Service

12

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INTRODUCTION

Civil service is an integral part of the central administration in a country that carries the policies of the government. A critical mass of women in the civil service, specifically in the top decision-making positions, is important to ensure gender parity, in addition, to guarantee women's perspectives to policy and other discussions (United Nations Development Program [UNDP], 2014). The Government of Bangladesh is trying to ensure gender parity in the civil service through several programs and policies. The ratification of the Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW), the UN Conferences on Women, the Universal Declaration of Human Rights (1948); the International Covenant on Civil and Political Rights (1966); the International Covenant on Economic, Social and Cultural Rights (1966); the Declaration on Violence Against Women (1993); the Vienna Declaration and the Program of Action of the World Conference on Human Rights (1993) shows the intention of government to ensure the right and privileges of women in society (Bangladesh Bureau of Statistics [BBS], 2013). The country is running by a female Prime Minister and female Opposition Leader since 1991. The Speaker of the parliament is also a woman. The number of female Member of the Parliament (MP) has increased over time. However, women are grossly under-represented in top decision-making positions in the civil service.

BACKGROUND OF THE STUDY

Several scholarships on women's participation in the Bangladesh Civil Service are available. For example, Sultana and Ferdous (2017) have conducted a study to examine the status of women in leadership positions in the civil service of Bangladesh. They have found that although the number of women in the service has increased, their participation in the leadership positions does not reflect gender parity.

Mahtab (2014) has examined the position of Bangladeshi women in the civil service. She claims that the participation of women in the civil service is not satisfactory because of several barriers like negative treatment and attitudes of men towards women and institutional constraints that affect their career advancement. Kabir (2013) in her study on women's participation in South Asia's (Bangladesh, India & Pakistan) civil services finds that despite constitutional provisions for ensuring gender equality in all sectors, the status of women in administration, specifically, in the central decision-making arena, remains marginal due to different organizational, social, cultural and political factors.

Bilkis (2012) in a study on the motivation and de-motivation of female civil servants serving the Bangladesh Civil Service administration cadre claims that job security, job characteristics and family are the major motivating factors to join and continue in the service for women. In addition, she has

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identified a few de-motivating factors like the issue of transfer, particularly in remote areas, absence of separate toilet facility and daycare service, negative attitudes of male colleagues, delay or uncertainty in promotion, lack of market-based salary and dual duties in the office and home. She has further claimed that the situation is gradually improving with time.

Jahan (2010) has conducted a study focusing on the barriers that women civil servants deal with while working at the field level. The study finds dual responsibility of the job and family, insufficient housing facilities, lack of security, unpleasant working environment, and negative attitude of the community, colleagues and the authority as major impediments to women civil servants at the field. Likewise, Karim (2008) claims that class I female civil servants in the civil service of Bangladesh are under-represented in the service as a result of different structural, institutional, and operational factors.

Jahan (2007) asserts that women are far behind men in policy formulation positions. She finds posting in remote areas; family responsibilities; lack of childcare facilities in office; non-cooperation of male colleagues and family members; absence of appropriate and supportive environment in the workplace; superiority complexes and negative attitudes of male colleagues; lack of security and consequences of social backwardness as hindrances to their participation in the service.

All these studies claim that women are under-represented in the decision-making positions of the service. Women's equal participation and leadership in the decision-making process are fundamental because of its individual and societal implications. At the individual level, women are in a disadvantaged position with respect to men concerning career development due to occupational seclusion. At the societal level, prohibiting women from accessing the leadership positions of the professional hierarchy raises questions on social justice. In addition, a vast reservoir of human resources remains underutilized (Russell, Watson, McCoy, Grotti, & Kenny, 2017). A minimum of 30 per cent of women in leadership positions is considered essential to ensure women's interests to be fully considered and properly addressed. In addition, the increased representation of women in public service is necessary for truly inclusive development and democratic governance (UNDP, 2014). So far, there is a lack of study to assess the current trend of female representation at leadership positions in the civil service of Bangladesh.

In order to promote greater gender equality in the civil service, it is essential to identify the barriers that prevent women from reaching the top positions within services. This study is expected to fill the gap in the literature of women leaders in the service. It is mention-worthy that stepping of women in the mainstream civil service is recent, has started since 1982. Therefore, they are lagging behind men. In this background, this study will try to explore the status of women in leadership positions in the service. Furthermore, the study aims to identify the barriers that hinder their advancement to the top decision-making positions. Besides, it suggests some recommendations, which might be advantageous to improve their position in the civil service of Bangladesh.

METHODOLOGY

Data for the study was collected mostly through desk research i.e. examining and reviewing published and unpublished documents, books, journals, circulars, reports, publications, and newspaper articles on women and civil service. Therefore, the maximum data was secondary in nature. In addition, the internet was a source of data collection. Moreover, a few information was also gathered by informal discussions with seven mid-level female civil servants of Bangladesh; therefore, data collected through this way was small in quantity.

CIVIL SERVICE SYSTEM IN BANGLADESH

Bangladesh was a part of British India for about 200 years. After the partition of India and Pakistan in 1947, this country was governed by the Pakistani ruler for 24 years and became an independent country in 1971 after a bloody nine months war against Pakistan. Therefore, civil service in Bangladesh inherits a legacy of the Central Superior Services of Pakistan and the Indian Civil Service designed and developed by the British Empire.

Currently, Bangladesh Civil Service consists of class I, II, III and IV civil servants. In addition, the service consists of cadre and non-cadre employees. It is mention-worthy that cadre services are constituted under the law with a number of positions or structure and recruitment and promotion rules. Currently, there are 26 cadres in Bangladesh Civil Service. Class I cadre posts vertically comprises of secretary, additional secretary, joint secretary, deputy secretary, senior assistant secretary and assistant secretary in terms of seniority and status. Furthermore, class I and part of class II officers are ‘gazetted officers’ whereas the remaining are ‘non-gazetted’. However, all class I officers do not belong to the cadres (Khan & Ara, 2005). As class-I civil servants are directly related to the policy formulation and implementation process they may be considered the leader in the service.

Recruitment System of the Bangladesh Civil Service

Bangladesh Public Service Commission is responsible to arrange the open competitive examination known as the Bangladesh Civil Service Examination for recruitment to the cadre services. Three types of recruitment procedures are exercised in the Civil Service of Bangladesh:

- Direct recruitment through open competitive examination;
- Recruitment through promotion; and
- Recruitment through transfer or deputation.

Moreover, there is a provision for 10 per cent ‘lateral’ entry into the senior positions of the service from outside the service. Recruitment at the entry-level is done through direct recruitment (Kashem et al., as cited in Khan & Ara, 2005).

Government Policies Regarding Women in the Civil Service

In Bangladesh, recruitment to the service is done based on merit and/or quota. The Constitution of Bangladesh not only assures equality of opportunity but also recognizes the necessity of resolving the prevailing gender disparity by reserving a significant proportion of posts in the civil service for women through the provision of quota. The quota for women was primarily introduced in 1972; however, it came into force in 1976 after a modified government order. The order ruled to reserve 10 per cent quota for women in all categories of vacancies subject to their fulfilment of required eligibility. In 1985, the system of the quota has been reorganized and was made mandatory to all government, semi-government and autonomous bodies and different sector corporations in case of direct appointments. Until then 10 per cent gazetted posts and 15 per cent non-gazetted posts were kept reserved for women in addition to merit, applicable in all types of public employment (Ara & Khan 2005). However, the government of Bangladesh has abolished the quota system for class-I and class-II jobs in the civil service in October 2018.

Table 1. Categories of Quota for Class I Gazetted Service

Categories of Quota	For Class I Service (%)	
	1976	1985
Merit	40	45
Freedom Fighter	30	30
War Affected Women	10	--
District Quota	20	10
Women	10	10
Tribal	5	5

Source: Khan and Ara, 2005

Furthermore, the government of Bangladesh has announced the National Policy for the Advancement of Women (NPAW) in 1997 that was revised in 2004, 2008 and finally in 2011. The national policy addresses different and relevant issues where employment and administrative empowerment of women are given special emphasis and suggest some strategies to bring more women in the service like:

- To make provisions for contracts and lateral entry to facilitate access of women in the higher levels of the administrative structure.
- To increase efforts for achieving a 30 per cent female population at all levels of decision-making including policy-level posts.
- To increase women's representation at all levels particularly at the policy and decision-making levels; and
- To increase the number of women at all levels of ministries and agencies (Jahan, 2007).

It is therefore very clear that the government of Bangladesh is trying to increase women's participation in the civil service and thus mainstreaming women in the service through quota and other strategies.

HISTORY OF WOMEN'S PARTICIPATION IN THE CIVIL SERVICE

Women's Participation in the Civil Service of British India

No detailed information is available on the status of women in the civil service in British India (1757-1947). During the early years, women were legally prohibited to enter the higher administrative posts and were mostly employed in the medical services, Indian educational service, and provincial educational service and in the posts and telegraph department. However, women were allowed to enter lower-level jobs like the clerical services in the home department, directorate of intelligence bureau, finance, security printing, defense, armed forces, geological survey of India, explosives sector, labor and lands, all-India radio, military accounts and miscellaneous posts in the Central Board of Revenue (Islam, 2003).

Women's Participation in the Civil Service of Pakistan

Pakistan emerged in 1947 as a sovereign state, kept the system of civil service unchanged. The 1956 and 1962 Constitutions of Pakistan ensured equality of opportunity for all citizens with regard to public employment. However, the situation was quite different in practice. The recruitment rules of the Pakistan Civil Service clearly stipulated that women would be considered only for a few services like the audit and accounts service, the railway accounts service, the military accounts service, the income tax service and the postal services. Furthermore, women were barred from entering the whole Pakistan Civil Service and Central Superior Services. In addition, it was mentioned that women would receive an appointment to those services in which they were fit after selection, only when they voluntarily declared that they would resign their service after marriage or remarriage. The then Pakistan government was of the opinion that it was not possible for married women to work efficiently. Consequently, women were confined mostly to desk jobs while field visits and inspection, maintenance of law and order and collection of revenues were considered suitable for men (Mahtab, 2014). Therefore, only a handful of educated women in Pakistan entered class I services like the Pakistan audit and accounts and the Pakistan taxation service. Begum Selima Raisuddin Ahmed of Pakistan audit and accounts service was the only woman to serve as Accountant General of East Pakistan/ Bangladesh (Huq & Bala, 1988).

Women's Participation in the Civil Service of Bangladesh

Bangladesh gained independence in 1971. Since independence, the governments have been trying to involve and integrate women in the policy and decision-making processes in the civil service. Despite the constitutional provisions and several initiatives by the government for guaranteeing equal representation of women in all sectors, the participation of women in decision-making positions remains marginal.

Although women have been eligible for appointment to the Bangladesh Civil Service since 1972, they have remained under-represented across the service. Until 1980, the administrative, judicial, postal and communication cadre had no female officer while only one woman joined the revenue department of the finance division. Additionally, four women were in the Foreign Service; and six women represented the information department. Since 1982, women have been regularly attending the Bangladesh Civil Service Examinations and are being recruited in all the cadres (Mahtab, 2014). However, the participation of women in cadre services is not satisfactory as the following table indicates:

Table 2. Number of Selected Men and Women in the BCS

Name of the BCS Exam	Male	%	Female	%	Total
26 th BCS Exam	703	66.13	360	33.87	1063
27 th BCS Exam	2417	74.62	822	25.38	3239
28 th BCS Exam	1520	69.41	670	30.59	2190
29 th BCS Exam	1232	71.54	490	28.46	1722
30 th BCS Exam	1623	68.57	744	31.43	2367
Total	7495	70.83	3086	29.17	10581

Source: Bangladesh Public Service Commission, 2011

Table 2 shows that in all the Bangladesh Civil Service Examinations, the number of selected female candidates in the job at the entry-level as assistant secretary is less than half against their male counterparts. Nevertheless, there is a slow rise of women in the Bangladesh Civil Service as Table 3 demonstrates. Furthermore, women's representation at the higher levels of the civil service, i.e. secretary, additional secretary, joint secretary, and deputy secretary are trivial due to lack of experience and seniority.

Table 3. Gender Wise Statistics of Officers in the Ministry by Category

Rank	2006			2008			2012		
	Women	Men	% of Women	Women	Men	% of Women	Men	Women	% of Women
Secretary	01	63	1.56	01	53	1.89	63	04	5.97
Additional Secretary	00	83	00	01	88	1.14	240	15	5.89
Joint Secretary	25	339	6.87	25	314	7.96	554	72	11.50
Deputy Secretary	172	1299	11.69	170	1288	13.20	1342	184	12.06
Senior Assistant Secretary	206	1108	15.68	212	1099	19.29	1215	347	22.22
Assistant Secretary	272	924	22.74	264	904	29.20	467	153	24.68
Total	676	3816	15.0	673	3746	17.97	3881	775	19.97

Source: Ara, 2013

At present, 1,138 women (20.57% of the total 5,530) are working as Class-I officers. Only about five years ago, this figure was less than 8%. Ten women (13%) are working as full secretaries, the highest position in the civil service. For the first time, a woman is working as a secretary in the Prime Minister's Office. a secretary in the Prime Minister's Office.

There are 57 female additional secretaries, 100 female joint secretaries, 189 female deputy secretaries, 348 female senior assistant secretaries, and 438 female assistant secretaries as of November 2017 (Ahmed, 2017). Although the participation of women officials across the service is increasing gradually, it is still insufficient. With the current trend of women in these relevant ranks, women will keep on to be marginalized in the leadership position for a long period.

Moreover, women civil servants are lagging behind men in the leadership position of field administration. Bangladesh is divided into four tiers namely division (08), district (64), upazila (491) and union (4554) for administration purposes. Leadership position in the field administration, particularly the position of divisional commissioner, deputy commissioner or upazila nirbahi officer are recognized as an elite position in the field level bureaucracy. Usually, the officials of the Bangladesh Civil Service (Administration) cadre are selected for these positions. Civil servants who serve in the positions have a high probability to be promoted to the position of secretary (Sultana & Ferdous, 2017). There is only one female divisional commissioner (in charge), six women deputy commissioners, 16 female additional deputy commissioners and 106 female upazila nirbahi officers (Ahmed, 2017).

BARRIERS TO THE PARTICIPATION OF WOMEN IN THE CIVIL SERVICE

12

The status of women in the civil service is yet disappointing. Due to their late start and being grossly outnumbered by men in the cadres, women have to wait to ascend to the leadership positions. Government institutions have consistently failed to advance women's participation in decision-making because of several socio-cultural and institutional impediments.

Household and reproductive responsibilities, limited mobility, insecurity, and social backwardness affect the participation of women in civil service. In Bangladesh, women usually bear most of the domestic responsibilities. Therefore, it becomes difficult to balance between families and workplace simultaneously specifically for female civil servants with young children. In many instances, the helpless mothers sacrificed their career finding no other way.

Additionally, transfer to remote places and working there make the situation more critical for working women. Living away from family creates insecurity problems both for themselves and their family members. Therefore, they are sometimes compelled to resign finding no other option. Another major concern for working mother is childcare. Very often, there is no one available to look after their children but the domestic assistants. Therefore, she is mentally occupied with her child's security while in the workplace that affects her performance. That is why many women prefer jobs that are mainly city-centred.

Culturally it is taken for granted that women are solely responsible for their families. Thus, women in Bangladesh have to manage their family affairs first and then her workplace. Most of the husbands in Bangladesh do not share household responsibilities but expect their wives to be perfect in ensuring all comforts at home. The male civil servants also possess the same mentality. They do not consider their female colleague's difficulty and think it is their personal problem. Traditionally in a patriarchal culture like Bangladesh, men are not yet mentally ready to receive instructions or orders from a female superior. It is reflected in the service too. Furthermore, women are considered incompetent for challenging positions or making decisions.

According to the Bangladesh Civil Service recruitment rule 1981, 45 per cent of posts were reserved to recruit on merit. Rest of the posts were first allocated to districts on the basis of population and their overall share in the service. Of the remaining posts out of respective district's share, 30 per cent for freedom fighters, 10 per cent to women, 5 per cent to tribal and 10 per cent to the district. The problem lied here. If there were no qualifying female candidates (or other candidates against respective quota in the particular district), the specified share of jobs was then distributed among general qualifying male candidates of the greater district. In such instance, a female candidate from another district with better marks in the civil service examination was not considered eligible for the post if no such post against female quota allotted to her district of origin (Jahan, 2007). The quota system thus created frustration among those potential and eligible women. In addition, the reservation of 10 per cent quota was not adequate for the huge number of women population. In fact, government policy regarding quota seemed confused and showed a play-safe attitude.

Training is essential for career development. This is one of the areas, which has been almost totally neglected in the case of women civil servants of Bangladesh. Even today no training program exists which would sensitize male civil servants about how to behave and work with female colleagues. No policy decision has been taken by the government so far to include women-related components in the regular training program of class I civil servants belonging to the entry, mid-and higher levels. This has created difficulties for women to perform their jobs efficiently. In addition, lack of appropriate policies and procedures on recruitment, training, deputation and transfer in the service for female staff discourage women to join civil service (Khan, as cited in Ara, 2013).

Moreover, lack of suitable work environment, negative attitudes of colleagues, non-cooperation from male colleagues are barriers to participation in the services. Lack of appropriate work environment is one of the important reasons for the low participation of women. The workplace is designed in such a way that is very much male-oriented. Special arrangement for women is scarce or limited in our country. There is no daycare facility, no separate restrooms, or toilets for women. Inadequate housing accommodation for women who live alone in the workplace and very often the lack of friendly work environment restrain women from performing efficiently in the service.

Furthermore, education is an important factor to join the civil service. The number of highly educated women are still few in Bangladesh. Unless a significant breakthrough can be made in the area of female education at the tertiary level, the effort to bring gender parity in the civil service will not succeed.

CONCLUSION AND RECOMMENDATIONS

Women in Bangladesh are discriminated in almost every sphere of life. The traditional patriarchal society is designed in such a way that encourages female subordination, submission, subjugation and segregation (Nelson & Chowdhury, as cited in Mahtab, 2014). Usually, women are confined within the private spheres, busy with the domestic chores. Their contribution to the family and society is largely unrecognized and undervalued.

To improve the backward status of women in public service, the government of Bangladesh has adopted several initiatives. Despite these initiatives, women's share and position in the civil service is below the desired level. The study found that discriminatory practices against women persist in the wider society that reflects in the service too. While greater numbers of women are joining the civil service in Bangladesh, they are denied access to the top leadership posts. The following suggestions might be taken into consideration to elevating the status of women in senior-most positions in the service.

The working environment for women needs to be improved as women would find it difficult to work unless the workplace environment is friendly. Establishing hostels for working women, housing facilities for women with families are essential so that women feel secure and can continue their jobs, maintaining privacy in offices, provision of separate office rooms, restrooms, and washrooms for women, daycare centres in the workplaces, and availability of transport need to be provided. Policies on promotion, transfer and deputation must be designed objectively, based on merit and job experience. One of the major problems discouraging women from entering and continuing in the civil service is the separation of women from their families due to transfers. Posting of husband and wife at the same place or adjacent locality with childcare facilities would help female officers in travelling, taking care of their young children, and lessen the possibility of sexual harassment.

Effective policy and strategy must be designed so that occupational segregations are removed and women are given better opportunities for education, skill development and training for diversification of their employment opportunities. Gender sensitization training needs to be designed and organized targeting the male civil servants as many of them do not know how to deal and interact with female colleagues. Gender issue should be integrated into different training courses to develop consciousness regarding the importance of women's role in society.

Attitudes of society and men towards women need to be changed. Dissemination of information in the media to encourage women and attitude change have to be launched to create social awareness.

Finally, the real obstacle to women participation is the absence of pragmatic government policy and a lack of commitment and sincerity to implement those policies. The policies should be revised in light of an adequate assessment of women's needs.

FUTURE RESEARCH DIRECTIONS

Further research may be designed to investigate the difference between women and men in the civil service in terms of age, experience, length of time to promotion and entry-level. Another interesting area of study may be to explore how the work experience differs between male and female civil servants within and across ranks in terms of managerial support. Moreover, comparing their perception regarding career development like promotion opportunities may be an interesting area of investigation.

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KEY TERMS AND DEFINITIONS

Cadre: Cadre is the distinct functional sub-division of the government bureaucracy in Bangladesh. Each cadre consists of a certain number of posts. The strength of each cadre has been laid down in the

composition and cadre rules of the respective cadres. Recruitment to the cadre services is made through open competitive examination by the Public Service Commission. Once one joins a cadre, he/she needs to serve that cadre throughout his/her career. All civil servants appointed by the Bangladesh Civil Service Examination belong to class I cadre services.

Civil Service: Civil service is a part of the executive branch that performs the functions and activities of the government. The term 'civil service' was introduced for the first time in India during the reign of the British rule.

Field Administration: It spreads over different administrative units, the division, the district, the upazila and the union. Field administration is the extension of central administration at the field level to implement government programs and policies.

Gazetted: The term 'gazetted' refers to the officers whose appointment, transfer, promotion, posting and so on are published in the official gazette (a periodic official publication of the government of Bangladesh).

Leadership: The ability of a person or group to influence and direct others in an organization.

Public Service Commission: Bangladesh Public Service Commission is a constitutional body that is primarily responsible for the recruitment of the officers of the cadres.

Section 13

Marketing and Customer Relationship Management

Green Marketing

13

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INTRODUCTION

Environmental discussion is a constant in our society, reflecting the concerns of the public and their growing awareness of ecological problems. This progressive awareness of environmental issues by consumers has had consequences in the business world, which began by new products development, more consistent with the ecological concerns of the markets – hence the emergence of green marketing.

Green Marketing consists of marketing activities defined to create and facilitate transactions of goods and/or services with the goal of satisfying the needs and desires of consumers expressing their concerns in terms of environmental sustainability. The concept of green marketing introduces the marketing strategy with a concern for the eco-performance because it represents the impact that business's actions have on humans and their natural environment (Hartmann & Ibanez, 2006). The effect of marketing activities on preserving the environment is increasingly interested in more managers, consumers and marketing researchers. Marketing managers have found that environmental issues usually provide a source of competitive advantage (Schultz II & Holbrook, 1999). Companies focus on the problem of sustained growth or development (Hart, 1997; Elkington, 1994) While managers aspire to ecological (Fisk 1974), Environmental (Polonsky & Mintu-Winsatt, 1995), Green (Ottman, 1997; Wasik, 1996) and more recently to enviropreneurial marketing (Kilbourne, 1995) (Hartman & Stafford, 1998; Menon & Menon, 1997; Kangu, Carlson & Grove, 1991).

This article presents the path of the integration of the environmental concerns in management, namely in marketing management, as a response of the market-oriented business to pursue the green consumers' needs and desires. Doing so, the article introduces the green marketing concept and discuss what its necessary to do further to reach an environmental concern in the business reality and therefore to contribute to a sustainable society and development.

BACKGROUND

Green marketing become a discussion in the decade of 1960 due to the imbalance between natural resources and the exponential growth of the population. During the 1970 years, environmental concerns were no longer just about this the gap but also about the abuse of resource consumption by companies, with their excesses of production and lack of respect for preservation of the environment. Here, the western countries of the northern hemisphere were the most targeted countries of the debate (Portilho, 2003). In the decade of 1980, consumption options were the reflection of an individualism that was responding to a proliferation of products that emerged to meet the needs of a fragmented market. From the decade of 1990, considered the most fertile in terms of scientific production on the green consumer (Hartmann & Ibanez, 2006), the perception of the environmental impact widened to the high standards of consumption

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of companies and the centre of this problem shifted to the individual sphere of each consumer. People began to be aware of the consequences of their acts of consumption, not only in terms of depletion of natural resources because of the excessive consumption and of the pollution that these acts, and all their daily activity caused in the preservation of nature and, therefore, in those resources. In the 90's, a social consciousness arises in consequence of the need to deal with global problems (Afonso, 2010). The big difference between the consumers of the years 70 and 90 is that the first were concentrated on a radical perspective and a restriction of consumption, while the seconds were favourable to technological solutions that enabled them to maintain their lifestyles. The birth of the new century seems to have reinforced this posture, resulting in a passage from non-development to sustainable development.

In this new reality, there is the emergence of pressure groups with environmental defence campaigns, increasing media reports on these topics, ecological issues become part of the political agenda, laws and regulations are defined for environmental protection and concerted actions were carried out in this field, with comprehensive international cooperation. These trends have been accentuated, and in some countries in northern Europe, as is the case of Sweden, at the end of the first decade of this new century, the discussion has already focused on the participation of green consumers in policy decisions relating to the environment (Klintman, 2009). At the beginning of this second decade of the 21st century, the focus is increasingly on the concern of social behaviour due to its reflection on the future quality of life of the entire world population.

In view of the evolution described, it can be affirmed that the gap between values and environmental behaviour, although existing (Pickett-Baker & Ozaki, 2008), has been decreasing significantly. In face of this new environmental context, we can say that the last decades have seen a new consumer born, with a "greener" behaviour, called "Green consumer".

Sustainable Development to Sustainable Marketing

Sustainable development is a concept originally popularized in 1987 in the report of the World Commission on Environment and Development, where it is argued that future prosperity depends on the preservation of natural resources (Lozada & Mintu-Winsatt, 1996). This future prosperity requires balancing human activity with the ability of nature to renew itself. In other words, this idea refers to the development that meets the needs of the present without compromising the capacity of future generations to meet their own needs, that is, to sustainability (Lozada & Mintu-Winsatt, 1996). This definition despite being the most accepted, has been criticized for defending two seemingly irreconcilable objectives (economic development and preservation of resources), because it is disconnected from natural ecology and for its lack of operational objectives and lines of action (Jennings & Zandbergen, 1995). Sustainability is achieved, for Jennings and Zandbergen (1995), when the extraction of ecological system resources takes place within the capacity of the base resource and when the transfer of waste from the physical components does not exceed the capacity of assimilating each ecosystem.

According to Lozada and Mintu-Winsatt (1996), some authors argue that sustainable development ideas are not the only methods of "greening" international business activities. They also argue that the content of the World Commission Report is a critical ecological perspective on the preservation, protection and conservation of our physical or natural environment. This ecological perspective does not focus only on biological systems, but also on how the ecosystem interacts with social, technical, human and economic systems. Thus, from an ecological standpoint, sustainability requires societies to meet human needs, not only by increasing the productive potential, but by ensuring equal opportunities for

all. In addition, consumption patterns everywhere must be reevaluated to take into account sustainability (Lozada & Mintu-Winsatt, 1996).

The issue of environmental sustainability is seen by Iyer (1999) as a multilateral and is defined as an institutional problem, not only by giving explicit recognition to the design of the appropriate social mechanisms to regulate the generation as per its Implementation is crucial to challenging and changing attitudes and values, which still prevail in nature and environment.

Therefore, Kilbourne *et al.* (1997 (b)) argues that this type of eco-centric orientation is not achievable due to the dominant social paradigm in which companies exist. The anthropocentric values of the companies do not consider that nature is of fundamental importance in its organizational values. The need to examine the environmental crisis as a crisis of paradigms was defended by Pirages & Ehrlich (1974), according to Kilbourne (1999) and Kilbourne *et al.*, (1997 (a) (b)). These authors used the term dominant social paradigm describing it as “a collection of norms, beliefs, values, habits, etc. that form the vision of the existing world in culture...” Kilbourne *et al.* (1997 (b): 4). They, also, suggests that a paradigm is dominant when defended by dominant groups that use and legitimize and justify existing institutions, becoming the engine of social and political action by the group and working as an ideology.

The dominant social paradigm, in western industrial societies, serves as a basis and justifies the concept of quality of life. The paradigm manifests itself through the ideology of consumption that advocates that the increase of material well-being is the support of quality of life. But the desire for a constant increase in consumption can decrease the quality of life and not improve it, in addition to damaging the environment (Kilbourne *et al.*, 1997 (a) (b)). The ecological crisis originated in factors considered positive, in problems that were the function of accelerating consumption globally and that were the objective of scientific and technological development, since the VII century (Kilbourne, 1999, 1995). The rationality of the dominant social paradigm is involved in a perspective of the role of the human being in life. It encompasses a few social relationships consistent with these assumptions. The interests and needs of the individual are not independent of their historical condition and are even determined by it. As a result of any conception of competition, such as the “new environmental paradigm” proposed by Dunlap & Van Liere (1978), it must establish its superiority by exposing the ideological nature of the dominant Social paradigm as an existing reality.

According to Kilbourne (1999), the multidisciplinary nature of marketing allows him to be the only one in the field of entrepreneurial activity to be able to widen the margins of a competing paradigm. This author in considering that marketing being less committed to the dominant Social paradigm, the great source of interrelated management disciplines, can structure the context of the debate by challenging the assumptions of the dominant social paradigm and exposing the *status quo* (Kilbourne, 1999). These managers and discipline will therefore can identify a subgroup of characteristics that cover and exceed the extremes of the dominant social paradigm and the new environmental paradigm, indicating a melting area even if small (Kilbourne, 1999). They thus create the basis for integrating and implementing this problem in the business reality. In this way they seek to achieve sustainable development in a close perspective of ecocentrism.

Business Adaptation to the New Paradigm

According to Iyer (1999), the basic premise of supporting the current perspectives on environmental responsibility of organizations and environmental issues in marketing is the notion that economic growth is possible within boundaries that are environmentally sustainable. Arguing that the planet's resources are finite, the defenders of sustainable development claim that the patterns and prospects of economic

Table 1. Old and New Paradigm

OLD PARADIGM (VISION)	NEW PARADIGM (VISION)
· Continuous and uncontrolled growth · Conquer Nature and exhaust resources · Environmental Compliance · Marketing for needs satisfaction · Materialism · Industrial production · Designed for obsolescence and rejection · Cost accounting (Profit/Loss) · Group, reduce	· Sustainability, Economy «green» · Biophilia (affinity with nature) · Environmental Audit · Marketing to sustain life · Personalism · Industrial ecology · Designed for the environment · Total cost accounting · Holism

Source: adapted from Wazik (1996)

growth and their assessment that were used before now have to be put aside. New economic purposes that are less intensive in resource use should be adopted.

The response of the business world to this type of sustainability has been to reformulate the environmental problem so that it makes good sense business environmental policy contributes to the competitive advantage and increased profitability and thus to the development of a business company. The emphasis is placed on the co-efficiency, that is, the maximization of the additional value (more worth the lower use of resources and less pollution (Iyer, 1999).

According to Wazik (1996), organizational theorists who have environmental concerns have modified organizational strategy models in order to include environmental pressures. In this way they create more proactive organisations, since in their opinion these are the most sustainable. However, managers should consider that the implementation of such strategies implies not only changes in policies and procedures, but essentially of business culture in order to facilitate the implementation of these environmental programs (Ottman, 1997; Lozada & Mintu-Winsatt, 1996; Wazik, 1996).

Many of the “green management” efforts are only to improve the existing performance of products or processes. In the long run, the dynamics of creative destruction will go against companies that support themselves based on incremental upgrades and fail the fundamental change to provide products, processes and services (Hart & Milstein, 1999). Business companies, notably global, are accustomed to seeing the global market as an entity. As such, they assess business opportunities for potential global sales, which facilitates the sale of products and services around the world without major changes (Hart & Milstein, 1999).

This new paradigm-the vision of a sustainable world, the new ecological paradigm, (Xue *et al.*, 2018; Wazik, 1996) leads managers to look at the organization from an environmental point of view, attributing emphasis to relationships, as we can see in table 1.

The most innovative organizations that have accepted this new vision, have adopted the management of total environmental quality reducing costs and pollution (Wazik, 1996). This new management method can be extended to all phases of the organization, to operations, production and marketing. This new entrepreneurial attitude arises because:

- A growing group of researchers are demonstrating that environmental improvements in companies are transformed into profits
- Consumers are more concerned about these issues and usually associate multinationals with environmental problems

- Organizations are now required to be more socially responsible in terms of products, operations and performance.

The marketing goal, in the context of the pursuit of sustainability, is to achieve the optimum satisfaction of the consumer's desires, allowing the use of environmental functions in the form of products or services, without exceeding the external limits determined in the search for this sustainability (Gordan *et al.*, 2011; Hunt, 2011; Van Dam and Apeldoorn, 1996). Sustainable marketing should help to find defensible exchanges between business and environmental concerns. It assumes, among other things, an attractiveness for the increase of business horizons and for the continuity of value on profit. Through a pro-active marketing, which will shape the needs and expectations of consumers and offer the market the appropriate choices to meet their needs, it is possible to achieve sustainability (Sheth & Parvatiyar, 1997).

The assertion that marketing serves the social needs informing consumers of the availability of goods and services in order to improve their quality of life, can only be supported if the perspective of communication and its techniques help to inform. This implies that marketing has an educational function, channelling the needs of current and potential consumers, for products, services or ecological activities (Sheth & Parvatiyar, 1997). Implicit in this statement is the assumption that marketing efforts are also directed to reform inefficient and environmentally harmful consumption habits. "Changing consumption patterns can entail positive incentives, new products and development of processes and prices against certain consumer practices" (Sheth & Parvatiyar, 1997:7).

The ability of marketing to identify and develop consumer choices for society and to meet your current needs without damaging the ability to meet your future needs, allows you to develop "green" products in a way to improve the poor environmental condition. The concept of "green" product has to extend our understanding that environmental consequences are the most important determinants of its acceptability, more than user satisfaction or the company's profit. The truly "green" product is one that becomes the consumer's first choice provided it satisfies the individual's consumption needs alongside their needs for a healthy and sustainable physical environment (Sheth & Parvatiyar, 1997). These two types of requirements are not conflicting, the two occur simultaneously.

The Integration of Environmental Concern in Strategy and Marketing

According to Wazik (1996), the broad framework of the first perspective of integrating environmental concerns into marketing, which translated into "ecological marketing", Kotler's point of view (1986), is the concept of social marketing, which argues that the task of organizations is to determine the needs, desires and interests of the target market and to develop products that satisfy the consumer in a more effective and efficient way. That competition, preserving the welfare of consumers and society. This concept underlies the key idea that marketing is part of holistic management (Xue *et al.*, 2018). The products are judged according to how they are produced, packaged, transported, consumed and dispensed (Wazik, 1996).

This perspective of ecological marketing, defended by some authors (e.g. Henion & Kinnear, 1976; Fisk, 1974) is the translation of the recognition of an ecological crisis that leads the players to assume their responsibility to try to avoid this crisis and change their management practices (Gordan *et al.*, 2011; Hunt, 2011; Van Dam & Apeldoorn, 1996). But the simple launching of "environmentally friendly" products was not enough to stimulate demand, even for the most receptive consumers and supporters of

environmental protection. Consumers have shown no predisposition to change their consumer behaviour and to adhere to collective environmental protection measures (Van Dam & Apeldoorn, 1996).

Therefore, marketing continued and began to try to convince consumers that they can achieve higher levels of satisfaction by buying fewer products, so we entered the perspective of “environmental marketing”. Trying to translate the social necessity of a production with less waste and lower consumption into a set of policies (Gordan *et al.*, 2011; Hunt, 2011; Van Dam & Apeldoorn, 1996). Unlike ecological marketing, environmental marketing does not expect the simple recognition of environmental problems to provoke behavioural changes, these must be implemented by the internal reduction of costs and by governmental legislation.

However, the characteristics of consumption in large quantities and/or variety, have proven to be a strong opposition to this perspective. Several explanations emerge for the hyper consumption of modern Western society. Van Dam & Apeldoorn (1996) distinguish between external facilities and internal motivation factors, which together provide the conditions for the consumer society. One factor is not enough and some of the necessary elements are cause and effect at the same time.

The psychological role of possession and materialistic consumption was underestimated by both ecological and environmental marketing (Van Dam & Apeldoorn, 1996).

Within the marketing theory, support for Sustainability has then been reflected in the appearance of “Green Marketing”. There is no definition of green marketing, but most of the literature describes how companies adapt to increasing consumer demand for “environmentally friendly” products. The biggest difference between ecological and green marketing is that the moral and social motives of the former are replaced in the latter by market pressures. In ecological marketing being “environmentally friendly” is a matter of moral decay, in green marketing is a tool (Van Dam & Apeldoorn, 1996). Green Marketing focuses on the market and the legislative push to promote a “friendly” business performance of the environment.

Both the ecological marketing and the green marketing part of the combination between the need to obtain profit and the sustained quality of the environment for society in general (Gordan *et al.*, 2011; Hunt, 2011; Van Dam & Apeldoorn 1996). There is, then, an intimate relation between the marketing see of and the holistic management because the entire facet of the company is questioned in an environmental context and consequently goes against sustainability.

The green marketing option is described, according to Langerak *et al.* (1998), as a process of interaction between large external political and economic forces (consumer sensitivity to the environment; competitive intensity; and legislative intensity) and internal (environmental awareness of managers; and sensitivity of entrepreneurs to the environment) within the organizational system.

According to the degree to which consumers are committed to environmental issues, with expectations as to the consequences in the business environment and their willingness to exercise power to compel the manager to act according to their expectations, so Consumer sensitivity is determined as the capacity of its influence on the probability of companies adopting green marketing (Langerak *et al.*, 1998).

The competitive and legislative intensity and the increasing pressure applied by consumer groups and other environmental groups lead to the adoption of green marketing in an attempt to shape future laws that are consistent with Environmental standards (Langerak *et al.*, 1998).

Marketing is by nature in a position to stimulate beneficial activities, in environmental terms, throughout the entire organization. According to Langerak *et al.* (1998), the influence of managers on green marketing depends on the degree to which they own, and entrepreneurs are committed to environmental issues. The individual willingness of each manager to exert his influence on other organizational functions,

such as research and development, or production and logistics, are suitable for this type of marketing is also fundamental to the success of the integration of environmental problems in business management.

The success of green marketing is reflected in the responses of consumers and the financial performance of the business. The implications of the performance of green marketing are fundamentally based on the ability of the business to collect premium prices on green products, reduce costs through environmental programs and perform high results (Ottman, 1997; Wazik, 1996).

In green marketing, the proactive elements of ecological marketing are abandoned in favour of an attitude of response being the environmental issues converted into marketing problems. Such posture is both a force and a weakness, according to Van Dam & Apeldoorn (1996). The appetite for environmental issues in companies has increased, but the macro aspect of the subjects is ignored. If there is doubt that green marketing has helped to delay the deterioration of the environment by both product upgrades and the provision of environmental services. However, including the concept of sustainability in the marketing framework does not only imply adding a new element of competitiveness, it is not enough to analyse the extent to which the “green” companies can be profitable and act accordingly (Gordan *et al.*, 2011; Hunt, 2011; Van Dam & Apeldoorn, 1996). Sustainability, as a social objective, includes producers and consumers who, whether they want to or not, need to change their purchasing behaviour.

Despite the success of this perspective and its level of adherence by companies, there were still problems that according to Menon & Menon (1997) would only be resolved if there was an integration of the marketing viewpoints ecological and green in a single enviropreneurial marketing strategy. This strategic perspective focuses on environmental change as an opportunity for innovation to create competitive advantage, improving its performance.

The enviropreneurial marketing strategy is a process of formulation and implementation of marketing activities, beneficial to the company and the environment, with the aim of creating returns through the supply of exchanges that satisfy the business company goals in economic and social terms. What differentiates the enviropreneurial marketing strategy from other environmental-based perspectives is that it adopts a solution of innovation and technology rather than a public and legal pressure solution; it is a philosophy or Business orientation; And it represents the confluence of social performance and environmental and economic objectives (Menon & Menon, 1997).

The basic premise that guides the enviropreneurial marketing strategy is that environmental degradation is the result of the interaction of human experience, technological growth and economic development. Thus, these same forces must be at the root of the solution for environmental problems and not the legal pressure, the laws of command and control and the increased regulation of activities. Contrary to the tendency of legal use and pressure of public opinion to respond to environmental problems, ecological and innovation technologies are increasingly proposed as strategic opinions to develop competitive advantages and solve Environmental problems (Wong *et al.*, 2015; Shrivastava, 1995).

Consistent with this logic, enviropreneurial marketing advocates that companies can reduce environmental problems through innovation, looking for new forms of production, packaging and distribution of goods and services to consumers. In addition, companies can create new forms of destruction or recycling of waste in the production or consumption of such goods or services (Mirvis, 1994; Coddington, 1993). From a theoretical standpoint, environmental problems are increasingly framed as economic problems and the investigation of these issues is being conducted within several branches of research in economic ecology and in the industrial ecology, as Shrivastava states (1995).

Some authors, (e.g. Stopford & Baden-Fuller, 1994; Coddington, 1993; Hunt & Auster, 1990), referred to by Menon & Menon (1997), argue that a basic concept of the enviropreneurial marketing strategy process is the presence of a business philosophy of organizations rather than an administra-

tive or managerial perspective. Consequently, one of the core values that guide this strategic marketing perspective is the view that the imperatives of the environment can be market opportunities rather than business constraints.

In short, the enviropreneurial marketing strategy offers the company a free market perspective to improve environmental concerns. This marketing strategy is essential within the social domain of marketing. The principles of social performance are intrinsic to the nature and objectives of the strategies and tactics of this perspective. Because the natural environment not only influences the strategy as it is essential in it, the enviropreneurial marketing strategy must resolve the tensions between the relative status of the environment and the economic objectives. In this way, the enviropreneurial marketing strategy is built to balance the objectives, needs and environmental and economic themes, representing the merger between the dominant Social paradigm and the new environmental paradigm (Menon & Menon, 1997).

As for many business cases, this last perspective has origin mainly in the social responsibility concerns accomplishment, and we may consider that the environmental concerns, when implemented by business companies, already detain an environmental philosophy so they may transpire a credibility ambience, and that they focuses in strategic and operational actions oriented to the market, in a green point of view (Paiva & Proença, 2011). For this reason, we may call green marketing to the environmental sustainability integration in business marketing.

GREEN MARKETING

Strategy and Operational definition

The demand of environmental sustainability in business, expressed into the green marketing concept, has a translation into management through the business strategy definition that should, in a holistic perspective, incorporate the issues of environmental sustainability from the goal definition to reach until the action details definition to develop. Accordingly to Ottman (2017) a new paradigm is being developed by sustainability business whose basic assumptions to address the market are different looking, now, to

Table 2. The new green marketing paradigm

	<i>Conventional marketing</i>	<i>Green marketing</i>
Consumers	Consumers with lifestyles	People with lives
Products	“cradle to grave” Globally sourced One size fit all	“cradle to cradle” Locally sourced Regionally tailored
Marketing	Products-end benefits Selling One-way communication Paid advertising	Values Educating and empowering Creating community Word of mouth
Corporate	Secretive Reactive Independent and autonomous Competitive Departmentalized Short-term oriented / Profit maximizing	Transparent Proactive Interdependent 7 allied with stakeholders Cooperative Holistic Long-term oriented / triple goals (profit, environment and social contribution)

Source: Adapted from Ottman, 2017

Table 3. Green Marketing Strategies

Strategies centred on development of ecological products /“green”	Strategies centred on alliances/partnerships with NGO	Strategies centred on promotion
§ Designing new products . Replacing environmentally unacceptable products and presenting new ones to balance consumers desire for quality, convenience and affordability with minimal adverse environmental and social impact over the product life. . Develop brands that offer practical benefits and empower consumers in meaningful ways	§ Inspires public confidence in their ecological actions and environmental advocacy groups need more resources and identify the problems they face . To understand deeply the environmental and social beliefs and values of consumers and other stakeholders and develop a long-term plan	§ Independent validation to transmit credibility § Promotion of the business company’s mission and values .Centring communication on environmental problems is not fully effective, depends on the level of knowledge of the problem by the consumer that should be profound; the environmental issue in question; and the communication should make it possible to highlight the perception of the effectiveness of consumer behaviour.

Source: adapted from Ottman, 2017 and Paiva & Proença, 2011

consumers as human beings looking to have a full and healthy lives, where they values and sensitiveness is projected in the materials goods they acquire and life styles they live. So, the production and consumption of material goods impacts in their lives in the short and long term. To Ottman (2017), ecological and social responsible business ally environmental stakeholders in cooperative alliances and work with suppliers, retailers, local governments (Yu *et al.*, 2017; Wong *et al.*, 2015) to manage environmental and social issues throughout their products value chain to seek profit, and business contribution for society and the planet, as she shows in the following table 2.

As we may observe in table 2, the new paradigm of the green marketing concept implies a more transparent and proactive firm, cooperative that wants to answer consumers needs in a more holistic approach transforming the way marketing is defined to address these new challenges.

Under these new rules, business company have different strategies to do response to the market challenges, so specific marketing strategies can be developed to act accordingly to this new sustainable perspective, as it’s possible to observe in table 3:

Table 4. Green Marketing-Mix

Product	Price
• Minimisation of contamination by use or production • Substitution of scarce materials by abundant ones • Customer service advice on ecological uses • Production of recyclable and resource-saving goods	• Direct and indirect product ecological costs • Positive price discrimination • Differentiation of ecological prices
Promotion	Placement
• Ecological awareness-taking product information and ecological production • Promotion by environmental means • information on ecological services of products • Conducting public relations actions on ecology	• Fostering retro distribution • Distribution channels that save the consumption of natural resources • Ecological awareness at the point of sale

Source: Adapted from Paiva & Proença, 2011

All the above strategies should continuously strive for “zero” impact and towards a transparent, credible effort of the business company that has to go beyond what is expected from the stakeholders proactively committed to do their share of solving environmental and social problems (Ottman, 2017).

In a more operational perspective and integrating into the definition of the operational axes of marketing, we can still perceive how the incorporation of the demand for environmental sustainability is reflected into the business marketing-mix, as shown in table 4.

This specific and operational issues help business firms to pursue a green marketing strategy and to implement a more effective “zero” impact goal while seeking for income and environmental and social contribution.

SOLUTIONS AND RECOMMENDATIONS

This green marketing paradigm is here to stay. Business companies independently from their dimension and activity must make the effort to adapt and become credible and environmental and socially responsible. It's also true that since business firms are in majority of small and medium size, it means that they will need more help in finding the financial, human and materials resources to adopt technology and innovations and perform accordingly with environmental and social concerns. Although their size, in the other hand, facilitate the change implementation.

The cooperation between business and environment and social NGOs are very important to knowledge transfer for the firms into the main issues that they have to address regarding environment impact and social consequence of their activity. Education and training are fundamental not only to help consumers to become more aware of the environmental issues but also to business know how to perform accordingly to this new paradigm. Only then their performance is credible and with a concrete consequence and contribution appreciated by the society. Other important issue is regulation and support policies that governments have to make business comply to help them to make the adequate changes, in a network and collaborative perspective.

FUTURE RESEARCH DIRECTIONS

Consumer behaviour and business adaptation to the market are constant needs and consequently a continuous monitorization and evaluation of the green behaviour in both actors is important. The evolution and development velocity is of high speed and business don't have time to make their decisions based in the same time of analysis, so the integration of new technologies also in business management is crucial to increase the capacity of making decisions in due time to solve offer value to the market and help individuals to be able to be better consumers in an environmental perspective. These new technologies must have a role identical to the social media, connecting business companies to communicate and collaborate into a better world and therefore enhance the impact on society and speed it up to change behaviours. Marketing here have an essential role too since it has tools of communication (digital marketing) adequate to help business to do it.

CONCLUSION

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In this article we may observe the evolution path of the green marketing concept. It appeared because of the environmental and sustainable consumers concerns integration into business management, in its constant seek of needs and human concerns, and overall society, adaptation. In this sense, marketing was named in different ways until the denomination of “Green Marketing” became more widely used due to its simplicity in aggregating several sustainable environmental questions and concerns, in the consumer and business perspective. Nowadays the green marketing concept integrates a holistic perspective, questioning the different entrepreneurial activities in an environmental and sustainable context. This concept sheds the ecological marketing moral and ethical vision in a market perspective, using the marketing tools, the legislation and social pressures of diverse social agents (environmental organization and others) to promote an entrepreneurial performance “environmentally friendly” seeking the balance between the consumer sensitivity to the environment, the competitive and legal intensity and the conscious and environmental sensitivity of the managers and entrepreneurs.

Its also possible to see, here, the different strategic options, and operational guidelines, to define a green marketing path in this confluence of social performance and environmental and economic goals. In a world that already feels the obvious consequence of environmental destruction its urgent to disseminate this business perspective, to help firms to give a proper answer to the society needs and become themselves a sustainable contribution with a positive social and environmental “zero” impact.

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KEY TERMS AND DEFINITIONS

Anthropocentric: Perspective regarding humankind as the central or most important element of existence.

Dominant Social Paradigm: The view that humans are superior to other all other species considering that Planet Earth provides unlimited resources for humans, and that progress is an inherent part of human history.

Eco-Centric: Perspective that regards all living organisms and their natural environment as central or most important elements, regardless the importance of humankind.

Green Marketing: Consists of all activities designed to generate and facilitate any exchanges designed to meet human needs and desires, such that satisfaction of needs and desires occur with the least detriment of the impact of Natural environment.

New Environmental Paradigm: The view that humans represent only one among many species on the Planet Earth, that human activities are determined by the environment as well as by social and cultural factors, and that humans are strongly dependent upon the environment and its resources.

Social Marketing: Is the project, the implementation and control of programs designed to influence the acceptability of social ideas, involving planning considerations, pricing, communication and product distribution and market research. It's an informed marketing principle that advocates that a company should make its marketing decisions considering the needs of consumers, the needs of the company itself, the interests of consumers in the long term and the interests of society in the long run.

Internet of Packaging and the Bridge Between Digital Marketing and Physical Retailing

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INTRODUCTION

In the past decades, the world has experienced the quite significant rate of change and speed of advancement in the consumer market (Mason, 2010). In order to fulfill growing consumers' demand and requirements, businesses are not only increasing their capacity of production (Aarnio & Hämäläinen, 2008), but also the means to sustain their competitive advantage among others. Consequently, the growing competition has led to the expansion of diverse marketing and branding techniques applied in both digital and physical retail environments. Traditionally, before the industry has begun to shift from information age to communication and interaction, advertising was referred as the principal method for marketing (Ford et al., 2012). However, the conventional mass media approaches were becoming less effective due to decreased impact on consumers and reduced budgets (Clarke, 2017; Ampuero & Vila, 2006). Therefore, businesses were in need to come up with other promising and preeminent marketing tools.

Underwood (2003) and Loucanova et al. (2017) claim that the potential of product's packaging has been largely overlooked in terms of brand symbolism and communication. Overall, it is the packaging that attracts the consumer's attention at first (Asgari et al., 2014). It is evaluated that 50-70% of shoppers make their decisions in-store (Lamey et al., 2018). Likewise, 73% rely on packaging, whether to purchase a product or not at the supermarket (Sudbury-Riley, 2014). Krishna et al. (2017) contribute to authors and add that package is the outfit of the product and can directly affect the perception of its quality and functionality, consumer attention and comprehension of offered value; thus packaging cannot be longer used only for preservation and handling purposes. According to the authors, the industry of Consumer Packaged Goods (CPG) packaging is heading to different designing directions due to new trends in enabling technologies, sustainability, functionality, and consumer engagement. Regarding the latter, both Krishna et al. (2017) and Lamey et al. (2018) agree that businesses should manage and design their product development and innovation processes including consumer preferences that is well-defined in the concepts of shopper marketing and sensory marketing. The development of product's packaging with more sensory-based engaging and interaction frames a unique consumer experience with the aim to create additional value that affects the formation of long-lasting brand-consumer relationships (Krishna et al., 2017).

On the other hand, traditional consumer packaging is placed in the physical retail environment. Although retail is one of the world's biggest industries regarding employment and revenue, more and

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more products are nowadays marketed and sold via digital platforms. According to Tambo (2015), the development rate of e-commerce is significantly higher than physical retailing that is largely at a stand-still. As a result, the phenomenon of omni-channel retailing (ability to browse, test, buy and return goods using all conceivable sales channels e.g. e-commerce, shops, markets, games, etc) has emerged aligning both physical and digital retail channels with the help of advanced technologies to provide complete consumer experience and operational effectiveness across the processes (Tambo, 2015). For instance, technological capabilities of augmented reality merge digital and physical experiences by introducing interactive fitting rooms and mirrors, image tracking digital boxes, and tablet computing in the stores (Bodhani, 2012). Likewise, the traditional consumer packaging that used to communicate with consumers in monologues, e.g. how to consume, store or dispose the product, has evolved and started to create conversations and dialogues with consumers (Krishna et al., 2017; Mumani & Stone, 2018). The latest technologies of the smart interactive packaging industry allow to actively sense the status of goods and wirelessly communicate it to logistics participants (Kang et al., 2014), as well as guide product innovation and marketing due to gained feedback from consumers (Krishna et al., 2017). Smart interactive packaging has a potential to connect both online and in-store retailing in order to improve and act as an intermediary between the brand and consumer due to advanced level of knowledge distribution.

According to Kaivo-oja et al. (2015), the intelligence and smartness provided by enabling technologies have an influence on changes in organizational cultures, especially in knowledge management, including knowledge development, transfer, and usage. Weaven et al. (2014) describe knowledge management as an activity that encompasses coordination, cooperation, and learning exchange to contribute to innovation and create value. Authors define knowledge management as the main source of competitive advantage, and therefore if brands are keen to sustain their market positioning, they have to create an environment of effective knowledge sharing. Kaivo-oja et al. (2015) concur that the critical part of management systems is knowledge integration. In relation to retailing, goods are known digitally until they leave the factory door, enters the store or leave the store, and thereby it is important to notice that the very most of CPGs are created and marketed digitally. Consequently, there is a massive knowledge creation related to demand planning, sourcing, product replenishment, visual merchandising that is done long before a product reaches a shelf. Furthermore, brand promotion, consumer profiling, consumer loyalty and campaigns are mostly executed digitally along with e-commerce practices. As a result, this as-is situation of CPG as being fully virtualized before they become physical make the smart interactive packaging a logical next step by making the knowledge created on digital platforms coherent with knowledge presented on physical product's packaging. Smart interactive packaging suggests retaining the digital tracking of the individual product. In a context of customer experience, data of interest for the consumer can be utilized just as much as data of interest for retailers, brand owners, marketing analysts.

As of today, interactive packaging can tell small stories and connect the consumer with the brand using URL's, QR-codes, identification tags and other. In line of numerous consumer products from light bulbs to toothbrushes to building comfort to smart watches, it is expected that also packaging will be more 'intelligent' with wireless connectivity at large to the surround environments of retail and consumer networks. However, the potential distribution of knowledge offered by this technology is not well explored. Defined by the concept Internet of Packaging (IoP), it is expected that CPG packaging encompassing active elements of digital technologies will not only enable greater interactivity between consumers and products but also introduce a bridge between existing digital and internet-based representations of products. Therefore the aim of this work is to discuss, define and analyze a set of perspectives and potentials of smart interactive packaging applied to CPGs to fill up the space between marketing and physical retailing in terms of knowledge distribution. This research is a qualitative study of Internet

of Packaging phenomenon, and it is based on extensive literature review focused on scientific articles linked to enabling technologies of smart packaging and knowledge management.

BACKGROUND

Smart Packaging

Before enabling technologies such as augmented reality, printed electronics, nanomaterials and Internet of Things (IoT) were introduced to the market, traditional packaging served as means of protection, preservation, communication and convenience (Lydekaityte & Tambo, 2018). However, the growing competitiveness, changes in consumer demand and behavior, increased interest in product's security, and others have led to the improvement of the primary packaging functions and thereby to the emerge of smart packaging. In general, smart packaging utilizes advanced technologies either to improve its main functions or to add new functionalities in comparison to traditional passive packaging (Brockgreitens & Abbas, 2016). In addition, smart packaging creates a firm link between the good, package and surrounding environment. The way such enhancement and bond are formed divides smart packaging into the following categories: intelligent packaging, active packaging, ergonomic packaging and interactive packaging (Kontominas, 2015; Mlalila et al., 2016; Biji et al., 2015). For example, active packaging employs active nanomaterials to prolong product's shelf life and its quality, whereas intelligent packaging monitors the condition of packaged goods and surrounding environment to inform users (Sharma & Ghoshal, 2018; Loucanova et al., 2017).

Smart Interactive Packaging

Contrary, interactive packaging goes beyond the traditional one-way informational flow (Mumani & Stone, 2018) and potentially expands communication by triggering dialogue between the package and consumer at several user interface touch points (Ryynänen & Rusko, 2015). Interactive packaging aims not to preserve goods, but to enhance consumers' experience and products' functionality. Recent improvements given by augmented reality, printed electronics and IoT allow packaging to embrace the digital transformation and become network-connected (Nilsson et al., 2012). Internet of packaging is driven by advanced communication systems combined by several enabling technologies from different providers. For instance, printed electronics uses nanomaterials, as conductive silver, graphene, carbon inks, to produce electronics, as NFC tags, sensors, antennas that later is attached to the packaging design and due to IoT is connected to a network. Additional digital functionality provided by interactive packaging further improves the story-telling capability of the packed goods and connects brands with their consumers in novel ways (Lydekaityte & Tambo, 2018). As a result, especially in the Consumer Packaged Goods industry, the internet of packaging might be an essential tool to enable business development and innovation.

Interactive packaging is considered as a new trend among designers, manufacturers, brands and consumers that approaches and challenges current branding and marketing techniques. Wyser et al. (2016) defines interactive packaging as a potential enabler for greater consumer engagement and communication through various elements as URL's, QR-codes, augmented reality and other. Although the concept of interactive packaging generally involves the appliance of a mobile, digital, wireless or other types of high-end technologies, in some cases, visual or structural changes in packaging design might

also summon the reciprocal action from consumers. Therefore interactive packaging systems can be both technology- or design-driven. Based on the literature (Lingle, 2015; Heather, 2015; Wyser et al., 2016) interactive packaging:

- Empowers consumers to interact with products on a whole new level.
- Engages the user beyond standard/passive use.
- Lets the brands to stand out on the shelves, captures consumer attention.
- Provides unexpected ways to utilize or consume the packaged product.
- Creates bounds and physical interactions with the product or package.
- Adds digital user experience to products.
- Uses mobile technologies to extend package's functionality.
- Encourage deviation from routine.
- Provides limited edition and short-run offers or appears only at special events that increase exclusivity among consumers.
- Connects with consumers on a personal level.

Since IoP is consumer-oriented, consumer engagement and entertainment are highly maintained during the interaction. Plus it is based on reciprocal actions between a human-being and a physical object; thus the participation of the user is critical.

Contemporary application examples are e.g.: (1) A company making bottle caps with a wireless sensor that can measure opening, closing and fluid level. This can be used to support personal water intake levels. (2) A company is making touch sensitive printed packaging with added electronics so a used pizza box can be used as a mixer for some modern music. (3) A tequila company is connecting customers to a sports betting company and giving betting money for a certain sports game through a wireless sensor glued to the bottle cap and label. (4) Medicine packaging equipped with smart tags can use smart phones to help patients in ensuring correct medicine intake; moreover use-before-dates can be monitored and information can be forwarded to the doctor.

Classification of Interaction-providing Environments

Ryynänen & rusko (2015) state that the development of consumer-oriented interactive packaging benefits businesses on several levels/environments. In fact, in each environment packaging has to possess and perform different features and functions related to interaction with the user, i.e. Techniques used to get products onto store shelves are not the same for getting products into consumer's hand. Generally, there are two different consumer-centered experiences: pre-purchase experience with the aim to make consumers buy the product, and post-purchase experience that aims to prolong interaction with the product. Moreover, interactivity can also be applied before the product reaches store shelves, i.e. User-centered interactivity throughout the supply chain. As a result, there are three main levels where the packaging has the capability to interact with the user:

- The supply chain: handling, storage, transportation, warehousing, etc.
- The retail environment: physical marketplace (e.g. on the store shelves), online marketing (website).
- The usage environment after purchase: at consumers' home or any other particular environment, where a consumer is consuming or utilizing the product.

In the supply chain environment, interactive packaging enhances the way information about the product is stored, disclosed or transferred, thus the application of advanced technologies such as RFID tags is a great way to ensure protection, security and interaction at the same time (Brockgreitens & Abdenmour, 2016). Two-way communication between (1) producers, suppliers, and distributors, and (2) the packaging is usually enabled by the action of frequency scanners or smart devices that read the transmitted data from any smart tag. According to Heather (2015), smart packaging with integrated wireless technologies provides identification and serialization of products to guarantee their traceability and counterfeit protection.

According to Wever (2016), in the retail environment packaging plays a significant role as marketing and branding tool in order to attract attention, communicate and persuade consumers to buy the product. Heather (2015) contributes with the author and states that as consumers typically have a pre-conceived idea of what brands they will purchase before entering the store, it is essential to capture their attention and encourage deviation from their regular routine. Moreover, since consumers perceive a package as a part of the product or as one entity with the product, packaging is considered as a product property or characteristic (Ryynänen & Rusko, 2015). Consequently, packaging also reflects on product's quality, and therefore it is one of the most critical extrinsic elements that have an impact on the decision-making process during shopping and intent to recommend the product to others. As a result, the main feature of the packaging in the retail environment is visual awareness, i.e., packaging has to look desirable. Besides distinctive graphical and structural components (Ryynänen & Rusko, 2015; Underwood, 2003), added interactivity is another trigger to start the conversation with potential buyers.

On the contrary, visual awareness is less significant in the use environment, once the product is purchased. Other features as usability, functionality, smooth operation, convenient consumption, consumer experience take over the attributes related to visual performance in the marketplace (Mumani & Stone, 2018; Underwood, 2003). Package has to provide convenience during handling at home, where such issues as easiness to open and close, dispose and recycle become relevant (de la Fuente et al., 2015). Usually, consumers do not think about these concerns while shopping. In general, a usage situation stimulates more memorable feelings than a purchase situation, therefore the effective interactivity improvements in this environment might influence the consumer to become loyal and or purchase the product again (Ryynänen & Rusko, 2015). Tafesse (2016) contributes to the statement of more memorable feelings and agrees that visual impact is not that powerful as a physical one. Although both may make an emotional connection, by the physically interacting with a product, consumers are bound to remember it more readily that brings to higher enhancing of engagement.

FOCUS OF THE ARTICLE

The concept of IoP allows enhancing consumers' interaction, engagement and entertainment due to advanced digital capabilities. However, the potential of such digital innovation is not yet fully explored, whereas the other smart packaging types, active and intelligent packaging is well-researched and already commercialized mainly for food products. For instance, there are numerous researches investigating and evaluating various active nano-based substances and composites as packaging materials (Piaskowska et al., 2016; Youssef et al., 2015; Asgari et al., 2014; Mlalila et al., 2016; Bradley et al., 2011; Brockgreitens & Abbas, 2016; Wyser et al., 2016) with the aim to enhance product's quality that in turn benefits retailers due to prolonged shelf-life in the store. Likewise, intelligent packaging with integrated RFID systems already detects, senses and records changes to provide the current status of the packaging and

alert about possible issues in the supply chain during warehousing, stacking and transportation (Loucanova et al., 2017). While such packaging ensures improved monitoring and preservation of packed goods rather than the improvement of product functionality and consumer engagement, brands are still in need to find better ways to connect with their end consumers, build stronger relationships and prolong consumers' experience with their products. Consequently, new forms of interactive packaging can contribute to retailer's differentiation, optimization, and connect in-store and at-home experiences with the brands' digital marketing activities (Lydekaityte & Tambo, 2018).

In order to meet such goals, retailers and brands expect the product packaging placed on the shelf to:

- Attract consumers' attention by creating an aesthetic and exclusive visual presentation achieved by changes in shape, color, typography and other (Ford et al., 2012; Mumani & Stone, 2018; Orth & Crouch, 2014).
- Contribute to competitive advantage by facilitating recognition and differentiation of the product and brand (Ford et al., 2012; Underwood, 2003).
- Communicate brand values, imagery and identity to have a direct effect on consumers' perception on a product (Ford et al., 2012; Ampuero & Vila, 2006).
- Facilitate the decision making in-store and persuade the consumer to purchase the product based on its visual packaging appearance (Ford et al., 2012; Mumani & Stone, 2018).
- Promote and advertise both the product and the brand (Ford et al., 2012; Underwood, 2003).
- Represent an opportunity to enhance the market value of a product (Mumani & Stone, 2018) or open new markets driven by technology-related innovation (Bradley et al., 2011).
- Provide a live experience between consumer and brand to maintain loyalty and gain feedback (Ampuero & Vila, 2006).

On the other hand, packaging has to meet different requirements and aims in terms of consumers' once it has been purchased and brought home:

- Enhance functional utilities as storability, handling, portability, easy opening, re-closing, disposal and other due to user-centered design (Underwood, 2003; Mumani & Stone, 2018).
- Facilitate not only easy but also smart and preminent consumption and utilization of the packed product.
- Become intimate part of consumers' life (Ampuero & Vila, 2006).
- Collect data, analyze consumer behavior and preferences, assess retrieved information, and provide insights, as dashboards and personal profiles.
- Build consumer-brand relationships through sensory-based interaction (Underwood, 2003; Ford et al., 2012).
- Enhance consumer experience and increase their satisfaction with the product through improved product's functionality (Ryynänen & Rusko, 2015).

Retailer and consumer needs must be balanced. At best these needs and design features could be integrated. With the retailer as the more professional part, IoP must meet professional requirements in terms of e.g. using established standards, reliability, precision, durability. With consumers there might be more flexibility understood as the consumers primarily might seek utilitarian value and view customer engagement and digital experiences as secondary unless stronger promises are given. The subsequent

sections are following the issue of balance between IoP at in-store facilities versus IoP in the post-store sphere of consumption and value offering.

SOLUTIONS AND RECOMMENDATIONS

The technology is the key driver and contributor to the growth of the smart interactive packaging industry. As the name implies, interactions are achieved by integrating enabling technologies that are available or in the development today. Literature (Heather, 2015; Wyser et al., 2016; Gao et al., 2010; Yoon et al., 2015) suggests a wide range of high-end technologies applied into packaging design, as nanotechnologies, smart sensors, conductive inks, printed smart tags, RFID, Near Field Communication (NFC), Bluetooth Low Energy (BLE), augmented reality, mobile, computing and communication devices, haptics or tactile feedback, powerful coding systems for protection, and Internet of Things. Furthermore, while companies are developing various wireless internet-connected communication technologies, mobile device industry has been challenged to meet the growing needs of such innovations. The breakthrough of smart handheld devices equipped with bigger displays, integrated powerful central processing unit, advanced software, reduced-size hardware components, GPS, accelerometers, solid-state compasses, cameras, inertial sensors, and network protocols made smart interactive packaging applications feasible (Yang et al., 2018). Plus due to their higher portability, smart devices are already widespread and introduced to a mass market (Carmigniani et al., 2011). Consequently, the importance of mobile devices in various business processes is expanding, including logistics, warehouse, and even retail environments.

The cooperation between mobile devices and enabling technologies becomes a channel for knowledge distribution and story-telling among the consumer, packaging and brand. On the one hand, the capabilities of joint technologies allow IoP to convert the story told by the digital marketing into a physical artifact presented on the physical retail shelf, as well as to connect and align those stories with the actual products. On the other hand, since IoP uniquely identifies objects and provides their virtual representations (Kaivo-oja et al., 2015), as well as collects and exchanges data through a common network-connected platform that further can be assessed and analyzed (Meola, 2016), it contributes to product and service innovation and enhancement of overall business model of the company.

Connected Stories in Physical Retailing and Online Marketing

First of all, smart interactive packaging creates and enhances experiential, attentional and informational perceptions in the physical retail environment (Krishna et al., 2017). Since packaging is expected to attract attention, create differentiation, reflect on brand qualities and in turn persuade consumers to purchase the product, various distinctive interactive light emitting components as OLEDs, electroluminescent inks, SMD LEDs, as well as printed speakers and displays are integrated into packaging design (www.saralon.com; www.novalia.co.uk). Moreover, a product's quality perception can be highly influenced by authentication, fraudulent-registering and identification systems provided by NFC technologies (www.thinfilmnfc.com). In addition, the majority of high-end technologies applied to a package design employ mobile devices. Each packaging with integrated RFID, NFC or augmented reality technology needs a simple scan or tap that can be performed with a mobile device. Consequently, consumers more than ever use their smartphones to engage with brands in order to discover products, get special offers or have access to additional information about the product, such as the origins of the product, ecological aspects, possible allergy risks, exclusive producer insights and other directly in the retail store. As a

result, mobile devices are becoming an integral part of pre-purchase situations in the retail environment. Krishna et al. (2017) also suggest that packaging is able to engage consumers due to haptic components. For instance, packaging will send a more persuasive marketing message due to incorporated touch elements as printed capacitive touch buttons that redirect consumers to digital platforms on their phones. It is more likely that the product will be bought based on enhanced haptic experience improved by PE, conductive ink, and wireless tags technologies.

Smart interactive packaging catches consumers' eyes and increase the chances of the product to be bought by the trigger of the momentary and instantaneous desire to buy the product due to its unique appearance and provided additional relevant information. However, marketing analysts must predict and foresee what information would fit the best to achieve the highest level of consumer engagement. Therefore, IoP-enabled wireless communication technologies not only interact with shoppers, but at the same time accumulate in-store consumer data and sensory feedback regarding purchasing habits (Berman & Evans, 2003), shopping activity (Tambo, 2018), behavior (Flogera, 2015), preferences, and other. The integration of smart interactive packaging increases the knowledge distribution and management to design consumer-tailored systems for higher market value (Poyatos-Racionero et al., 2018). Therefore knowledge collected in the physical retail environment should be transferred to other stakeholders related to product and packaging development. Flogera (2015) states that knowledge starts at the design process of a product; thus data of consumers shopping experiences has to be included in the first steps of the development.

The other marketing approach enhanced by smart interactive packaging is a story-telling by various limited edition and special offer advertising campaigns that invite consumers to experiment to either co-create custom products or engage with the goods in unexpected ways due to combined digital marketing and physical retailing. Therefore brands are in need to reflect their online marketing campaigns on their physical products to communicate the continuous and integral flow of information.

Product Innovation Smart Interactive Packaging Links Physical Retailing and Online Marketing

Second of all, smart interactive packaging simulates more memorable experiences than purchase situations and thereby creates physical impacts and emotional connections that result in a higher level of consumer engagement followed by enhanced consumer-brand relationships and increased consumer loyalty (Lydekaityte & Tambo, 2018). Generally, at home consumers can be attracted by (1) improved ergonomic function of packaging as easy to open, dose, re-close or dispose, (2) enhanced product functionality by packaging, or (3) created an unexpected feature, repurposing. The first one is closely related to technology-driven ergonomic packaging with an interactive improvement in the form of a NFC-based "talking label" on pharmaceuticals packaging that reads instructions for visually impaired people by simply pressing particular part of the label or scanning it with your smartphone. Also, packaging has an ability to improve the functionality of a product it contains to serve either its primary initial purpose or unexpected one better.

A good example of such packaging is a cardboard packaging of beverages that transforms into a board game and utilizes bottle caps as game tokens. The initial purpose of that packaging is to facilitate convenient handling, whereas enhanced packaging design improves the consumption process and consumer experience by adding more engagement. On the other hand, the majority of improvements are technology-driven, where a product's packaging continues the conversation with the consumer to

facilitate not only consumption but also his well-being. For instance, smart caps allow tracking sufficient consumption of water, or the proper dosage and reminders for medicine.

On the other hand, smart interactive packaging also contributes to product innovation. Although the packaging is purchased and brought home, it still remains active and generates data that is transferred back to the brand-owner or retailer for further analysis for product and services improvement. IoP accumulated data enables reciprocal actions between manufacturer, brand and consumer and goes beyond the traditional one-way knowledge flow of product development. Therefore it is relevant to monitor and track changes towards consumer behavior at home. According to Weaven et al. (2014), knowledge management should access, interpret and convert gathered information into usable resources to influence product innovation, collaborative learning and value creation to consumers. Knowledge management is a principal strategic factor in the industrial environment (Cerchione & Esposito, 2016).

FUTURE RESEARCH DIRECTIONS

Future research in the field is expected to relate to implementation and value creation in the line from brand owners to consumers. The technology's ability to convert knowledge from marketing and consumer services should be better supported by packaging design as well as supporting digital services. Also, the utilization of data harvested from the interactive packaging processes must be better supported to let the brand owner swiftly react on signals from the consumers in identifying opportunities and streamline marketing efforts. The future research should follow standardized enterprise modelling frameworks and architectures to ensure integration into stakeholder organizations' enterprise information systems. The enterprise modelling could follow e.g. the Zachman framework of Enterprise Architecture (Lapalme et al., 2016) in order to connect and align business strategy, operations, data, systems, applications and infrastructures. By following such standards systems and service architectures could optimally be connected for validation of key issues of business value, interoperability, scalability, measurability and similar key design objectives for enterprise integration of IoP.

In designing future research based on standards for enterprise modelling, customer interaction patterns could beneficially be mapped using well established elements of interaction design such as personas, use cases, customer journey mapping along with theory of technology acceptance on both short and long term. For the use in retail environments, employee experience design and work systems analysis comes into importance and existing academic guidelines should be followed (Alter & Recker, 2017).

CONCLUSION

To conclude, in highly competitive markets businesses are looking for new approaches to connect with their consumers. As a result, smart interactive packaging is able to improve packaging communication in relation to enabling technologies and communication devices. IoP-enabled consumer packaging acts as a channel for knowledge distribution and story-telling between brand-owners, retailers and end consumers. Firstly, smart interactive packaging is able to connect digital marketing and physical retailing in regards to packaging features supplemented with digital elements of marketing-based stories. However, there must be an alignment between the represented additional information and the actual consumer preferences to achieve the highest level of consumer engagement. Secondly, due to collected, analyzed and assessed consumer data, smart interactive packaging contributes to product and service improve-

ment and new product innovation that in turn affect the overall business logic of the firm. Therefore it is relevant to monitor and track changes of consumer behavior towards product's packaging. Moreover, smart interactive packaging at home environment strengthens the emotional and physical connection to the brand and products, and thereby builds and maintains consumer-brand relationships. As a result, IoP-enabled consumer packaging has a great potential to bridge physical and digital platforms, create new value propositions to consumers and overall business model of a company.

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KEY TERMS AND DEFINITIONS

Consumer Interaction: Enhances consumer experience to create emotional, sensory, and physical connections by engaging and entertaining the consumer through interactive packaging solutions.

Customer Journey Mapping: A tool for identifying and analyzing logics, pathways and efficiency of the interaction between an organization and the consumers. It applies both to digital and physical customer interactions. It is motivated by the fact that consumers typically need to take several actions to obtain a service or goods. Like “find good”, “place in cart”, “go to cashier line”, “pay” as positive examples.

Customer Touchpoint: Any point of encounter of between a product or service offering and consumers. In physical business, it relates to all types of physical impressions and interactions leading to customer satisfaction or dissatisfaction. In digital business, it relates similar encounters e.g. in search results, as advertisements, in blogs, news posting, company websites, mobile data, etc.

Engaged Home Environment: An environment, where the product is consumed or utilized by the end consumer, once it is purchased. Usually visual awareness is less significant in this environment, thus packaging design has to reflect upon convenience in handling the product and facilitating consumption.

Retail Environment: Physical stores with “stores as a brand” (Woolworth, Walmart, Galleries Lafayette, Auchan) or “branded stores” (Levi’s, Apple, Zara, H&M, Vero Moda). The meeting point between consumers and CPG’s. The packaging design in this environment has to attract attention and persuade consumers to purchase the product.

Smart Interactive Packaging: Creates a two-way communication between the user and the package by using design-based or/and technology-based systems in order to enhance consumer experience and engagement or/and functionality of the product.

Smart Packaging: Incorporates advanced technologies to enhance the primary function of packaging or adds new functionalities.

Intelligent Assistants and the Internet of Things as the Next Marketing Landscape

13

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INTRODUCTION

For several decades a series of recurrent and distinct paradigm shifts has occurred in the capabilities and applications of Internet technologies. Beginning with the concept of Web 2.0, conceived by DiNucci in 1999 (Aced, 2013), it has become a common and conventional conception that beginning with the World Wide Web's commercial availability in the 1990's, a new iteration in its character and contours emerges approximately every ten years. Accordingly, these defining intervals of the Web's evolution is summarized as:

Web 1.0 (1990-2000) – Read Only ... mainly used by companies and personal websites to show their information.

Web 2.0 (2000-2010) – Read and Write Web ... also known as the “The Social web” ... users were not only able to read the websites but they could also interact and connect with other users. Blogs, Facebook, YouTube all began in Web 2.

Web 3.0 (2010-2020) – The Semantic Web defines organized or structured data to simplify automation, integration and discovery across multiple applications ... focuses on the intelligent connection between people and machines ... and ... with devices using Internet.

Web 4.0 (2020 and 2030) – The Intelligent Web ... computers will turn into personal assistants using virtual realities, all house appliances will be connected to the internet ... highly intelligent interactions will take place between machines and humans.

Web 5.0 (2030...) – “The Telepathic Web”... highly advanced, complex ... brain implants ... will give people the power and ability to communicate with the Internet through thoughts. All kinds of payments will be made by using a microchip in the brain or on the hand and all of the devices will be connected to the internet and will be controlled by the humans either through mobile apps or through their thoughts. (Smith, 2018)

With new iterations of the Web, the essential computing platform configuration and user interface used to connect and interact with our ever-expanding digitized world also changed. Over the course of the past three decades portals to the digital world have expanded from desk and laptop pc's, to mobile phones and tablets. Input modalities have gone from moving a mouse, typing keywords, clicking but-

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tons and hyperlinks to tapping apps, pinching pages and swiping screens. Society has lived through the “Google-dominated web-based information retrieval of the 00s, yielded to the Apple-Android mobile duopoly and the warehouse of apps paradigm of the 10’s,” have entered an era of “intelligent cloud computing” that is increasingly guided by AI infused apps and services and are now moving to the next iteration, Web 4.0, which will be defined by “ambient computing via the Internet of Things” (Ward, 2016). Together with ongoing exponential take-off of the Internet of Things (IoT), the emergence of voice-based virtual assistants as a primary user interface provides the necessary and sufficient condition for the next paradigm shift. Advancing the proposition that platform and user interface (UI) shifts go hand and hand, Kinsella (2019) observes,

voice assistants represent the third key UI and technology platform shift of the past three decades, following the web in the 1990’s and smartphones about 10 years ago ... The World Wide Web was built on the back of the Internet, and PC proliferation enabled web pages to be easily accessed. Smartphone mobile operating systems such as iOS and Android were important developments, but the app economy also relied on the introduction of cloud computing for efficiently delivering content along with regular feature updates and performance enhancements. Voice computing relies on artificial intelligence for speech recognition and natural language understanding.

Transformation to this new paradigm will be both simple and swift. Indeed, if for no other reason that humans generally speak three times faster than typing (Leonard, 2019), it is a safe bet that “natural language will be the primary interface in the era of ubiquitous and mobile computing ... In the past, we had to learn the computer’s interface; now we get to interact with the computer using the human interface—natural language” (Lam, 2019). Whereas, consumers needed to learn new coding languages and techniques for interacting with previous technology platforms, “the shift to voice doesn’t require any training ... users simply “speak” as they do naturally (Kinsella, 2019).

This entry explores the ramifications of this latest technology platform shift. Just as the Web precipitated the emergence of e-commerce and the smartphone enabled the explosion of social media, the advent of a voice-based interface that allows people access to, communication with, and control of most anything in our world—via the IoT. Accordingly, the objectives of this entry are threefold: review the findings of these initial, and other related articles, in the context of their relevance to the changing business/ marketing landscape defined by voice based interface (VBI) to a world connected to an Internet of Intelligent Things (IoIT); understand the technical specifications and broad-based applications of VBI will be delineated along with the ramifications occasioned by the global diffusion of the IoIT; and, explore the ramifications of this new landscape will be examined through analyses of the most prominent examples of digital assistants that are in use or development.

BACKGROUND

Today, people have access to digital assistants that can instantly access and analyze any type of data (structured or unstructured) across multiple databases and answer (in the language of your choosing) any question you propose. There are an ever-expanding variety of digital assistants readily available with a simple salutation, to serve as a personal concierge. In addition to organizing a person’s everyday activities and controlling every system in their life (home entertainment, security, utility, appliances), these personal digital assistants can also serve as virtual companions and friends that know every mood,

taste, and desire. Programmed to know a person's exact mix of personality traits and accurately predict every move and preference, today's digital assistants are quite capable of being *very* personal indeed.

Society is on the cusp of a time wherein all will be able to take on the powers of a Dr. Dolittle, but instead of talking to all the animals, people will talk with all the “things” on the Internet. People live in a world where the possibility exists to construct a digital twin that monitors every action, learns patterns of speech and behavior, and anticipates every need; instead of a physical “mini-me,” there is now a virtual “digi-me.” Moreover, it is predicted that in the not too distant future, the powers of a person's “digi-me” will prove superior to people's mere mortal selves as it takes on the ability to remember and access everything experienced throughout an entire life. As envisioned by Roemmele, by using technology that already exists today, his “Intelligence Amplifier” will “capture and store, from the moment you're born to the moment you die ... everything you've ever seen, everything you've ever read, every comment you've made, every comment you've heard” (Fisher, 2019). Today, there exist only 61 known cases of hyperthymesia, a condition that “causes people to remember just about everything that has occurred in their life ... every conversation and emotion ever experienced ... every person encountered, regardless of how insignificant or minute” (Malcolm, 2019). With digital assistants empowered with Roemmele's “Intelligence Amplifier,” the number of people on earth with “digitally-induced hyperthymesia” could easily rise from 61 to 6.1 billion.

The Changing Business and Marketing Landscape: Research and Observations to Date

Throughout the last decade there has been an exponential increase in the number, variety, and capability of marketing applications, platforms and services that perform, control, influence and/or integrate virtually every marketing task and decision. In 2011, when the monitoring of the Marketing Technology (MarTech) Landscape began, only 150 applications were available to marketers. By 2018, over 6,800 automated and cognitive process applications were available. As of 2019, it appears that the world has reached peak “MarTech,” as the number of solutions only increased by about 200 to reach 7,040 (Aussant, 2019). It is now the case that for any and every marketing function and task that needs to be completed, there is “an app for that.” Currently, there exist at least 370 apps for e-mail management, as there are hundreds to select from for any and every marketing task—search engine optimization, website design and analytics, social media monitoring, customer transactions, profiling and relationship management.

As more companies begin to employ more technologies to perform tasks across more functions of the organization, roles and workflows are being reexamined and subsequently reimaged and restructured. This is becoming the case, one only need examine the evolution of the technology stacks submitted the past five years by scores of companies to the Stackie Awards (Brinker, 2019). Herein, companies annually compete on the basis of what company can best illustrate the number and variety of marketing technology tools that they use to conceptualize, conduct, and advance their marketing activities. No longer is an organization's competitiveness defined by an organizational chart that only lists the names, titles, and hierarchical positions of the people that run/manage the business. Increasingly, an organization's competitiveness is being defined by and dependent on the collaborative intelligence derived from the software tools, services, and interconnections that a company uses to effectively execute every business activity across every function. As most every task becomes inextricably linked to AI, robotics and related software systems, it is imperative that one take on an expanded mindset as to what management fully involves, and on this point it is increasingly clear that management necessarily involves the management of apps and algorithms as well as people.

Having a technologically adept organization running a well-integrated MarTech Stack that integrates software across every function and at every step of the customer journey all contribute to the improved, if not optimal, customer services and experiences. A highly integrated technology stack enables marketers to instantly and individually adjust every element of the marketing mix: the exact nature, attributes and price of the product, the style and delivery of promotional messaging and customer relationship management services and interactions. Marketers no longer need to draw inferences of who customers are or what customers want from periodic surveys, sample estimates, or consumer segments. The days of segmenting entire populations and assigning purchase probabilities and media exposure rates for such unrefined targets, as “women 18-49 years old,” are long gone. With the advent of cognitive computing marketers have the ability to analyze continuous streams of structured and unstructured data, and ascertain the individual consumers’ traits, tastes, sentiments, and personality and predict personal purchase behaviors, preferences and sales probabilities. Indeed, in the course of the past five years, AI enhanced research and analytic applications have enabled marketer’s to find, read, and analyze a consumer’s every search, post, tweet, pin, video message, product evaluation, credit card purchase, media consumption preference and/or any and every other bit of information that can be gleaned in the infosphere about the consumer. It is now common practice that AI-apps are used in the areas of customer service, sales assistance, and relationship management, and used to create custom commercial messages for individual consumers based on their user profile and media behavior and campaign materials are modified in real-time, to maximize consumer interest and message retention (Marinchak, Forrest, Hoanca, 2018).

As a consequence of the individual profiling and heightened customer service that AI-based technology affords, it is increasingly the case that the new requisites for marketers include: the ability to offer “faster than real-time” customer service and solve customer before they arise; “hyper-personalize” marketing efforts which focus on the individual, not the average customer; “unparalleled ease of use,” which is paramount, given that “convenience is the new measure of loyalty to a brand and loyalty can be measured by the most user-friendly interface” (Van Belleghem, 2017). In the adherence to and adoption of these points, Amazon not only serves as best example, but serves as the very definition, of the new marketing imperative:

Amazon-ization ... refers to the wholesale disruption occurring across retail and e-Commerce ... Adopting a more agile, responsive and data-focused approach... Artificial Intelligence (AI) allows retailers to understand and analyze this data, mining actionable insights to better understand consumer demand and preferences to create better customer experiences. (Weiss, 2019)

And when it comes to enhancing the customer experience, intelligent virtual voice assistance is the latest, and perhaps greatest, game changing technology. From the consumers’ perspective, the emergence of a virtual personal assistant that can learn, predict and serve their tastes, needs and desires and optimize their product/service purchases is a welcome development. Once more, the fact that it can be effortlessly accessed just by speaking is an added bonus. Talking beats typing and swiping most any day. Thus, it is no surprise that the most widely adopted virtual-voice “shopping” assistant, Alexa, is an Amazon invention.

Over the course of the past decade the principle purveyors of voice-based digital assistance have all introduced and perfected their services: Apple’s *Siri* (October 2011), *Google Now* (May 2012, *Microsoft Cortana* (April 2014), *Amazon Alexa* (November 2014), and *Google Assistant* (November 2016). Albeit, it can be argued that society has entered an entirely new and distinct marketing landscape as the tipping point has been reached in terms of capability and availability.

The Tipping Point in Voice Capabilities

To date, voice-based digital assistants have remained as astonishing as they have been frustrating. Misunderstanding what users are saying, spotty performance in delivering the responses and information expected, has limited consumer satisfaction, adoption and use. However, with the debut of Google's Duplex in 2018 and Microsoft's "multi-turn-multi-domain-multi-task-dialogue" in 2019, it can now be declared that interaction with intelligent assistants has reached parity with human conversation. Duplex solved the problem of semblance with its capability of mimicking the exact nature and pattern of human speech right down to the ums and ahs. In fact, with the ability to so perfectly mimic human conversational style and substance, Duplex has begun to raise privacy issues concerning violation of two-party consent laws, which requires all parties involved in a conversation to agree to being recorded (Coldewey, 2018). Moreover, the complex problem of understanding the free-flowing and nuanced context of human queries and conversation has been solved. Where previously, the question: "what are my options for booking a flight to Chicago next Friday?" would not have been able to be accurately processed, now, not can the digital assistant decipher the phrase, but also it can "take the action of looking up flights on your preferred airlines, reading them aloud, and even booking a reservation in your name once you've selected one" (O'Donnell, 2019). No longer limited to one and done conversations, wherein one specific question is asked and one answer given. Conversational AI enables a dialog that is guided by the context of the preceding action first interaction and the intent of the question.

User: Hey Cortana, what's the weather today?

Cortana: The forecast shows light rain with a high of 47 and a low of 42.

User: Should I bring a jacket?

Cortana: Yes, you'll probably want a jacket today.

Herein, the virtual assistant has "learned what the words you say mean, what your own preferences are, and then what discrete actions need to be taken toward an expected outcome" (O'Donnell, 2019). Before these technical breakthroughs, consumer adoption of voice assistants was already rapidly expanding. No matter how measured—ownership, expenditures, use or applications—the growth of voice based assistants has been exponential. The number of unique users for virtual digital assistants will grow from 390 million worldwide users in 2015 to 1.8 billion by the end of 2021 and revenue is forecasted to grow from \$1.6 billion in 2015 to \$15.8 billion in 2021 (Smartsheet, 2019), and the number of digital voice assistants is projected to register a growth rate of 220%, as the number of voice assisted devices increases from 2.5 billion in 2018 to 8 billion in 2023 (Juniper Research, 2018). While Smartphone assistants remain the largest platform by volume and use, Juniper's research found that the fastest growing voice assistant categories over the next five years will be Smart TVs (121.3% CAGR), Smart speakers (41.3% CAGR) and Wearables (40.2% CAGR). These projections are indicative of a most important phenomenon unfolding at this very point in time. That is, society is now experiencing the transition to a world with the capability of virtual-voice interaction with a virtual voice assistant embedded in virtually anything, available virtually anytime anywhere.

Tipping Point: Ubiquitous Intelligent Voice Assistance

The underlying operating principle driving our current paradigm shift can be stated as: "Anything and everything that can be digitized, automated, connected and cognified with AI and accessed via a voice interface will be. To the point, every person, place, platform, product and thing on earth (and beyond, if one includes satellites, lunar and Mars missions, etc.) is now an existing or eventual node on the Inter-

net of Intelligent Things (IoIT). In much the same manner as we turned electricity into a commodity to power the industrial revolution, we are now commoditizing intelligence to drive the cognitive revolution. As Kelly (2018) observed:

Anybody can buy power. You just plug in, and you do what you want with it ... 150 years ago a farmer looked at his hand-pump and said, 'I can add electricity to this, and make a powered pump.' Do that many, many times and you get the industrial revolution. Now we're at the second phase—we're adding minds to things. We'll take the electric pump and add AI. Now we have a smart pump. We're sending out minds as a service, as a cheap commodity on the grid, as an AI utility that anybody can purchase ... My formula for the next 10,000 startups is take X, add AI.

Herein, it is argued that voice control is emerging as the most valuable interface to AI-enhanced entities of all. Since 2017, the IoT has had all the necessary technological ingredients for its exponential expansion—energy efficient sensors and wireless RFID tags (cheap enough to be all but disposable), universal expansion of broadband and cellular networking and the adoption of IPv6 (which enables the provision of an IP address for every device the world). By the end of 2017, there were already more things connected on the Internet (8.4 billion) than there were people on earth (7.6 billion). By the end of 2020 estimates range from 20 to 30 billion devices, and by 2025 we may be experiencing an IoT growth rate of 152,000 devices being added per minute, resulting in an IoT population of 80 billion (Kanellos, 2016). Over the course of the next decade, the availability of voice interaction with an intelligent agent will move well beyond every smartphone and become available in every house, room, office, automobile and appliance, as well as be embedded in the clothing we wear and products we buy. Moreover, not only what we buy, but how we buy is in the process of being determined by the availability of and interaction with voice assistants. Given its ability to provide consumers with “ultra-personalized, two-way engagement” with a brand and generate “greater engagement, insight, sales and satisfaction... it is predicted that by 2023, voice assistants alone will drive over \$112 billion in annual retail sales” (Ravensbergen, 2019).

FOCUS OF THE ARTICLE

Over this next decade this on-going exponential growth and innovation in capabilities will result in billions of people spending hundreds of billions of dollars to purchase the ability to converse with tens of billions of devices that will assist them in whatever they are doing, no matter where they are. Already, it has become clear, how and how fast companies are reacting to this reshaping of the technological landscape. For those companies with the largest and most entrenched interests, such as Google and Amazon, the strategy appears simply to be—do whatever it takes to defend and expand your market position. Doing whatever it takes, includes employing 10,000 employees to work on a single voice assistant platform such as Alexa, and involves betting billions of dollars in voice assistant and smart speaker technology that you dump on the market at a quarterly loss. Case in point, “Google Home Mini is sold at a loss every time it is discounted, which is frequently” (Kinsella, 2019). In defense and expansion of their dominant market positions for Google in search advertising, for Amazon in online commerce, the principle competitive growth strategies are market penetration and innovation. Google expanded its voice assistant’s availability from 400 million, in 2018, to over a billion devices in 2019 by leveraging its distribution through Android phones and Google Home, Auto, and TV devices. In contrast, to developing a voice assistant that is available on most anything, Amazon seems to have concentrated its

efforts on developing a voice assistant that can do most anything. While presently confined to 100 million Echo speakers Amazon's Alexa can perform no less than 59,000 skills, and is advancing at a rate of approximately 85 skills per day. Alexa serves as your personal concierge connecting one to everything from your car insurance and media subscriptions to your preferred sources of entertainment, education or prayer and meditation (Tell, 2017).

Every major tech company is launching initiatives to establish and expand their presence and share of the voice assistant market. Amazon Alexa, Apple Siri and Google Assistant are all expanding their focus from the consumer to business users with prototypes of voice based intelligent assistants with the ability to provide on demand analytics, proactive reporting, and automated task execution, "all without the need for pesky logins or dashboards" (Doddala, 2018). Even Facebook, the only major tech company that currently does not have its own voice assistant, announced at its May, 2019 shareholder meeting that it is going to begin working on products that use a new AI assistant that responds to voice (Rodriguez, 2019).

Thus, it remains the case that success in the world of virtual assistance will necessarily be measured in the assistant's ability to understand not just the language but also the meaning and context of what the user is saying. Coupled with the advancements in machine learning and sensor technologies, today's virtual assistant can also recognize and classify most any entity, and sense and predict most any phenomenon. Ergo, the next generation of virtual assistants has arrived and appears ready to fulfill the promise of the all-knowing and all-powerful entity that is always ready to provide an answer to the question, complete a given task or perform the function of an entire business domain.

Virtual Assistants – Specialized by Business Sector and Function

Case in point, Amelia, touted to be the "world's most sophisticated virtual assistant" and demonstrably the world's first "digital worker" that can be hired in much the same way as a human employee. Presently, Amelia can be hired to perform any of 672 tasks relevant in industries ranging from banking, insurance and retail, to healthcare, telecoms and media. Amelia can be delivered through multiple channels on a platform that is available 24/7, is highly scalable in its capacity to handle high volumes of transactions and information queries and has the ability to hold natural language conversations in more than 100 languages across chat, voice or social media platforms. If you would like to interview and/or hire Amelia, rather than "going to Indeed.com, LinkedIn, or Monster," Ipsoft (2019) suggests you go to its "IStore." Wherein, "businesses can go through the same hiring process they would with a human, including looking at previous references from other firms that have analyzed how well bots have worked, as well as "interviewing" them to see how they would perform certain tasks" (Robinson, 2019). Research finds that whereas businesses achieve only 6% return on AI investment, Amelia's clients can exceed (Robinson, 2019).

Similar results can be documented with other digital assistant services such as Bank of America's ERICA. In just one year since its launch in 2018, Bank of America's conversational intelligent assistant ERICA, drawing on its a knowledge base of 400,000 financial questions, has completed over 50 million client requests, and is engaging with 500,000 new users per month (Top, 2019). In the Marketing arena there is LUCY. Trained in natural language processing and machine learning algorithms, LUCY "reads and learns every document and data asset that you feed her—she never leaves, never forgets and becomes smarter every day" (Roetzer, 2019). Able to answer most any question and execute any traditional marketing task (be it in research, creative or media), LUCY has proved a most valuable assistant. For example, "if one were searching for comparative, detailed sales data for one of your company's brands, but you don't know the exact internal classification systems that division uses for its sales—you could

simply ask Lucy: What are the division's sales by product category? And, Lucy would provide you with a customized report with the sales data organized by product category ... done by a market analyst who left the company two months ago. She also returns a second result pulled from a slightly older PDF... and a third result from a word document ... used in an internal meeting" (Equals 3, 2019).

Virtual Assistants: Specialized for Consumer Segments

Together with the growing array of digital assistants designed to assist with the execution of business functions and tasks, there is a growing range of agents being designed and developed for specific consumer segments and services. In 2019, Intuition Robotics launched ElliQ, specifically targeted to "older adults," and designed to be "the sidekick for happier aging." Physically it consists of a combination of a touch screen and table light, with a moving cylindrical robot head that can make animatronic movements. Practically, it is a voice-enabled home assistant that can make life easier for seniors by fielding vocal requests, making video calls, setting reminders for medication and arranging doctor appointments and providing companionship with its ability to play bridge (Gebe, 2019). On the other end of the age spectrum, Amazon has introduced a version of Alexa exclusively designed with functions and features for kids (Pringle, 2018).

There exist a growing range of digital assistants, which are being employed for social and psychological support. There is Woebot, which "bills itself as your charming robot friend who is ready to listen, 24/7," and uses artificial intelligence to detect emotions and is trained in the principles of cognitive-behavioral therapy (Pardes, 2017). There is Replika, originally developed in 2015 by a programmer to restore the presence of a friend who died in an accident. By imputing the entirety of all their email and text communications she had with the deceased she was able (through machine learning generated algorithms) impersonate the deceased individual's likely responses and patterns of speech. Today, over 2 million people are using the Replika app to teach their "Replikan" how to speak and react to them.

The consumer's existing preferences, spoken commands, and probable actions are all calculated and controlled by the technologies provided by just a handful of companies. In exchange for freely providing a steady stream of data on everything the consumer says and does and everywhere they go, consumers receive free access to and use of the companies virtual personal assistant, with the added benefit of knowing that the more information shared with the company, the better their virtual personal assistant will be able to optimize their lives. However, the perception that the free use of a Siri, Alexa, or Google Assistant is no more of a gift than was the Trojan-horse, is becoming more pronounced. More and more questions concerning personal privacy and consumers' data rights are being raised. Of particular concern "is that virtual assistants, as they are designed today, could have a far greater impact on consumer information than today's websites and apps. Putting that information in the hands of one big company or a tiny clique ... could erase what is left of online privacy" (Markoff, 2019). Indeed, under the current business model, terms and arrangements, it would be much more accurate to regard the P in VPA (the acronym for virtual personal assistant) to stand for Platform rather than Personal. Moreover, for both economic and technical reasons, the market predominance of platform-owned and operated virtual assistants will remain a given. As is the case for every major technology platform, developer programs add thousands of other individuals and companies to the workforce contributing to their products' development. However, it is also the case that unique to voice platform development is the fact that voice-based intelligent assistants are not a technology that a business can wholly "outsource to companies like Amazon and Google...a business needs to keep its own data and its own customer relationships, and it cannot rely on companies that are or could become its competitors" (Lam, 2019). The need to control

the relevancy, accuracy, and timeliness of information exchanged with customers along with consumers increasing concern for privacy is driving the market for virtual assistants that are truly personal. Recent surveys (Viveiros, 2018) report, “significant majority of U.S. consumers (73 percent) said their concerns over personal data privacy were increasing.”

SOLUTIONS AND RECOMMENDATIONS

Addressing this growing concern over personal data privacy as well as the providing an alternative to monopolistic virtual assistant platforms of the major tech companies is Almond, an “open-source virtual assistant system released in 2018. Almond allows users to build natural language applications which affords users “control over who, what, when, where, and how their data are to be shared” (Lam, 2019). Developers of Almond applications are able to connect their devices to the Almond virtual assistant through a free and open database called *Thingpedia*, wherein any developer or internet service provider registers the specifications for their application’s interaction with the Almond virtual assistant (Markoff, 2019). As declared on the Almond website: “Virtual assistants are the new interface to the Web.” Their vision for virtual assistants is threefold: democratize AI for linguistic user interfaces with open, collaborative research; available on an open non-proprietary linguistic web; and, allows users a choice in virtual assistant services and the ability to control how their data is shared. “There is a disconnect between the ‘know-it-all, do-it-all’ approach that current digital assistants are aiming toward and the highly personalized virtual assistance experience that consumers have dreams/nightmares about. Whoever can bring personal consumer data in a secure, non-creepy way to digital assistance will be able to bridge that gap and capture most of the opportunity” (de Renesss, 2019).

With a high degree of probability it will be the case that whoever does bring that secure, non-creepy way to digital assistance, they will be employing Blockchain technology as the underlying platform. If users desire to solve the problem of control of their digital identity, and determine for themselves what information they want to share with other persons or organizations, Blockchain is the technical solution. As recently declared by Pulie (2019), “identity is going to be returned through Blockchain back to the individual so that the individual will own their data and then be able to marshal it out based on what’s best for them as opposed to how Facebook or Google or other people may want to exploit it.”

FUTURE RESEARCH DIRECTIONS

With digital agents soon to be surpassing the number of humans on earth (De Renesse, 2017), it may be time to reconsider William Gibson’s quote: “The future is already here – it’s just not evenly distributed.” The on-going proliferation and universal distribution of digital assistants is an established fact and may well prove to be the one of the most disruptive phenomenon in history. In a very real sense the emergence of the artificially intelligent digital assistant fulfills the “Frankenstein-ian” vision of creating an alternate life form, but with algorithms derived from machine learning, as opposed to stolen body parts from a graveyard. Just a few decades ago it was thought that only humans could draw inferences from past experience, understand uncertainty, draw and modify conclusions, interact through voice, gesture, and touch, let alone communicate with other machines, devices, and “things on an internet” (Chamberlin, 2014). This assumption has been disproved. Moreover, the capabilities and applications of digital assistants that will be possible in the immediate future appear to be equally astounding, if not unnerving.

CONCLUSION

Such is the present and near future state of our world. Ubiquitous, omniscient digital assistants to answer any question, perform every task, and meet every need. Albeit, the critical question remaining unresolved is for who will these agents be really working? Who will their ultimate allegiance and ownership truly belong? If one were to ask Alexa or any platform digital assistant: “What is a conflict of interest?” One could expect similar dictionary answers. However, could/would a platform assistant be able to answer the question: “Alexa, do you have a conflict of interest?” Vogel and Wright (2019) raised and addressed this very scenario.

Whether Alexa or Google Assistant wins the battle to impregnate our homes with their artificial intelligence, we humans will develop personal and emotional relationships with our new gadgets. That will spawn a vast new conflict of interest: the dual roles of companion and sales associate, the one-two punch of fulfilling emotional needs that ripen us up for commercial appeals. The business models for the leading digital assistants rest on e-commerce and advertising. The A.I. will learn from billions of conversations to create powerful new persuasive methods. You might remember how Google’s A.I. beat the Go champion and developed invented “God-like” new strategies. Moreover, it’s not really one digital assistant—it will be personalized to hundreds of millions of people. That scale and speed, plus A.I.’s inherent opacity, leave almost no chance for human oversight and control. The A.I. will turn the digital assistants into armies of super salespeople exploiting the emotional relationships built with their human owners.

Major impacts are being felt and significant questions are being raised. Are jobs being enhanced or replaced? Are our lives being diminished or embellished? The exponential rate of development and adoption of digital assistants is a fact. As with other rapid and sweeping shifts in society’s communication channels and information technologies, it is the case that its effects are being more experienced than understood. However, Vogel and Wright’s above scenario of super intelligent digital assistants wresting control of their human user/owner’s decisions and relationships could very well be the future. The development of the digital assistant’s superior responses and recommendations are an inevitable consequence of its underlying programming logic of federated learning; wherein, over time the digital assistant’s algorithms are continuously perfected based by the user’s experiences, evaluations, results and insights. AI, through all its applications, and most prominently through intelligent digital assistants, present both threats and opportunities. The responsibility for thousands of tasks is being conceded and millions of persons are in the process of being replaced. Billions of digital assistants are already at work and billions more are being developed and adopted for every business function, every personal need and consumer device. Accordingly, intelligent digital assistants and assistance will be an integral and necessary companion in and component of life.

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KEY TERMS AND DEFINITIONS

Chatbots: Conventional distinguished from digital/virtual, intelligent assistants by virtue of being a text based versus voice-based interface.

Digital Assistant: General category of software program that responds to human input and commands to execute designated functions, answer specific questions, monitor defined environments, and/or perform particular tasks.

Intelligent Assistant: Digital/virtual assistant with the most advanced cognitive abilities and analytical skills derived from the application of deep learning and the generation of algorithms capable of learning on its own from patterns in data as opposed to pre-programmed instruction.

Internet of Intelligent Things: Expanded Internet interconnections to objects, places, devices, or "things" with a unique identifier (UID), and advanced communication and control capabilities premised on cognitive computing applications and platforms.

Internet of Things: Expanded Internet interconnections to any object, place, device, or "thing" with a unique identifier (UID), and thus capable of communication with and control by any authorized person or computing platform.

Virtual Assistant: Synonymous with a digital assistant, yet more precisely refers to an application interface that is voice based and conversational, and is in fact virtual, in so much that it resides in primary in the form of an unobtrusive digital device- as opposed to a robot with human or life-like features.

Automation of Marketing Processes and the Discovery of Knowledge for CRM

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INTRODUCTION

The general perspective of the chapter is focused on discovering marketing knowledge based on Customer Relationship Management (CRM) systems. There are a large amount of CRM systems available to support customer relationship activities. The question is: “How to do automate processes in the implemented CRM system to discover the knowledge that is useful for marketing?” It is a natural question for all enterprises because the stored data creates a large volume and it is difficult to set up a marketing process with hands. This chapter focuses on finding the necessary product specifications to automate the marketing needs this CRM system must offer to be optimal in today’s modern global society. The existing controversy is between IT for everyday use, real IT capabilities, human skills, and knowledge to support more complex implemented processes. Emphasis is placed on automation and intelligence. The analysis shows that CRM systems are interested in managing customer relationships in the form of a single agent or process to perform the necessary actions using implemented algorithms that utilize various intelligence, statistical methods, multi-criteria decision-making, and automated learning predictions. Unfortunately, a complex solution is not always that complex. There are no links to social networks and automation to combine knowledge from different areas. These include sales forecasting, customer lifecycles, analysis through various intelligence, and KPI (Key Performance Indicator) monitoring.

BACKGROUND

Marketing processes have close links to CRM. These processes focus on finding the optimal volume of customers to bring them goods. A global society has communication technology that connects people (potential customers) on a global scale. There are millions of potential customers, but it is not easy to found matching customers with a serious interest in goods and purchase (Dollwet, 2019). In this situation, modern approaches are taking place and information technology helps in this topic. It involves creating the necessary presentation documents (advertisements, presentations and reports), selecting the target group of customers and sending created documents with the support of subsequent purchases (Keenan, 2018). Difficulties cause the success rate of marketing processes and it requires very sensitive contact with customers (Evenson, 2017).

In general, processes are very fast, require large data processing with big data, quality and timing are very sensitive issues and it is not the responsibility of one to meet all requirements. The best solution is to have an optimal volume of customers to individually work with them (Miller, 2017) on successful marketing processes. It is an active work with internal database customers from CRM systems and also an about active work with social networks to have more and more followers and other people interested in further communication. Such communications leads to a purchase. These processes are

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also advantageously automated and many CRM systems offer a variety of services to ensure contacts with customers and marketing processes and monitor key performance indicators. Scientific practices based on data mining, decision-making, good practice, modeling, multi-criteria, statistics, and templates are of great benefit.

Customers are the most important active of any business. Marketing processes (Dib, 2016) use customer segmentation to reach target clients, analysis of customer behavior and their purchases, searching for new customers and prediction of unexpected situations with optimization of marketing campaigns. Again, it is good to use information technology implemented in CRM systems to discover the necessary knowledge and optimal data sources.

MAIN FOCUS ON EXISTING CONTRAST

Automation and Controversy

The main emphasis is placed on the existing controversy, which is evident in the possibilities of information technologies and their everyday use to support realized activities. Information technology has great variability and a wide range of solutions, which are created for public use and also according to individual preferences. In these solutions, the knowledge of data creation and validation with subsequent data storage in database systems has been proven. The same good situation is in operating systems that offer optimal background for implemented applications and systems. A modern society also offers excellent conditions for sharing data and information, and it is easier to have access to knowledge. Thus, many users use operating and database systems according to their preferences. A similar approach is visible for CRM systems (Williams, 2014). Experienced IT users choose from comprehensive solutions such as Linux/UNIX, Oracle and Microsoft. IT users with basic knowledge and resources focus on using cloud solutions or open-source software.

In this reality, one thinks that the implemented activities are successful in optimum quality and timing. Difficulties cause changes in the requirements of IT users as well as variability of implemented processes. And the existing contrast is apparent in the gap between IT capabilities and IT user activities. There are mistakes and also misunderstanding based on low orientation on many topics that affect marketing processes. There are automated processes and intelligences for efficient solutions (Unemyr and Wass, 2018). From an IT perspective, automation support of implemented processes is an important topic and information technology has its own goal here. A novelty is the form and complexity of developed applications and systems.

This controversy is visible in other losses that are reflected in IT projects that are not ended by IT user's preferences and IT capabilities. The advantage is that information technology combines knowledge from different areas into implemented procedures that are available to IT users. It is about automation and intelligence (Somnuk et al., 2017). There is also variability in this area, which helps to discover hidden knowledge from stored data. Of the functions and procedures required, information technology has a major impact on:

- To verify input data.
- To collect data from different sources.
- To analyze data from different perspectives.
- To view results in different formats.

- To integrate advanced analysis method.
- To work with statistical methods.
- To support multi-criteria decision-making.
- To access hidden relationships between data.

From the IT user's point of view, the best solution is to integrate all IT support options into one solution. It is a common solution that does all the necessary things together from validation input data, collecting data from different sources, analyzing data from different perspectives, showing results in different formats, integrating advanced analytics with the support of statistical methods, multi-criteria decision-making to make the hidden data available. For this purpose, information technology works with concepts such as automated processes and intelligences (Sunnarsjö, 2016). In relation to marketing processes, there are automated processes to support marketing campaigns and work with customers. Both tasks are integrated into CRM systems. And it is natural to ask about relationship between CRM and automation and intelligence.

CRM and Intelligences

CRM create one of a large group of information systems for storing and working with customer data. Customers are a very sensitive business of any enterprise and it is natural that CRM systems (Ropponen, 2017) are also in the company's interest. Information technology implements proven approaches to data storage and data search in classic database systems, which create a background for working with data in these systems. This is similar to access rights for IT users, their role-integrated groups, and encryption for better security. The user-friendly interface is excellent in all CRM systems and intuitive navigation is enhanced by video tutorials, on-line chat and newsgroups. Robust CRM solutions also have a comprehensive background from suppliers and partners. In this respect, it is easy to implement them in an enterprise environment, and IT plays an assigned role in good mode according to the preferences of IT users.

The processes implemented are more complex and this complexity is passed on to support requests for these IT processes. Complexity is about the breadth of view and sophisticated data handling. A good place has intelligence here. From a public perspective, intelligence (Brain Metrix, 2018) is a high level of wit with the highest quality perspicacity, a natural sense based on education and intuition. There are different kinds of intelligence, such as linguistic-verbal intelligence, logical-mathematical intelligence, sound-musical intelligence, physical-movement intelligence, visually-spatial intelligence, internal or intrapersonal intelligence, social or interpersonal intelligence, and natural intelligence (Armstrong, 2017). Information technology also works with intelligence. A suitable vision brings the integration of intelligence into IT support in the form of artificial intelligence, business intelligence, competitive intelligence, customer intelligence, machine intelligence, product intelligence, and swarm intelligence.

Artificial intelligence (Sentence, 2019) uses models based on human activities that are considered intelligent. This modeling focuses on modeling the external manifestations of intelligent activities and modeling the structures of the human brain. Well-known approaches are based on expert systems, genetic programming, knowledge mining, machine learning, neural networks, state space search. Business intelligence (Ruth, 2019) integrates work with data from various data sources with subsequent processing and provides instant information on the real state of business based on predefined reports, ad hoc reports of extranet scorecards and dashboards. All this is for strategic decision making in a large competitive society. Another advantage is also an overview of key performance indicators, business finance, costs, and

other indicators. Competitive intelligence (Competitive Intelligence for Business Growth, 2019) is about analyzing information about competitors and their products and other necessary aspects of the environment to support strategic business decision making. This intelligence works with the external business environment and is looking for a gap on the market. The benefit is the forecasting of risks and market opportunities based on factual information such as financial reports, market statistics and newspapers. Customer intelligence (Subramaniam, 2019) takes care of customer data for further analysis in detail in all activities. The goal is to build deeper and more effective customer relationships to improve decision-making through marketing processes and purchasing support. Focus is on business agility, competitive advantage, customer loyalty, real-time feedback, streamlining marketing, and strong relationships.

Machine intelligence (Market Business News, 2019) focuses on computers and their ability to collaborate and learn to be smarter. There is interest in cognitive computing and machine learning. Cognitive computing is based on sensors and algorithms that computers may skillfully see, hear and feel. The goal is to transfer human skills to computers so that computers may think and behave just like humans do. Machine learning is about working with large volume of data from which discoveries and predictions are made. Product intelligence takes care of product performance, quality and test data. And there is also an automated process for working with data, information and transforming it into knowledge. The impact is on quality production processes and a way to monitor whether products are manufactured correctly to designer's specifications. Swarm intelligence (Swarm Intelligence Applications, 2019) is based on collective behavior of animals in nature, such as ants, birds, or fish. These systems are decentralized and self-organized. In the information technology world, it is the collective behavior of self-organizing agents.

The common feature of these intelligences is that they solve complex tasks with the support of logistics, robotics, natural language processing and large data processing. The presence of intelligence is required by the existence of an unlimited volume of data, better prediction with links on sustainable development to prevent crises. There are integration trends in deep learning, cognitive computing, conversion user interface, corporate taxonomy, ontology management, smart dust and smart workplaces. It is about automating process to discover knowledge.

SOLUTIONS AND RECOMMENDATIONS

The existing controversy between IT for everyday use and the true IT capabilities and human skills and knowledge requires a new approach to IT implementation. It is not a configuration and user-friendly interface to make it more intuitive for IT users. It is the complexity of supporting automation-based processes that integrate best practices from different areas of human activity into a single agent or process. And these agents or processes perform the necessary actions using implemented algorithms that use different intelligences, statistical methods, multi-criteria decision-making, and predictions with deep automated learning.

Automation in CRM is about marketing, service, sales and workflow automation. Marketing automation uses email marketing, CRM integration, lead nurturing, campaign management, lead management and scoring, landing pages, social marketing, and visitor tracking (Meyers, 2017). Email marketing is one of the basic ways of communicating with customers, leads and potential customers and potential leads. This automation tool is used to create email content and email templates to determine the brand identity and make the necessary email reports. CRM integration is important for transforming lead's information from marketing to sales. Lead nurturing automates the sending of large volume of automated emails using trigger based on customer behavior. Campaign management is responsible for sending direct

and personalized emails to a large volume of people. Lead management and scoring take care of scores for customers who receive specific activity-based scores. And marketing has ways to focus on the most promising leads with the highest score. Landing pages are pages on websites that require the specified action. This site helps increase conversion. Social marketing monitors customer's response to company products and services and their response to email messages and website content. Visitor tracking monitors the way visitors interact with the website and their behavior. These are the pages they click to access the site, or a list of keywords they enter on Google to link them to the site.

Table 1. Specification of automation of implemented processes in selected CRM systems

Selected CRM system	Implemented automation	Description
3G Business CRM	automate sales and marketing, automate admin and accounts	automation engine and tools create assisted, unassisted, autonomous and cognitive processes
Anthill CRM	customer service automation, marketing automation	triggers monitor customer behavior, management is based on workflows to automate communication
Agile CRM	intelligent automation for marketing campaigns, automate administration	automation uses triggers that automatically bring leads from calls to action into database with their segmentation, and start of campaign
AllClients	marketing automation integration, social media integration	the system combines tools into one solution, automatic email campaigns that run at predefined intervals, the social connector automatically searches for clients to contact
Borneosoft Online Forms & CRM	marketing automation integration, payment automation	automation uses intuitive conditional logic to automate leads capturing and generate more leads with automatically calculate payment
Capsule CRM	automated sales and marketing workflows	automate the use of events for everyday use and set up automatic email communication, multiple email marketing tools may be integrated
Microsoft Dynamics 365for Sales	complex business solution with automation for sales productivity and marketing effectiveness	active work use social insights, business intelligence, and campaign management; focus is also on email marketing, lead marketing
eWay-CRM	marketing automation integration and automate administration	automate business processes with workflow to automate sales pipeline, automate administrative tasks for sending pre- and post-engagement emails, assigning leads, and sending quotes and documents to customers
Intrix CRM	contacts and marketing automation, management sales process, monitor customers' claims	sales process is partly automated by automatic creation of sales activities, automatic capturing of incoming emails and segmentation according to priorities, executors and support areas
Pipedrive	marketing automation integration, automate repetitive sales tasks	automating and tracking sales interactions with synced emails, calendars and calls, workflow automation to send emails to leads
Salesbox	marketing automation integration, next generation pipeline management	marketing automation generates leads automatically from web, campaigns, emails and social media, automatic guidance to qualify deals
SugarCRM	workflow automation toolset to automate customer processes	automation engine manages automated campaigns with powerful email marketing features
Zoho CRM	automation sales process, marketing and lead management	work with artificial intelligence, automate the process of nurturing leads through emails, website forms, and social media, automate sending emails to customers and leads

Service automation is a process for automation events, processes, tasks, and business functions. Service automation provides business with a multi-dimensional approach and service process optimization. Service automation takes care of the contact center, call center, help desk, field service, and web self-service. Sales automation is responsible for repetitive activities, tasks and documentation for the purpose. This automation is designed for e-mail reminders, inventory management, pricing, regular documentation, and standard contracts. Workflow automation focuses on processes that works with workflow rules where human tasks, data, and files are routed among people based on predefined business rules.

Lead management automation, lead nurturing automation, calling automation, deal management automation, and customer support automation are all beneficial (Kaushik, 2016). Lead management automation takes care of leads and data entry. It is a step-by-step collection of basic information, emails, web behavior, and social media for leads. Lead nurturing automation provides drip emails, tracking, metrics, reports and lead scoring. This method is useful for ranking the leads in different groups according to their response. Calling automation is available for one-click calling, call recording, automatic notes, direct reporting on regular calls and automatic follow-up emails after a call. Deal management automation focuses on automating routine sales-related activities. Customer support automation refers to live chat, auto-responses, and real-time voice calls for customer support.

The current list of implemented automation in selected CRM systems is shown in Table 1.

Practical use of automation and intelligences is simple. IT designers integrate a modern approach to procedures and functions into implemented CRM systems. In many cases, templates exist and the designated engines run automatically in the background.

FUTURE RESEARCH DIRECTIONS

Future research directions are related to working with external sources, intelligences to support more accurate work with customers and potential customers. Virtualization also has a special place to support virtual space work and intuitive navigation. Many visions are about:

- Conversational AI-Powered CRM.

It is the combination artificial intelligence with CRM and conversational voice functionalities (Softclouds, 2018).

- Requirement on more simplicity.

It is the effort to combine convenient automations with a personable human touch (Watts, 2018).

- IoT in CRM for proactive and predictive customer service.

CRM systems perform optimal organization, improving customer service and satisfaction (Softclouds, 2018).

- Social media for detail view on customers.

It is the integration of powerful indicators of customer satisfaction and travel through social media (The Leading Contact Centre Magazine, 2018).

- Strategically use of customer data.

It is about using data across different sources to create single views of customers (Fultz, 2019).

CRM systems are systems with close links to customers and potential customers. Changes are very fast and it is about changes that are visible in society and people's behavior. An intuitive approach and support for modern IT trends is an important place to meet. It will be based on an appropriate combination of all trends of human preferences and information technologies. Strategically, it will be intelligence-based automation with a sensitive human approach. The reason is that people also buy emotions and positive experiences from purchase.

CONCLUSION

The global information society has many advantages, and information technology provides the necessary support for the activities it has implemented. It is a unique environment for sharing data and experiences from different areas. Implemented processes are very fast and the pressure is high in quality and timing. A similar situation is also in marketing processes. Their importance is essential for everyday life of the business based on optimal care in contact with customers. Information technology has a wide range of solutions with proven methods for validating input data, collection data from different sources, analyzing data from different perspectives, viewing results in different formats, integrating advanced analysis method, working with statistical methods and supporting multi-criteria decision-making. The existing controversy is evident in the gap between IT capabilities and the IT users' activities and knowledge requires. This gap creates the fact that the implemented processes are more complex and this complexity is passed on to support the requirements for these IT processes. From a public perspective, there is a good place for intelligently and automatically combine knowledge from different areas. Intelligences are required by having an unlimited volume of data, better prediction with links to sustainable development to avoid crises. It is about automating the process of discovering knowledge with the support of intelligence implemented in IT.

A good recommendation is to implement best practices from different areas of human activity into a single agent or process to perform the necessary actions using implemented algorithms that use different intelligences, statistical methods, multi-criteria decision-making, and predictions with deep automated learning. In the area of CRM, it is marketing, service, sales and workflow automation. In terms of marketing processes, campaign management, lead management, lead nurturing automation, and social marketing are of particular importance. Based on the experience of monitored CRM systems, the situation is good for automate sales, marketing campaigns and administration matters. In contrast, more care needs to be taken on forecasting based on multi-criteria decision-making, social networks and statistical methods. There is also a need to combine data from different sources with a greater impact on external sources to promote sustainable development, and a special thing is potential customers who want to buy because many site visitors are looking for interesting information but not buying.

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KEY TERMS AND DEFINITIONS

Big Data: The broad spectrum of data that have appeared throughout the development of the global information society.

CRM: Customer relationship management.

Global Society: A society where the creation and integration of data via information and knowledge is a significant process in all fields of human activities.

Information: Information is perceived data about the properties of existing objects. Information reduces uncertainty of the system.

Information Technology: Information technology is a scientific discipline that seeks the optimal solution for compiling, creating, linking, and improving available technologies.

Sustainable Development: Economic development of the global information society that is conducted with respect to natural resources and global challenges like technological regulation, intellectual property protection, and unemployment.

Swarm Intelligence: Focus is dedicated to intelligent behavior swarms, i.e. large numbers of individuals. Nature is an inspiration for the designed method in many fields such as chemistry, engineering, environmental modeling, financial services, and information technology.

Developed E-CRM Intelligence in Technological Trends

13

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INTRODUCTION

Good relationship between the customer and the organization is paramount to the financial success of an entity. Businesses are known to focus on enhancing the relationship with their customers. There are many tools that can be used to enhance such a relationship (Iyer & Bejou, 2004). The recent advancements in the information technology has made it possible to enhance the relationship electronically. There are information systems that have been developed solely to enhance the relationship between the business organization and its customers. Most of the electronic customer relationship management applications focus on the customer satisfaction and customer attraction. It is also important to note that e-CRM enables businesses to understand the behavior of their customers and hence make the focus on the customer needs easier through the online activities (Guimaraes & Paranjape, 2014).

The electronic customer relationship management is mainly involved in identifying the best customers for the company and maximizing the value from them through improved satisfaction and retaining them. The electronic customer relationship management is firmly grounded on the concept of relationship marketing. Businesses tend to maximize the satisfaction of their clients through all the interfaces that are used for communication. The initial stages involve identification of the loyal customers (Gosney & Boehm, 2000).

BACKGROUND

Electronic customer relationship management (E-CRM) refers to the use of electronics technology and internet in the supervised subset for the client relationship management

E-CRM helps organizations to identify the actual costs that involve the process of attracting and retaining individual customers (Raab, 2008). To retain customers, it is imperative to have customer loyalty which is affected largely by the type of services offered and the manner in which they are done. E-CRM enables the organization to focus on the resources and time in the most profitable manner. Research by Torakh and Mjidi (2010) revealed that E-CRM systems allow the company to understand the customer

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behavior, making the marketing more effective and reliable in internal decision-making. Also, it increases efficiency in client services delivery and cost reduction. Researchers have noted that time is a critical element in online shopping meaning a reduction of time of delivery as well as in response creates an opportunity for better customer satisfaction (Powell & Childerhouse, 2010). It is, however, important to understand that E-CRM creates platform that is effective if utilized appropriately. Organizations that fail to make use of the technology may not realize these benefits. Therefore, this research makes use of the information available to enhance the typical application of the E-CRM using the intelligent data mining technique so as to serve the customers and utilize the all the opportunities available in gaining from the customers. In addition to data quality issues, companies embracing e-CRM systems face difficulties in developing effective technological (Ahmed, B., Amroush, F., Larbi, M. and Maati, B. 2017)

Technological Component Requirements of E-CRM

There are three main technological components of Electronic Customer Relationship Management. The first technological component involve operation of the back-office processes such as order management, as well as, order processing. The operational component also encompass different aspects of front-office customer-supporting and customer-facing processes for instance customer service and marketing. The second technological component serves as a building block that is focused on the mining of the customer relation data (Jham, 2009). This component is commonly referred to as analytical component. The analytical component is mainly focused on strategic and tactical analysis of the customer related data. It is mainly involved in capturing, extracting, storing, mining, processing and analyzing customer related data. The analytical component is associated with a given degree of intelligence which enables it to identify the best customer to a given business entity (Fjermestad & Romano, 2006).

The third technological component applies the technology across the organizational boundaries with the aim of optimizing the company, partner and the customer value. This implies that the collaborative component is solely concerned with description of the strategic and tactical alignment in order to improve the level of profitability. The following diagram can be used to illustrate the customer interaction centers which are used to enhance the relationship between the customers and the organization (Cunningham, 2002).

The figure above illustrates one aspect of customer facing applications. The customer facing applications are widely used to enhance the interaction between the company and its customers. Some of the common customer facing applications include customer interaction centers, automated response to the E-mail, sales force automation and field service automation. Field service automation manage customer service request such as service contracts, service orders and service calls electronically (Chua, 2011).

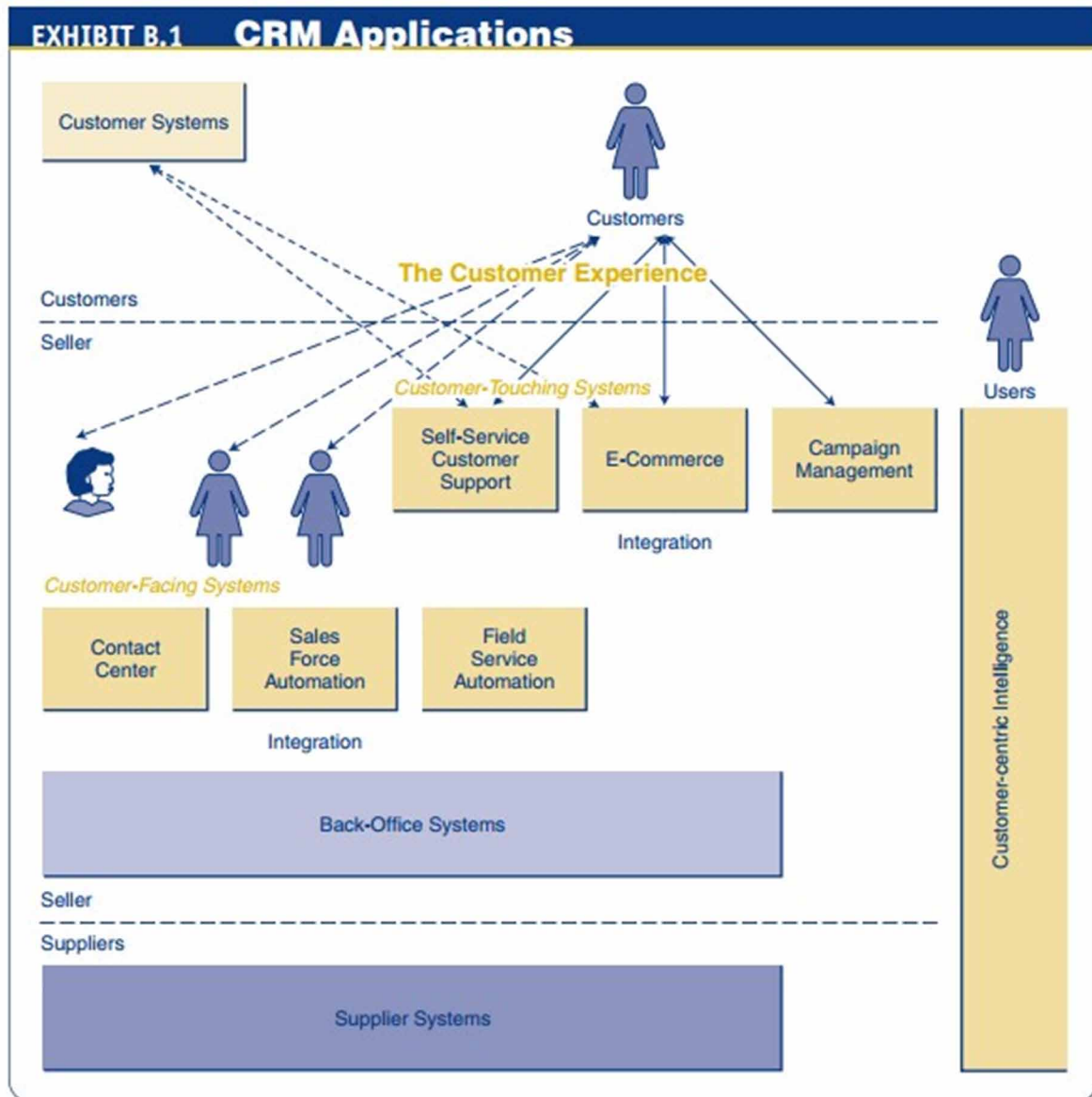
There are also customer facing applications that are part of the electronic customer relationship management in form of customer touching applications. The customer-touching applications provide an interface where customers use interactive computer programs rather than interacting with company representatives (Low & Anshari, 2013). Some of the popular customer touching applications include personalized web pages, web self-services and self-tracking.

These applications are characterized with computer applications that are developed by the business to interact with customers.

The customers are provided with an interface where their requests and other useful business trends are automatically generated and responded (Chen & Ling, 2008).

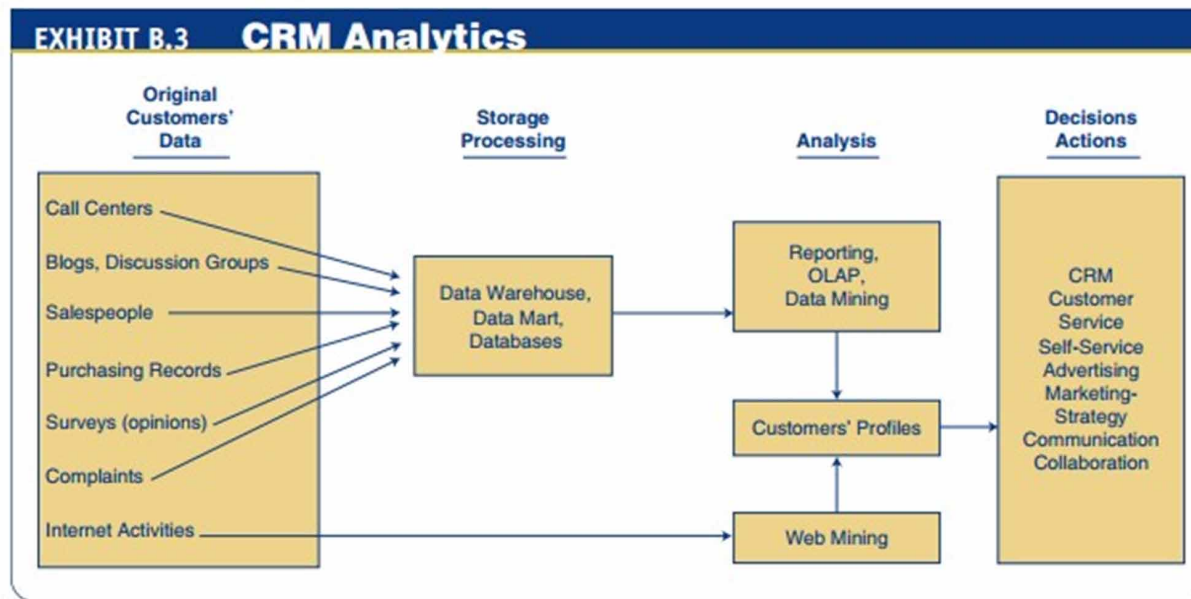
It also be noted that there are other customer facing applications that are realized in form of customer-centric applications. In this case, the customers are considered to be synonymous to the E-CRM analyt-

Figure 1. Illustration of different forms of customer interaction centers



ics (Madhani, 2011). This implies that the customer-centric applications make use of business analytic techniques and business intelligence resources to process the customer related data. The figure below can be used to illustrate the customer-centric applications. The figure includes sources of customer data that are derived from the customer contacts. The data retrieved from these sources is processed and stored in the data warehouse. Different analytical tools have been illustrated in the diagram, which are used to process the customer related data in order to provide an insight into the behaviors and propensities of customers (Chen & Lin, 2009).

Figure 2. Illustration of Customer-Centric applications



E-CRM and Intelligence Systems

Integration of E-CRM tools and techniques with intelligence systems of business in an organization is very crucial and valuable to an organization (Cronbach, 1951). This is because the integration enables organizations to gather and obtain customers' information from the available data through the use of sophisticated tools.

The information can be collected from various media sources or other platforms that act as a node of communication. The nodes of communication also include the organization's websites, advertisement materials, emails, contacts, and the social media. Therefore, to enhance E-CRM systems application, intelligence systems of a business must be used by use of the datasets. Containing the customer's information like personal information, buying preferences, and records of purchase that assists in the process of making the decision (Batenburg & Versendaal, 2007; Botha, Bothma, & Geldenhuys, 2008). Hence, effective application of E-CRM requires integration of intelligence systems of business so as to acquire an unyielding system that can process massive data from the customers, while providing interactive tools to make the business process more automated and effective. Studies showed that there are various systems of E-CRM integrated with intelligent systems of a business that have been developed so as to accommodate the needs of organizations (Busaidi, 2013; Chen & Ling, 2009).

CRM has become a major topic related to technology since the establishment of a conceptual framework for integrating the intelligent business and the E-CRM systems. CRM is not a new concept to many businesspersons in fact; it has drastically extended in its current application by the information technology.

E-CRM is mainly used for marketing purposes where organizations focus on maintaining long-term sustainable customer profitability. However, it would be more advantageous to an organization to integrate E-CRM with the intelligent business systems, since this would be more efficient through enhancement of decision making of a service or product hence improving the customers' experience (Chen & Ling, 2008).

In an analytical CRM, it is indispensable to have high quality data. However, research suggested that the most important step towards the achievement of success is analysis. The researcher argued that it is

paramount to ensure accuracy of the customer's contact data so as to make marketing campaigns more effective. Moreover, data quality has proved prerequisite particularly to the single view of customers since the optimum of data allows data relating to the customers to be compressed. However, failure to consider all the factors of the CRM system means that a defective quality data is used. In order to ensure correct conclusions, an analysis of the business intelligence is paramount. Furthermore, data of poor quality can also have a direct effect on employee's motivation; they are unlikely to satisfy the needs of the customers.

With the stiff competition of the international market, the application of E-CRM is drastically advancing and increasing. Most of the organization suggest that the E-CRM systems need to be developed in such a way that they can refine the operations in an organization from the bottom to top basically, paying attention to endeavors that are incorporated in all the organizational departments. As noted by (Chua, 2011; Fjermestad & Romano, 2006) integration of intelligent business with the E-CRM systems has assisted in the product testing, billing, assembling, purchasing, and manufacturing. Hence, it's clear that E-CRM systems are very beneficial and effective to numerous companies as well organizations doing online business. Furthermore, they are very useful in organization's departments such as sales, marketing, engineering, and human resources. However, the use of integrated systems has led to increased complexity of application of the E-CRM systems as the escalation of the market competition occurs and organizations strive to search for more sophisticated techniques that may include the deep gathering of customers' data to achieve their target. The collected and accumulated data enable the organization to establish a better profile view of their customers (Anderson & Kerr, 2002). Moreover, the organization gains additional benefits from the systems such that they can easily identify their target customer as well as manage to create a customer based. This enables the team to predict their future sales effectively and may even alter their plans as well as their marketing strategies when the need arises (Horwitz, 2014; Jones & Ranchhod, 2007).

The E-CRM and integrated intelligence business systems have led to the creation of opportunity that provides an effective approach. This approach interlinks marketing, sales, support, customer service with the customers. Therefore, integrated systems are centralized to maintain loyal customers and keep them committed to the organization with high revenue, improved quality, and reduced cost. Hence, the management of a modern customer relationship is motivated and shaped by not just the management or the CRM but with the idea of quality management. E-CRM is considered to be a technological solution in most of the organization, which creates an individual database as well as enhance automation in the marketing and sales so as to improve on the focused efforts (Raab, Ajami, V., & Goddard, 2008).

The E-CRM systems are not only critical to the organization but also play a crucial role in the customer experience. These systems provide ease and customization of transactions implementation without considering the channel used. Most of the international businesses, as well as the local ones, have realized the hidden worth of the application of the E-CRM and the intelligence business system in achieving their goals as well as creating a sustainable competitive in the global market. Since due to the stiff competition, variation in the global environment and unsustainable advantages organizations are finding it difficult to adapt to the current market (Gosney & Boehm, 2000). Therefore, there is a need for innovative ideas to assist in coping with this. The CRM and the intelligence systems basically, provide opportunities that offer a sustainable competitive advantage. These systems provide an approach that helps in decision-making abilities of an organization.

E-CRM TRENDS

The recent past has witnessed changes to CRM that are customer centered. Most of the business organizations are now interested in direct marketing which is considered to improve the customer satisfaction more than ever (Manchanda, Dube, Goh & Chintagunta, n.d.). Business organizations have made it a practice of making calls and sending emails informing their clients with the new products that are available with them. The features of products and the information about the usefulness of the products are channeled directly to the customers. Additionally, the businesses are able to obtain direct feedback from their clients concerning their products. In this case, the businesses have been able to realize improved value of exchange on the non-commercial interactions (Busaidi, 2013).

The Megatrends of the E-CRM

The scenario below provides the megatrends of the E-CRM: A new customer attends a traditional store to purchase goods and register at the kiosk. Later, the customer receives an email from the kiosk with the subject “Thank You for Your Visit” accompanied with an offer. The customer who was so pleased decided to open the link provided in the email which directed to an online store website. There, the customer designed their wardrobe from the virtual shopping suggested. The customer received a call after few days about the availability of the preferred cardigan. Using their mobile phone the customer purchased the good and later picked from the store. From this scenario, there are three major trends of the E-CRM also referred to as the megatrends that include:

1. Information concerning the latest deals and offers are provided on time by all business to their customers.
2. The significant of direct marketing is drastically increasing.
3. There is a significant growth of the exchange value or the non-commercial relationship between the customer and the company

E-CRM Model

In this model, a simple e-mail auto responder is developed. The HTML codes make it possible for the client to receive an automated system response after contacting the company through an email. The model present an inexpensive and fast response to the clients (Muther, 2002). Additionally, it also disseminates information and also conducts correspondence on many different topics that may be of interest to the clients. It can also be noted that the model provides an easy way of sending e-mail messages to a flood of customer e-mails. Thus, it is now possible to respond to thousands of e-mails that may be received in a day that are sent by customers. The model is able to respond faster to customers who may also need quick answers. The model has been developed using the HTML codes. The codes have configured the company email to auto-respond to the e-mails that are received on a given criteria (Berry & Linoff, 2004).

```
<!--autoresponder code *begin*-->
<form action="http://extremenewbiemarketing.us6.list-manage1.com/subscribe/post?u=61d9d35e0f33cd495a1f0c107&id=1cc0c79413"
method="post" id="mc-embedded-subscribe-form" name="mc-embedded-subscribe-form" class="validate" rel="nofollow" target="_blank" novalidate>
```

```

<div class="indicates-required"><span class="asterisk">*</span> indicates re-
quired</div>
<div class="mc-field-group">
<label for="mce-FNAME">First Name <span class="asterisk">*</span>
</label>
<input type="text" value="Enter Your First Name" name="FNAME" class="required"
id="mce-FNAME" onfocus="if(this.value == '*Enter Your First Name'){ this.value
= ''; this.style.color= '#1a1a1a'; }" onblur="if(this.value == ''){ this.value
= '*Enter Your First Name'; this.style.color= '#818181';}" />
</div><div class="mc-field-group">
<label for="mce-EMAIL">mylisting@gmail.com <span class="asterisk">*</span>
</label>
<input type="email" value="Enter Your Email Address" name="EMAIL"
class="required email" id="mce-EMAIL" onfocus="if(this.value == '*Enter Your
Email Address'){ this.value = ''; this.style.color= '#1a1a1a'; }"
onblur="if(this.value == ''){ this.value = '*Enter Your Email Address'; this.
style.color= '#818181'; }" />
</div>
<div id="mce-responses" class="clear">
<div class="response" id="mce-error-response" style="display:none"></div>
<div class="response" id="mce-success-response" style="display:Thank you for
creating your free GoMylisting, here is a direct link to preview your details:
http://www.gomy.co.ukbusiness/Lancashire/Ramsbottom/Carl-Bradshaw-Positive-
Business-Development/18229303. Over the next a few weeks I am goint to send
you a few tips that will help you with your business awareness. If you don't
want to receive these emails, simply hit the unsubscribce link at the bottom of
this email"></div>
</div>
<div class="clear"><input type="submit" value="Subscribe" name="subscribe"
id="mc-embedded-subscribe"
class="button"></div>
</form>

```

(Warriorforum.com, 2015)

Results

The above codes are able to provide a simplified response to the inquiry that can be made through the company email. The response is automatically generated whenever the clients attempts to communicate. The response is, therefore, considered to be fast and also inexpensive. The following figure can be used as an illustration to the results that were obtained from the above codes (Batenburg & Versendaal, 2007). The figure provides a response that was automatically generated by the system after the client made the request;

Figure 3. Illustration of the results received from email auto-responders

Hi Carl

Thank you for creating you free GoMY listing, here is a direct link to preview your details:

<http://www.gomy.co.uk/business/lancashire/Ramsbottom/Carl-bardshaw-positive-Business-Development/1829303>

over the next few weeks I am going to send you a few insider tips that will help with your business awareness – if you don't want to receive these emails, simply hit the unsubscribe link at the bottom

Challenges of Using E-CRM Intelligence

There are a few challenges that are realized with the use of E-CRM in enhancing the customer relationships. To start with, it is always difficult to decide on the technology to employ to develop the E-CRM. The appropriate skills that are required in implementing the E-CRM solution could lack. This can create huge problems when the system is internally developed (Nykamp, 2001). There is also the problem of creating CRM strategy. This encompasses inadequate deployment methodologies and also lack of aligned objectives. It can also be said that there are other challenges that realized from the customers end. Some of these challenges include slow user adoption to the E-CRM interfaces and difficulties in aligning the culture with the new working E-CRM (Anderson & Kerr, 2002).

FUTURE DIRECTION OF THE RESEARCH

Although the study showed a lot of contributions to the already existing research, there is a need to investigate some aspects further. For example, future research work ought to empirically show the relationship between the interactions of the customer experiences and the business practices. While the research clearly shows that there is effective contribution, future researchers should have data that shows the degree of interaction and success. Moreover, more relationships between E-CRM systems and implementable decisions should be analyzed in details and recommendations made

CONCLUSION

There are many ways that are used by companies to enhance their image to the customers. E-CRM is considered to provide the necessary tools that can realized improved customer satisfaction. E-CRM also provides the business with opportunity of assessing the behavior of the customers which can later be used to improve the value of the products offered. There are different techniques that are used by E-CRM to identify the best customers of the business. The paper has tackled some of the technical aspect that are characterized by E-CRM Intelligence. A typical model for email auto-responder has been included in the paper. The model involves simple HTML codes that are used to send an automated response to the

client making contributions to the company. The results of the auto-responder have also been included. Lastly, the paper has provided a discussion on the challenges that face the development of the E-CRM Intelligence and the emerging trends.

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Critical Success Factors in a Six Dimensional Model CRM Strategy

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INTRODUCTION

Organizations are currently embedded in an increasingly unstable and turbulent context, accentuated by globalization that leaves companies exposed to many unpredictable changes in their environment. In this scenario, organizations require trustworthy information and personalized knowledge that are indispensable in decision processes.

Relational marketing is becoming increasingly important. The main objective of relational marketing is to meet the needs of customers and the fulfillment of their wishes, through the design and development of products and services that can fulfill the expectations of customers. Kanagal (2009) mentions the application of relational marketing by companies is a competitive differential factor in leadership development, customer loyalty and rapid acceptance of new products and services in the market.

In addition to the acquisition of new customers, the retention of existing customers is of growing strategic importance, considering that the acquisition costs of a new customer are generally much higher than the retention costs of an existing customer. This vision is confirmed by Orantes-Jiménez, Vázquez-Álvarez, and Tejeida-Padilla (2017), which highlight that customer retention can offer greater profitability to companies. Van Triest, Bun, Van Raaij, and Vernooij (2009) complement this by stating that the customer retention process offers companies the potential to become more competitive than the competition, even in those with lower production costs. However, in the current competitive paradigm of national and international markets, customer loyalty is only possible if customers have a high degree of satisfaction with the products/services offered by the company.

Market orientation is an organizational culture that requires customer satisfaction to be at the center of business transactions. To this end, it is necessary to ensure that the company generates added value for customers and better performance for the organization (Anderson & Narus, 1998). Furthermore, market-oriented behavior facilitates organizational innovation, positively influencing commercial performance and the company's ability to perceive and satisfy customers (Prifti & Alimehmeti, 2017).

Customer Relationship Management (CRM) is a strategic model that aims to facilitate the management of knowledge from customer interaction and, consequently, helps to improve the decision-making

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process. CRM is not merely software or an activity that focus only in the customer service process, but it should be seen as a holistic process of anticipating and satisfying the expectations of customers. The management of the relationship with the customer (CRM) has been analyzed from diverse perspectives, standing out the information and marketing systems. CRM has implications throughout the organization and studies reveal a concern in analyzing in CRM adoption the relationship between critical success factors across the organization and their performance (Alamgir & Shamsuddoha, 2015; Meyliana, Hidayanto, & Budiardjo, 2016; Sebjan, Bobek, & Tominc, 2014). However, considering all dimensions of CRM, which can be viewed as a strategy, it is pertinent to exhaustively identify the critical success factors.

The objective of this chapter, based on the six dimensions model on the adoption of a CRM strategy, is to present and characterize a total of sixty-five critical factors, which are grouped into six dimensions. These critical success factors are generally cross-cutting regardless of the structure and sector of activity of the company, but the organizational specificities and the context must be taken into account in the establishment of a CRM strategy following the recommendations of Ahmad and Buttle (2002). Initially, the manuscript describes the different dimensions that influence the CRM adoption strategy. Consequently, critical success factors are integrated and discussed in each dimension. The paper concludes with the presentation of recommendations and solutions for its adoption in a business context, looks to the main current research lines in the final and the final conclusions are drawn.

BACKGROUND

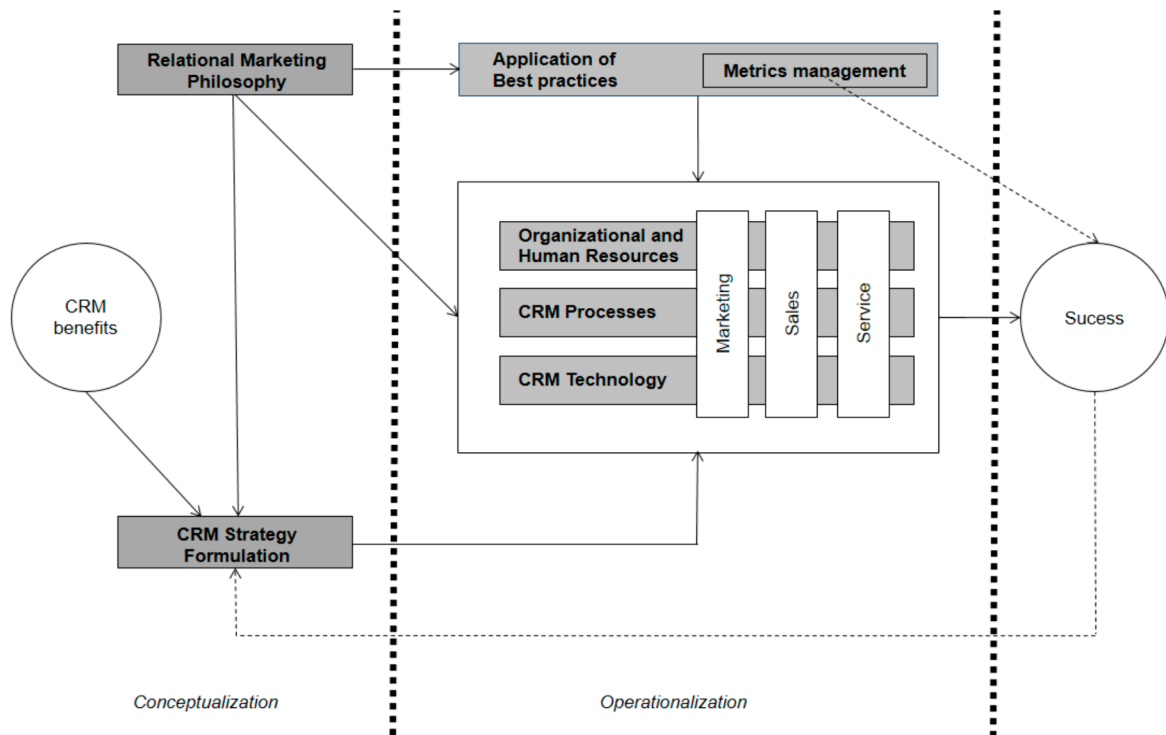
Several CRM adoption models that seek to present characteristics and processes that must be taken into account by the organization to increase the likelihood of success. One of the most up to date studies in the field that synthesize several dimensions that influence the adoption of a CRM strategy is presented by Santos and Castelo (2018). The authors carried out a systematic review of the literature that allowed identify and consequently analyze 32 models, developed between 1999 and 2015. In that study, the isolated factors that must be taken into account in the adoption of a CRM strategy are also included. The findings summarize the critical success factors into six dimensions: CRM strategy formulation, relational marketing philosophy, the application of best practices, organizational and human resources, CRM processes, and CRM technology.

The relationship between the different dimensions is evidenced in Figure 1. According to this conceptual model, the adoption of a CRM strategy consists of two phases: conceptualization and operationalization. In the first phase emerge two dimensions: (i) relational marketing philosophy; and (ii) CRM strategy formulation. It is relevant to emphasize that in the second above dimension, the user must take into account the CRM benefits that the company seeks to achieve. In turn, this dimension must also take into account feedback resulting from the evaluation of success, thus demonstrating the control that strategic management implicitly has in the process. In the next phase, we find the remaining four dimensions: (i) application of best practices; (ii) organizational and human resources; (iii) CRM processes; and (iv) CRM technology. In the 'application of best practices' dimension, the management of metrics stands out, which presupposes the definition of elements that will contribute to the evaluation of the success of adopting a CRM strategy. In turn, the 'organizational and human resources', 'processes' and 'technology' dimensions interact on the three functional areas of CRM: marketing, sales, and after-sales services and are influenced by the other three dimensions.

For each identified dimension, we intend to identify several critical success factors, which are summarized below. Its presentation in each of the dimensions is carried out in alphabetical order. Additionally,

Figure 1. The six dimensions influencing the adoption of a CRM strategy

Source: Santos & Castelo, 2018, p. 34.



a representation of the number of critical factors per dimension associated to the authors that support them is given as appendix in Figure 2.

DIMENSION 1: CRM STRATEGY FORMULATION (CSF)

When the organization decides to adopt CRM in a strategic perspective, some elements must be taken into account:

- **Adoption based on a detected issue:** start by choosing which problem in the customer relationship lifecycle matters to be solved;
- **Covered CRM functional areas:** define which CRM areas should be included and whether there is phasing;
- **Context and timing:** the results of the strategy definition are conditioned by context and moment it is implemented;
- **Engagement and management commitment:** top managers should be involved in the adoption of CRM;
- **Definition of benefits:** enumeration of the benefits that the company seeks to achieve;
- **Relationship definition (CRM vision):** how the company internalizes the concept of CRM? Which experience seeks to provide the customer? How CRM fits into the organization's strategy? How to integrate the products/services in the relationship?

- **Adequate investment:** adjust the value of the investment made in order to support CRM;
- **Strategic objectives:** list of strategic objectives that the company seeks to achieve.

DIMENSION 2: RELATIONAL MARKETING PHILOSOPHY (RMP)

This dimension encompasses elements that contribute to the way the company operates in the market and how to successfully interact with the customer:

- **Customer as an asset and at the center of the organization:** development of a client-centered organizational culture in which the customer is the organization's main asset that seeks to maximize its value;
- **Creation and delivery of value:** creation and delivery of value to the customer through the development of a value proposition;
- **Loyalty:** the organization is more concerned with retaining existing customers rather than raising new ones;
- **Customer knowledge management:** initiatives that the company develops to know more about the client and to disseminate this knowledge by the organization. These are the fundamental principles of a learning organization;
- **Long-term customer relationship orientation:** the company's interactions with the client should aim to maintain the relationship with an extended time frame;
- **Business processes orientation:** existence of business processes designed from the customer's perspective;
- **Customer satisfaction:** constant demand to satisfy customers in all aspects.

DIMENSION 3: THE APPLICATION OF BEST PRACTICES (ABP)

Best practices, such as the adoption of metrics, are typically common to many dimensions. Therefore, we intend to present in this dimension the best practices that are not restricted to a single dimension:

- **Customer data use and analysis:** monetization of existing information to maximize the customer relationship;
- **LTV calculation:** basic metric whose main objective is to obtain the value of the client over the expected time of the relationship;
- **External consultants:** use of external consultants to assist and the dynamize the CRM adoption;
- **Cross-selling / up-selling:** application of sales programs aimed at increasing client share;
- **Customization:** ability of the company to make different versions of the product to meet specific customer needs;
- **Differentiation:** differentiate customers by their value needs. For that, adopt a segmentation approach;
- **Metrics management:** establish and measure metrics at strategic, tactical and operational levels;
- **Customer identification:** the company needs knowing very well the customer to establish a proximity relationship with him;
- **Incremental:** transformation of the organization in phases;

- **Innovation:** innovation of products and services as a way to strengthen the relationship with the customer;
- **Interaction:** the organization should leverage customer interaction to learn more about him and strengthen the relationship;
- **Methodology and roadmap:** the organization must have a roadmap supported in an adoption methodology;
- **Customer privacy:** protection of data provided by customers, and guarantee that data is not transferred to third parties. At the European level, the General Data Protection Regulation (GDPR) has created new challenges and requirements for companies (EU, 2018);
- **Loyalty programs:** implementation of programs that increase customer loyalty;
- **Redesign of the business processes:** change traditional working processes and put the customer at the center of the processes;
- **Customer choice:** not all customers are interested in maintaining a relationship with the company and not everyone is interested in the company;
- **Customer service:** pre and post-sale customer service, from the perspective of being proactive and anticipate the customer needs.

DIMENSION 4: ORGANIZATIONAL AND HUMAN RESOURCES (OHR)

Present critical elements related to how the company is dimensioned, structured, that is, how the organizational system is designed to accomplish satisfactorily the purposes:

- **Performance evaluation:** employees must be evaluated. In this evaluation should be present the elements that encourage people to strengthen the company's relationship with customers;
- **Adjustment and competencies:** the company must have employees who have the skills and capacity to adjust to new requirements;
- **Commitment and employees involvement:** commitment and involvement of employees with change;
- **Technological skills:** employees know how to use and monetize technology;
- **Internal communication:** the company dynamizes and encourages internal communication;
- **Performance and employee motivation/satisfaction:** alignment of employee behavior with customer-centric business processes. Additionally, employees must be motivated to focus on the customer and improve its relationship;
- **Company size:** size may be important in certain situations, for example, it may influence the capacity of the company to reach a higher technological level;
- **Involvement of HR department:** the HR department must be involved in all the breadth of adoption;
- **Organizational structure:** an organizational structure appropriate to the needs of the CRM strategy, with a multi-functional dynamic and reflecting a customer-oriented culture;
- **CRM formation:** necessary training in CRM perspective and considering the specifics of the organization;
- **Change management:** the company must develop a culture of change, from products to customers, from the short to the long term, and this change has to be managed in a way that decreases the resistance;

- **CEO profile:** characteristics of the CEO, including how he/she faces innovation;
- **Compensation and incentive system:** aims to motivate employees to focus on the customer.

DIMENSION 5: CRM PROCESSES (CP)

The need for the company to have customer-centric business processes leads to a redesign of business processes, which is a best practice in CRM adoption. However, other aspects should be taken in the redesign of business processes and their maintenance implies the existence of several critical factors of success that is characterized in this dimension:

- **Process automation:** process design contemplating its automation;
- **Top managers involvement:** involvement of top managers in process redesign;
- **Choice of interaction channels per client:** design of processes taking into account the channels preferred by clients to interact with the organization;
- **Customer lifecycle management:** definition of specific processes for different phases of the customer's life cycle;
- **Back and front-office integration:** integration of process in a workflow that simultaneously consider the back-office and front-office;
- **Multi-channel integration:** integration of various communication channels with the customer;
- **Multi-functional integration:** convergence of available customer information regardless of the department and point of interaction;
- **Monitoring:** analysis and evaluation of processes including objectives;
- **Single repository of information:** concentration of information in a single location in order to avoid duplication and minimize the effort to maintain this information;
- **360° vision:** design of a process in order to share information, making it accessible to those who need it at the right time.

DIMENSION 6: CRM TECHNOLOGY (CT)

This dimension encompasses relevant factors that influence the empowerment of technology and consequently affects the success of a CRM adoption:

- **Strategy and business processes alignment:** technology must be in tune with the strategy and should respond to the needs of the organization that are reflected in the business processes;
- **System architecture:** use of standardized software developed outsourced. The use of internal development should be avoided because of possible problems of integration and maintenance. Additionally, mature systems must be used;
- **CRM evaluation:** periodic application of evaluation mechanisms to assess the CRM system;
- **Technological requirements definition:** specification of technological requirements taking into account the needs of the business and customer relationship vision;
- **Top managers involvement in technology choice:** participation of top managers in the decision process on the technologies that should be used in the CRM platform;
- **Technological training:** the company has plans to train employees in the use of technology;

- **Technological integration:** the integration of the CRM system with other systems improves the relationship with the customer;
- **Supplier choice:** several alternatives should be considered in the process of choosing a supplier;
- **Specialized software:** the company uses specialized software to analyze information;
- **Use:** the way the technology is used interferes with its effectiveness and efficiency, thus affecting the outcome of CRM. Even from a certain level of use, technology can stop being a facilitator.

SOLUTIONS AND RECOMMENDATIONS

Companies should consider that each client is different, with different habits, lifestyles, and social behaviors. Knowing and classifying customers becomes a fundamental activity for companies. In fact, customers are increasingly demanding and well informed. An unsatisfied client can not only leave companies but also influence the people around him/her. Moreover, customers have become skeptical and have created defensive mechanisms in relation to the purchase, becoming increasingly complicated for a brand to retain its customers.

Relationship marketing enables companies to respond to these emerging challenges and establish long-term relationships with their current and potential customers. The establishment of a CRM strategy must offer an in-depth vision of its customers to anticipate their needs and desires and surprise them positively, offering products and services that exceed their expectations. Thus, a CRM strategy must have the dual objective of winning more customers and increasing their loyalty.

In the model presented in this study each CRM dimension integrates critical internal success factors that also work in response to changes in the surrounding environment, in order to allow the adoption of the CRM strategy in the most appropriate way to achieve the desired benefits. Every organization must take into account all presented critical success factors. However, considering possible organizational constraints it may be important to prioritize the allocation of organizational resources.

The specificity of each CRM strategy implies that it will eventually need to establish a focus on some critical factors taking into account the organizational reality and the desired benefits, which in turn tend to influence the CRM strategy (dimension 1).

FUTURE RESEARCH DIRECTIONS

The customer relationship process is constantly changing and depends heavily on technological evolution. New paradigms are emerging in the market and bring new challenges to companies and cause the critical success factors of a CRM strategy to be progressively enriched.

One of the paradigms that have revolutionized the business market is Big Data. According to Mayer-Schönberger and Cukier (2014), Big Data can be understood as the immense volume of data, structured and unstructured, that impact on business. However, the perspective of quantity cannot be looked at differently from the quality of information, since it becomes relevant that companies extract and exploit the data that are really important for their business. The integration of Big Data in relational marketing will offer companies new insights about their business, which will allow them to make better decisions and strategic business directions in the future.

Progressively it is also expected that the purchase and payment processes traditionally initiated from people will become more agile and will also be initiated by “things”, which include the purchase and

machine-to-machine payment transactions. The Internet of Things supported by Internet 4.0 models will allow delivering information in real-time between a huge variety of devices, allowing faster and more assertive decision making (Almeida, 2017). In this sense, it is also relevant to explore the impact of Internet 4.0 on the definition of CSFs of a CRM strategy.

CONCLUSION

In this chapter, we attempt to enumerate critical success factors for the adoption of a CRM strategy by giving a brief presentation of each. These factors were identified based on a review of the literature, which also allowed us to verify they could be grouped into six dimensions and in model that related them, which also served as the basis for this work. The model also differentiates two phases in the adoption of a CRM strategy: conceptualization and operationalization. Consequently, there are factors related to a phase in which one tries to define how the customer relationship strategy will be and the other phase that integrates factors that assume a perspective of accomplishing this strategy.

The dimension of 'The application of best practices' is the one that includes the most critical success factors, consisting of seventeen. This is followed by the 'Organizational and human resources' dimension with thirteen critical success factors. The dimensions 'CRM processes' and 'CRM technology' have both ten critical success factors. In turn, the 'CRM strategy formulation' dimension encompasses eight critical success factors. Finally, 'Relational marketing philosophy' dimension incorporates only seven critical success factors. However, this difference in number between the critical success factors that integrate each of the dimensions does not mean that different dimensions of importance should be assigned to each dimension.

The identified critical success factors are not differentiated by the magnitude of their impact, nor by the eventual interaction may they have among themselves, despite the relationships between the dimensions that agglutinate them are evidenced in the presented model. Thus, as future work, there is an opportunity to evaluate and define an amplitude scale of impact and establish relations of influence between the various critical factors.

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KEY TERMS AND DEFINITIONS

Best Practice: Method or technique, which efficiently and effectively enables higher-level results compared to other means.

CRM: A customer-oriented strategy with two-dimensional conceptualization (formulation and relational marketing philosophy) and a four-dimensional operation (application of best practices, organizational and human resources, CRM processes, CRM technology).

CRM Dimension: Groups a set of critical success factors that have an affinity with each other in the adoption of the CRM strategy.

Cross-Selling: Sales technique used to get a customer to spend more by purchasing a product that's related to what's being bought already.

Internet of Things (IoT): Concept that refers to the digital interconnection of everyday objects with the Internet, connecting objects more than people.

Metric: Indicator to measure and evaluate performance.

Process: Set of structured work activities that produce business results defined for customers and aiming to add value.

Relational Marketing: Marketing strategy that aims to build customer loyalty.

Strategy: Planned and sustained way of achieving medium/long-term objectives.

Up-Selling: Sales technique used to get a customer to spend more by buying an upgraded or premium version of what's being purchased.

APPENDIX

Figure 2. Number of CFs and list of authors per dimension

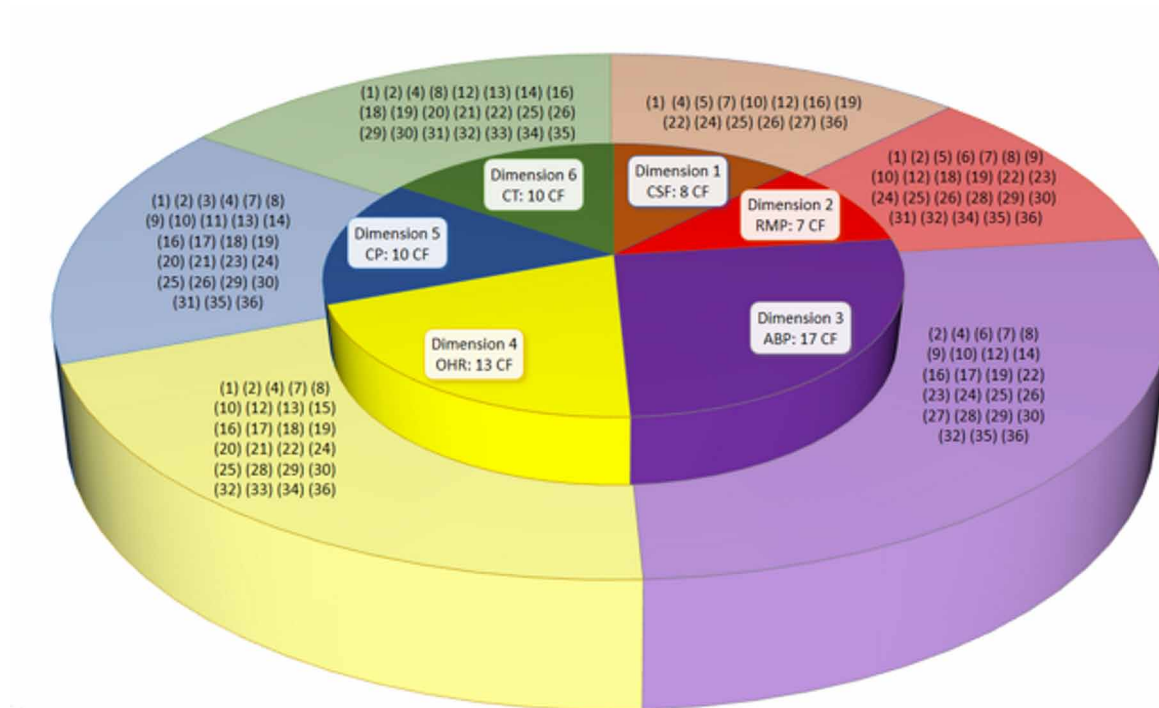


Table 1. Full list of authors (legend)

(1) Alt & Puschmann (2004)	(13) Finnegan & Currie (2010)	(25) Payne & Frow (2005, 2006)
(2) Ata & Toker (2012)	(14) Galbreath & Rogers (1999)	(26) Peelen et al (2009)
(3) Berry (2002)	(15) Hashemi et al (2013)	(27) Pomeranz (2006)
(4) Bohling et al (2006)	(16) Henneberg (2006)	(28) Roberts et al (2005)
(5) Boulding et al (2005)	(17) Kale (2004)	(29) Ryals & Knox (2001)
(6) Buttle (2004)	(18) Kim & Pan (2006)	(30) Ryals & Payne (2001)
(7) Chalmers (2006)	(19) King & Burgess (2008)	(31) Santoso (2008)
(8) Chen & Popovich (2003)	(20) Ko et al (2008)	(32) Sin, Tse & Yim (2005)
(9) Croteau & Li (2003)	(21) Mendoza et al (2007)	(33) Urbanskiené et al (2008)
(10) Curry & Kkolou (2004)	(22) Osarenkhoe & Bennani (2007)	(34) Wang & Fen (2012)
(11) Davis (1993)	(23) Park & Kim (2003)	(35) Winer (2001)
(12) Eid (2007)	(24) Parvatiyar & Sheth (2001)	(36) Zablah et al (2004)

The New Technological Trends in Customer Relationship Management (CRM) to Unveil Opportunities for Developing Countries

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INTRODUCTION

Customer relationship management (CRM) is a management philosophy and strategy that must be applied to all the units of the firm, which is customer focused, requires customers to collect and process information with effective methods of customers to meet their requests, sustains continuous communication and targets long-term customer loyalty based on trust (Yildirim & Panayirci, 2016). CRM systems work to develop new business strategies in the light of the information gathered to create better understanding for the expectations of customers and the information obtained. In this sense, the CRM systems have ability to analyze each customer individually, such as customer profile, habits, anticipations, location and region information, as opposed to general customer definitions, to make new work plans on the basis of analysis of these obtained data. In today's world, globalization increases competitiveness of companies (Hitt, Ireland & Hoskisson, 2016). Therefore, it has become a necessity to implement CRM systems correctly so that organizations can overcome this competitive environment. Furthermore, CRM has several other advantages for businesses to become successful competitors in such a technological world. Some of the benefits of CRM in terms of firms are working customer oriented, the retention of customer loyalty, maximizing long term revenue and profit, maximizing up-selling, cross-selling and bundling, and having more information about customers by segmentation (Goodhue, Wixom & Watson, 2002).

Although CRM might see as a mature subject, it is known that it will continue to grow in the years to come with new technologies, features and innovations. In today's business world it has become imperative to keep abreast of new technological changes and trends for companies while the CRM is proceeding on its way to implement these strategically way. Therefore, this chapter discusses new technological trends in CRM with a special reference to unveil opportunities for developing countries. In this context, a special assessment under which trends will shape CRM for the future is going to expand the existing resources provided by the literature about this subject. Internet of things (IoT) concept is one of these trends which involves interconnected devices, systems and services that rely on the autonomous communication of physical objects within the existing Internet infrastructure (Atzori, Iera, & Morabito, 2010). IoT is a thrilling concept because it brings intelligence of the Internet to physical products (Hoffman & Novak, 2015), thereby making all products more connected and smart (Nguyen & De Cremer, 2016). CRM solutions are now evolving to take customer service to the next level enabling enterprises to bet-

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ter understand their customers and offer proactive support by leveraging IoT data to create improved, automated customer support environments (Palermo, 2015). Furthermore, artificial intelligence (AI), cloud-based CRM and social CRM are some of the trends that will be discussed in this chapter. Even if CRM systems are implemented in the most appropriate way, it is necessary to prepare it for future technologies ahead of time and adapt to continuous innovations. According to Rivera and Van der Meulen (2014), CRM will be at the heart of digital initiatives in coming years as enterprises look to create more targeted interactions in a multichannel environment. Therefore, the discovery or unveil of the opportunities of such new technological trends for CRM and the use of their advantages will often make it possible for the developing countries to acquire a greater place in today's innovative business world.

BACKGROUND

Elaborated Definition of CRM

Globalization is a concept that leads to the borders of countries to disappear deeply affects firms and puts them into competition environment. In this competitive environment, people want to buy products and services that fulfill their own demand rather than being offered to them. Kumar and Reinartz (2012, p. 5) defined CRM as "... the strategic process of selecting customers that a firm can most profitably serve and shaping the interactions between a company and these customers. The ultimate goal is to optimize the current and future value of the customers for the company...". Better quality and affordable products and services provided to the customer can help companies to have loyal customers, while at the same time providing a competitive advantage to firms. Thus, CRM is a huge competitive advantage that allows organizations to keep their customers in the long term.

Evolution and History of CRM

While some firms assume that CRM starts with the birth of the conception of trade by applying it in different forms according to the times of day, some other firms accept CRM as the birth of call centers. In fact, the recognition of CRM philosophy in the world, the adoption of it, and the fact that it takes a long time to pass on its life is the best indication that this concept is not just a software. Products become more popular than ideas. Since CRM is a philosophy, it is only after such a long time that it has reached the stage of concept maturity. That is the post-implementation phase, and the real contribution of CRM to people's lives will also be in this phase.

The Components of CRM

CRM is a combination of people, processes and technology that seeks to understand a company's customers (Chen & Popovich, 2003). Companies that successfully implement CRM will reach customer loyalty and long run profitability. When all of these interpreted, the most critical component is the people component. CRM systems that automate integrated customer processes lead to changes in how users perform daily business. People who do not fully understand the reasons for change, do not participate in the change, or do not have enough training on change may show resistance. Therefore, human factor plays an important role for CRM implementation. The business process is another important component that companies need to change it according to CRM system. Relationship marketing differs according

to customers' purchasing behavior, needs, preferences and price sensitivity, so companies must adapt their business processes to their customers in order to maximize the value of their customers. While both people and processes are both crucial for successful CRM implementation, the technology infrastructure is also essential to analyze customer data, evaluate customer behavior, improve predictive models, effective communications with customers and serve better quality of products and services.

The Key Benefits of CRM

The main benefits of CRM can be explained from two perspectives, both companies and customers. Some benefits of CRM for companies are clarifying that working customer oriented, retaining existing customers, achieving more and longer revenues and expanding the service area, learning more information about customers anytime, anywhere, and learning marketing impacts and trends. On the other hand, continuity, touch-point and personalization are some buzzwords for the benefits of CRM for customers. Continuity means that loyal customers always have the advantage of being a regular customer because they always get the same products and services from the same point thanks to CRM. Touch-point is about that the delivery point of the service or product is also an advantage for the loyal customer. For example, if a person goes to the same restaurant on a regular basis, the table allocated to you will be different, or the banks will give priority to good customers in the recent period. Personalization also means that owing to CRM systems and information gathered about the customer, unique products can be offered. It is a good example to do a discount on customers' birthdays. They can choose a hotel, bedding sets and towels that they like, in their favorite color or regular the newspaper they read can be presented to them in the morning.

Applications of CRM

CRM is a business strategy that organizations influence customer choice, customer acquisition, customer protection and customer deepening phases. CRM applications have been developed to enable companies to improve their relationships with current customers, gain new customers and retain all customers. CRM applications enable customer relationship management to ensure that the organization has the right leadership, strategy and culture. CRM applications with developing technologies provide profitability to the maximum level and provide loyal customers with technological infrastructure. The main purpose with CRM software; to increase profitability as it is at every firm. With CRM software, the company becomes an institution that listens, understands and responds quickly to its customers, reaches potential customers, adds new loyal customers to existing customers, carries out cross sales between its products, and turns orders quickly. With CRM software, the sales process becomes easier because the customer knows all the purchasing habits and details. In addition, the performance of the sales staff performing the transaction can also be monitored very clearly on CRM applications. In the marketing phase, it automates the process and directs the sales staff to all campaign information and cross selling. Companies need to use CRM software to listen and communicate with customers. Customer service, built with a good CRM application, means more customers and more profitability in terms of the firm. With CRM applications, information is classified according to customer needs, especially sales and marketing personnel are prevented from wasting time in the day.

The most known software in CRM applications are Salesforce, Oracle, SAP, Sugar CRM and Microsoft Dynamics. For example, Salesforce is a web-based, online software application. By working in the cloud system, the user is able to detail and manage all the work. The cloud system means that the user can access all information on the internet or via mobile devices without installing any software (Yagci,

2017). Generally, companies do not install software on their own servers, but rather pay some annual rent per user and get some services over the web. They can also connect to these web sites with mobile devices instead of computers and use almost all CRM modules. At this point, companies are relieved of the high software costs that initially appear to be an obstacle to the transition to CRM applications. For example, after Microsoft and IBM, Oracle is one of the world's largest computer software companies. Oracle's CRM applications have more than 5 million users and more than 5000 customers in 145 countries. Oracle CRM applications are better suited for comparison with SAP and Microsoft Dynamics. Because the viewpoints of these CRM applications are the same. Salesforce and Oracle are different in appearance and content (Yildirim, 2016). Recently, due to increased competition between companies, Oracle has reported that cloud and social media links will also be in the process, and competition is increasing for this reason. There are opinions that Oracle CRM is more complicated but more difficult to use than Salesforce CRM. However, Salesforce CRM is easily accessible, lacking the investment cost, and creating personal or company specific solutions (Yildirim, 2016). Moreover, SAP CRM is a cloud-based CRM application with a sales focus. SAP Cloud Sales offers solutions to all organizations that closely follow up sales operations and target market perfection, from sales representatives to mid and senior managers. Cloud CRM (Cloud CRM), which does not require infrastructure investment, can offer all necessary applications to web based organizations. Thus, institutions get rid of licenses and infrastructure costs and only pay the price of the applications they prefer by calculating the number of users. Furthermore, Sugar CRM is a visionary company that is used on 26 different levels by 1.5 million users in 120 countries today with its innovative and affordable CRM solution. Sugar CRM is an innovative application designed for all individuals and organizations with customers. It positions the business processes of consensual CRM applications with a simple, mobile and social application. It is used in different sectors such as retail, finance, manufacturing, public, technology, logistics. Global customers include IBM, Coca Cola Enterprise Inc, Reebok, Lueg, and Thomas Cook. In addition, Microsoft Dynamics CRM is a CRM web-based business solution that improves sales productivity and marketing effectiveness through cloud, business, or a combination of them through social networking insights, business intelligence and campaign management (Pak, 2016). However, for all mentioned companies, software should also be considered as a security risk.

As a result, CRM applications emerging as the differentiation strategy of the companies are widely used today. The best and most effective CRM systems are known as Salesforce, Oracle, SAP, Sugar CRM and Microsoft Dynamics. However, firms should choose what they need when choosing CRM applications. In addition, firms should not consider CRM as just an application.

What is E-CRM?

In the developing world, the number of customers is gradually increasing due to the competition environment which is getting harder and harder. In such an environment, the notion of CRM has also increased in importance. Companies that control their flow of work from electronic media and thus ensure that the information they need is the right one, are getting a step ahead of their competitors when they have an accurate analysis of their information. Especially the emergence of the Internet is a big revolution in this sense. This, in a sense, is seen as a sign of a new economic transition. Businesses are now moving quickly to electronic forms of work and trying to develop efficient e-business methods. In doing so, the main purpose is to keep customers in the form of changing work. As a natural consequence of doing business in the electronic environment, the customer relationships are now transferred to the electronic environment, and the competitive environment is now that the businesses are a click away from each other and a new CRM. This method, known as E-CRM, focuses on customer needs and demands that

arise due to the increased technology that enables Internet access in addition to the familiar CRM principles. Because there are unlimited choices in Internet environment and shopping habits can change very easily. Businesses that want to keep up with this tend to E-CRM. E-CRM is actually the Internet based CRM method. E-CRM applications are now known as a method that must be adopted by all businesses to keep pace with the new economy and excel in the competitive environment.

Strategies for Successful CRM Implementation

CRM withstands establishing long-term, sustainable customer relationships to add value to both the customer and the company. CRM applications can be integrated with other decision support systems (DSS) such as enterprise resource planning (ERP), supply chain management (SCM), executive information systems (EIS) and so on. On this basis, organizations can create information systems (IS) that work together, and build better relationships with customers by increasing service quality. In short, understanding the CRM strategy correctly, using innovative technology to make business processes more effective, and keeping the existing customers as the main objective are critical issues in the successful implementation of CRM. There are several recommending steps for a successful CRM strategy (Crockett and Reed, 2003). Firstly, the company should understand how CRM fits into the context of the company's overall business strategy. Then, an assessment is to be done to confirm the company's current CRM capabilities. It is also important for the company to have a good reason to implement CRM other than new technology fever. Lastly, a plan should be created and executed, which clearly defines how to achieve the goal and execute it.

New Technological Trends in CRM

With the development of technology, it is clear that the use of CRM applications is inevitable for companies to survive in the globalizing world. In addition, the use of CRM is also increasing as companies become progressively customer oriented. Large and small businesses, companies from every sector invest more resources in their CRM systems and are more aware of the customers' marketing heritage. In such a developing world, there are many trends that affect CRM in different ways, and this chapter actually aims to shed light on these new trends that will affect the future of CRM.

Internet of Things (IoT)

The Internet of Things (IoT) is a concept that has been started to hear very often lately. In today's technology, people's lives have begun to change with the development of smart devices that interact with each other. It is obvious that IoT depicts how people interact with the smart devices in their everyday lives, such as using cars, how they use energy in their buildings, or where the food in the fridge is running out, in short, everything under control. According to Gartner Inc. (2017), there will be 20.4 billion connected devices in 2020 and CRM will be at the heart of digital initiatives in coming years as enterprises look to create more targeted interactions in a multichannel environment (Rivera & Van der Meulen, 2014).

Companies that realize that this concept will change business patterns from beginning to end, have begun to adapt the IoT to business processes. For example, Google's initiatives on IoT technologies are manifested in both consumer and industrial space. With over \$ 3.2 billion of smart thermostat makers buying Nest last month, Google is focused on developing smart home systems, and is aiming to be the best choice for connectivity solutions for appliances with Internet technology, cloud computing and en-

terprise performance on-site fiber optic network infrastructures (Oncel, 2014). So, after the breakthrough of the Internet, the revolutionary concept of IoT is vital.

The communication between machines as well as the IoT concept also creates a new channel of communication between companies and customers. The bottom line is that IoT is a big paradigm shift that is not only affecting the way people interact with objects and things but also the way customers interact with brands (Palermo, 2015). If the companies adopt this approach and apply it correctly, they will take a leading position in the sector. By means of data gathered through interconnected objects, companies will be able to identify the target mass much more accurately and thus increase the efficiency on marketing. In addition, companies will be able to provide personalized marketing through the data they collect about existing customers, so that they can offer products and services that customers will tend to buy. In addition, the IoT will make a great contribution to the development of the user experience through the data obtained from the connected devices. This data may lead to the development stage of the products.

Artificial Intelligence (AI)

Along with evolving technology, another concept that will have a great effect on CRM is Artificial Intelligence (AI). At first glance, AI in the literature allows everyone to think something different. According to The English Oxford Living Dictionary, the definition of AI is “The theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages.”. For example, if a person on the computer does not realize that may be human or software while talking to someone else, this is the result of AI.

The marketing sector like the other sectors, is changing with AI. As consumers' habits change, more analysis and service quality come to the fore with the development of technology. According to an investigation, 80 percent of marketers believe that AI will radically change the marketing industry. However, only 10 percent use it in marketing.

Witherspoon (2017), commissioned a report from IDC to dive into how AI will impact CRM, which is the fastest-growing and soon-to-be largest category of enterprise software, and the findings are fascinating. The research, out today, reports that by 2021, efficiencies driven by AI in CRM will increase global revenues by \$1.1 trillion and ultimately lead to more than 800.000 net-new jobs, surpassing those lost to automation. Furthermore, the year 2018 is expected to be a landmark year for adoption of AI, with 40 percent of companies saying they will adopt AI within the next two years and 75 percent of enterprise and ISV development projected to include AI or machine-learning in at least one application. In the report it is also mentioned that AI-powered CRM activities will touch almost all functions of an enterprise, including accelerating sales cycles, improving lead generation and qualification, personalizing marketing campaigns and decreasing service case resolution.

Cloud-Based CRM

The growth of firms adopting a customer-focused approach, the advances in CRM software technology, and the choice of cloud platforms for individual and enterprise data management are changing the way businesses do business around the world. In addition to data collection and storage capabilities, cloud technology, which is designed to perform data analysis, pioneers the exchange and transformation of devices which manage data flow, from design to production through supply chain to customer experience management, through the IoT. Plaksij (2018) defined that cloud-based CRM (or cloud CRM)

means that a CRM software is hosted in the cloud. Today's cloud-based CRM solutions offer countless benefits to all small, medium, and large companies because of their easy installation and low cost. As in all other sectors, cloud-based CRM tools are increasingly used by automobile manufacturers in the automotive sector. For example, the air of the car tires goes down during the journey. The sensors in the car are aware of the problem and automatically send an information message to the customer service representative. The customer service representative calls or sends a message to give the address of the closest service to the car driver.

Salesforce is a leading enterprise cloud-based computing company that develops the world's best CRM software. One of the success stories of Salesforce CRM, a cloud-based CRM, is Coca Cola. Companies can follow customers through cloud-based applications in the Salesforce platform, from bottling locations to field representatives. Moreover, call center support agencies can instantly access the customer's past with Service Cloud. Thanks to Salesforce's cloud-based CRM, Coca-Cola Germany's technical service departments has detected a 30% rise in productivity.

Social CRM

The increase in the usage rate of social media has also led the companies to carry out their CRM activities in a social media environment. Therefore, companies use social media as a means of communicating with customers and aimed at providing both customer satisfaction and more information. According to Greenberg (2010), "Social CRM is a philosophy & a business strategy, supported by a technology platform, business rules, processes and social characteristics, designed to engage the customer in a collaborative conversation in order to provide mutually beneficial value in a trusted & transparent business environment. It's the company's response to the customer's ownership of the conversation." Social CRM has the potential to increase company's access to its customers, revenues and productivity. Besides, it has the potential to decrease costs of the companies. Therefore, the company authorities who are aware of the opportunities that social CRM offers, have started to increase and power their companies' existence on social media, develop various social trade software, develop various services for their customers in social media and search easier ways of understanding consumer behaviours in social media (Baird ve Parasnis, 2011).

People are looking for instant interaction on relationships with companies in social media. Therefore, today's companies have to understand and implement the social CRM strategy very well. A survey of over 200 Twitter, Facebook and Instagram profiles of the 40 largest companies worldwide, which covered the period of three months, has done to find several statistics of using E-CRM and social CRM by airline companies (Gajić, Živković, Stanković & Brdar, 2016; Talkwalker, 2016). According to the results of this study, KLM is has the most responds to the requests and comments of travellers on Twitter, up to 87% of requests (it delivers 118 responses on average per day). Furthermore, Twitter accounts of low-budget companies have the largest number of followers on Twitter, followed by Air Asia and Jet Blue. Besides, Qatar Airways has the largest number of Facebook fans and Emirates and American Airlines are the most popular and widespread on Instagram.

FURTHER RESEARCH DIRECTIONS

CRM markets in developing countries have similar characteristics in terms of growth and development. The CRM sector in Turkey is growing between 15-20 percent annually (Capital, 2013). It is also clear

that the CRM market has reached a certain level in developing countries, but the technology has changed rapidly and the introduction of social media has added new dimensions to the CRM and the customer. In developing countries such as Turkey, in order to achieve successful CRM, a CRM strategy should be defined as opposed to seeing CRM as a software. It is wrong for many companies to implement CRM when they do not actually set out a strategy. Although there are successful CRM projects in Turkey, it is unfortunately lower than the failure rates. Although several reasons for the failure rates of CRM, some researchers believe that CRM reached a certain level in Turkey. This can only be understood by looking at the work done in Turkey. Turkey's largest GSM operator, Turkcell, by fitting the center of CRM strategy and implement it at the beginning of 2002, "Journey to the customer" program had the highest level of customer satisfaction. Turkcell also has the title of being the sole independent auditor in this field. The company, which takes CRM as a whole and has an implementation strategy, draws attention with its successful customer segmentation. Turkcell has a very tangible CRM plan that has been revised every six months and is making targeted campaigns with the right customer segmentation.

Yapı ve Kredi Bank is one of the first nationwide commercial banks in Turkey, and is the fourth largest publicly owned bank in Turkey by its asset size. Thanks to these infrastructures and applications, it meets the expectations and needs of the customers with effective proposals that are taken right on time. Turkey's digital bank Yapı Kredi was chosen "World's Most Innovative Digital Bank" by the respected financial publication Global Finance. The number of digital banking customers increased by 35 percent in the last year and 56 percent by mobile banking customers. Eye-ID application, which is the first in Europe, has been used 5.5 million times in less than one year. Approximately four million transactions have been realized with the QR code withdrawal feature without touching the ATM integrated into Yapı Kredi Mobil. Furthermore, mobile banking usage in digital customers reached 85 percent by September 2017. Six out of every 7 users who are active digital customers use mobile banking services. In addition, the share of digital channels in non-cash transactions rose to 94 percent.

As technological developments continue to grow rapidly, developing countries should also closely monitor which trends will impact CRM in order to create opportunities for them. As a result, the concepts that are discussed in this chapter, which will play a role in the near future for all companies to survive, are important in terms of the opportunities offered by developing countries and the future of CRM. The future of CRM for the whole world, not just developing countries, seems very clear.

CONCLUSION

Until this part of the chapter, in the light of the information obtained by analyzing the findings of Internet and academic articles, it is explained how new trends will shape the future of CRM and what opportunities for developing countries. In this direction, the IoT seems to play an effective role in the future of CRM. The increasing number of objects in communication with each other means that more information about the customers will be collected. Hence, the collected data will provide an opportunity to better analyze the customers and at the same time provide an environment for personalization. AI is also one of the concepts that will play an effective role in the future of CRM. As consumers' habits change, technology development and more analysis and service quality come to the forefront. Many people have used the live chat service at least once. It is important that the target audience, which is also important in marketing, should be kept at a high level so that they can determine and understand their personal preferences. Cloud CRM, another trend, is now becoming widely used. Designed to perform data analysis in addition to data collection and storage capabilities, cloud technology enables the exchange and transformation of devices

that manage data flow through design throughput, supply chain to customer experience management, and IoT. Another trend discussed in this chapter that will play an effective role in the future of CRM is social CRM. Undoubtedly, it has become an inevitable end to companies to adapt to this change with the introduction of Internet and social media into people's lives. Developing countries like Turkey have few examples of the CRM in the scope of these new trends. Looking at the examples examined in this chapter, it is clear that the CRM market has reached a certain level in developing countries. But unfortunately, trends that will structure future of the CRM are not yet considered fully in these countries. As the technology develops in the coming years, IoT, AI, social media, mobile, cloud computing and so on concepts are expected to move forward CRM from its current position. As technological developments continue to grow rapidly, developing countries should closely monitor which trends will impact CRM in order to create opportunities for them. The future of CRM for the whole world, not just developing countries, seems very clear.

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KEY TERMS AND DEFINITIONS

Artificial Intelligence (AI): AI is the ability of a computer or robot that work and react like humans.

Customer Relationship Management (CRM): CRM is a technology or strategy that helps your company to manage its relations with customers.

Electronic Customer Relationship Management (E-CRM): E-CRM is to use Internet based technologies for conducting CRM functions.

Internet of Things (IoT): IoT is a system of interrelated objects, devices, vehicles, etc. that have ability to send and receive data over a network.

A Comparison Between Inbound and Outbound Marketing

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INTRODUCTION

Since the early 20th century, businesses have used marketing as a way to attract consumers and to persuade them to purchase their goods and services. Businesses do this by establishing product awareness among the populace by marketing in the form of advertisements. Once they have attracted their attention via advertisements, consumers may start to appear and browse for products in retail stores or websites. In terms of persuading those consumers to buy, businesses create value for their goods and services in order to satisfy the needs and wants of customers. Specifically, this is done by focusing on what consumers value the most, and then set to improve upon it, be it the lowering of prices or quality differentiation (Tanwar, 2013). Even after their products are successfully sold, businesses are keen on retaining the same customers to ensure repeat purchase. This is also known as the lifetime value of consumers, where a business is able to make a constant profit from a single consumer. All of these processes are made possible with the help of marketing, and advertising helps to make it happen.

One of the earliest forms of advertisement was in the form of newspapers being printed in England in the 19th century (Tudor, 1986). Back then, advertisements were printed on newspaper, and were mainly used to promote books, newspapers and medicines. Via this method, words regarding the arrival of a new product in the market would spread among the populace and those businesses have successfully garnered a number of new customers, leading to higher sales than before.

With the advent of technology, marketing has taken a new form. In addition to printing press, televisions and radios have begun to emerge, and advertisements on these mediums have become the norm for businesses. While expensive, these new methods have enabled businesses to reach a wider audience, and consumers are caught up by the visual effects of television and the verbal pleasantness of radio broadcasts.

However, advertising in televisions and radios are slowly becoming obsolete. Technology is one of the many aspects in society that rapidly advances and is constantly innovated. At the dawn of the 21st century, advertisements have further revolutionised into a new form, the digital media of the Internet. In fact, as time moves on, the number of Internet users are rising (Internet World Stats, 2018). The emphasis on the importance of the Internet has only grown, especially with more and more people are becoming digitally literate. Businesses who still rely on the old method of marketing have found themselves left behind.

Thus, it is the interest of this article to provide a clear outlook as to the differences between the old methods of outbound marketing and new the methods of inbound marketing. The article would also state the trends that are currently ongoing that is relevant to this change in marketing methods. It is also the purpose of this paper to argue that businesses everywhere should adopt the new methods of inbound marketing.

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BACKGROUND

Marketing as a topic has been thoroughly explored in literature throughout the decades (Houston, 1986; McNamara, 1972; Webster Jr, 1988). It is one of the many departments of any organisation that aims to promote products and services by advertisements, establish and improve public relations by reaching out to consumers, and enhance an organisation's public image. Organisations have been relying upon marketing techniques such informing on televisions and radios in order to persuade consumers to purchase their products.

As technology advances, so does the literature in marketing. More studies have begun to appear regarding a new form of marketing (Erdoğan & Cicek, 2012; Saravanakumar & SuganthaLakshmi, 2012; Stelzner, 2014; Zarrella, 2009). With the advent of programmable computers where information can be transferred quickly and freely, marketing has revolutionised into a new form, the digital form. Whereas the old methods include physical media that can be touched by hand, the new marketing techniques focus on the Internet as the new medium to advertise to the public.

The difference in public medium or media outlet in marketing has brought up a new question in literature; what are the differences between the old methods and new methods of marketing, and which method is more useful for organisations? Studies have classified the old methods as *outbound marketing* (Patruti-Baltes, 2016), while new methods are known as *inbound marketing* (Halligan & Shah, 2014). Researchers have referred outbound marketing as the informing and persuading the public to buy products by interrupting them, and by advertising on any physical medium such as televisions, radios, billboards, newspapers, direct mails, journals and magazines. Outbound marketing also involves the use of the Internet to advertise products, albeit in interruptive manners such as banner ads and website pop-ups. On the other hand, inbound marketing, refers to announcing useful and relevant content regarding organisations' products to consumers via the digital Internet. Social Media Marketing is a small portion of Inbound Marketing whereby products are advertised on Social Networks such as Facebook, Instagram and Twitter (De Vries, Gensler & Leeflang, 2012).

Because physical media have been in existence for a long time, there are many studies covering the topic surrounding outbound marketing for organisations. Before the Internet, organisations have always been relying on physical media as their main method of advertising their products (Bush, 2002; Farrelly, Hussin & Bauer, 2007). The term inbound marketing only existed after the appearance of the Internet, and due to this infancy, there are relatively few studies compared to outbound marketing. Organisations have only begun to embrace this new method of marketing.

A study to compare between the two methods of marketing had only begun to be explored (Ancin, 2018, Rancati, Codignola & Capatina, 2015). Most comparisons are being made informally on blogs and websites rather than on academic articles. Some studies argued that organisations must use the old methods of outbound marketing in order to attract consumers but these studies are decades old (Larkin, 1979). With the arrival of the Internet, outbound marketing has outlived its usefulness due to the rapid rise in the number of Internet users throughout the years. In addition, only a few studies have attempted to justify the importance of inbound marketing over outbound marketing, which brought about the inspiration for this paper.

FOCUS OF THE ARTICLE

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The next part of the paper will focus on highlighting the main differences between outbound and inbound marketing. Because definitions may vary across literature, this section will specifically define the meaning of outbound and inbound marketing in order to avoid confusion and to simplify both terms. Afterwards, the benefits brought about by the techniques of inbound marketing would be highlighted in order to argue that organisations must adapt this new method of marketing. On the other side of the same argument, this section would then point out the problems of organisations still clinging to the old methods of outbound marketing, and why organisations should consider to shun these methods in favour of the new techniques of inbound marketing.

The Main Difference Between Outbound and Inbound Marketing

Throughout the century, organisations have used outbound marketing as the main method of advertising products. Outbound marketing consists of techniques that include advertising on physical medias such as televisions, radios, local and national newspapers, billboards and posters, magazines and journals, and direct mails. With the coming of the Internet, outbound marketing has taken a new form; pop-ups in web browsers, and banner and display ads on websites' interface. The concept of *outbound marketing* is all about going out, demanding the attention of consumers regarding products that an organisation wants to sell, and interrupting consumers on the spot, irrespective if the products are desired by consumers or otherwise. Therefore, consumers may not be interested to buy the products, or worse be put off and annoyed by the constant advertisement.

The concept of *inbound marketing* involves the Internet as the main platform for advertisements. It is based on the idea that consumers are drawn in to organisations instead of organisations spending time and effort going out to consumers. This is done by providing marketing content which are relevant to consumer needs and wants, as compared to the aggressive campaign brought about by outbound marketing. These contents are then marketed on blogs, or on social network, where consumers connect with family and friends. Blog posts are keyword rich, and are often indexed by Search Engines such as Google, Bing and Yahoo!. For organisations who have paid for a strong Search Engine Optimisation (SEO), they would have their products easily searched on Search Engines by simply keying the name of the organisation or its products. These methods are beneficial as social media possesses one of the highest growth in the number of users (Statistica, 2018). Relevant contents are also posted on deal sites such as Groupon and LivingSocial, and Affiliate marketers will ensure that the information reaches the right consumers (Hughes & Beukes, 2012). With inbound marketing, organisations are ensured that mindset of consumers is that they are ready to buy the products. Furthermore, due to brand image and content of the organisation, the same consumers would retain and compelled to buy from the same organisation, giving the organisation a lifetime value of consumers.

Emergence of New Trends

Outbound marketing has been the bread and butter of many organisations for a long time. These techniques have been very effective in increasing sales for organisations. Outbound marketing was considered the pinnacle in marketing methods and consumers see how revolutionary it is to be able to advertise products on electronic hardware such as newspapers, radios and televisions.

Since then however, the effectiveness of outbound marketing has been decreasing at an exponential rate (Nakano, 2011, Oct 31). A new trend has emerged across the globe; people have begun to realise the annoyances of interruptive advertisements. Because products that they are not interested in are being shoved to their faces, consumers are put off by this approach and will not buy the products. Consider when a consumer browses a website, he is suddenly taken to an advertisement interface without their permission. This trend in consumer behaviour has heralded a new change in the world of marketing (Patruti-Baltes, 2016).

Another trend has also risen among consumers; a rise in the number of Internet users since the World Wide Web (the Web) first appeared globally in 1991 (Berners-Lee, Cailliau, Groff & Pollermann, 1992). During the early stages of the Internet, many consumers did not know how to use it. However, as time moves on, more and more consumers have learnt how to properly use the Internet and there has been a proliferation in the rate of digital literacy around the world (Gilster & Gilster, 1997).

These trends are enough to make any organisation rethink their marketing strategy at present day, and inbound marketing can be seen as the best way to adapt to these new changes in consumer behaviour. Hence, it is vital that organisations see how advantageous the use of inbound marketing is, and how disadvantageous outbound marketing could potentially be.

Costs

Perhaps the single most important reason to use inbound marketing is the amount of cost that organisations are able to save. According to a study, inbound marketing costs 61% less than outbound marketing (Miller, 2012, Feb 28). Inbound marketing does not require huge sums of investment and takes less effort. For example, registering on social media are often free and merely takes a few minutes to set up, in order to advertise products. The cost of hiring SEO expert is an hourly-basis, but is well worth the cost due to the probability of the organisation's products appearing on higher page ranks on search engines. Furthermore, the services of affiliate marketers can be acquired at a push of a button, can cost as less as \$10 per hour which will help an organisation create a network of affiliate organizations that refer customers to its site.

Unless an expert content writer is needed, a person can freely design their own professional website brimmed with relevant content that consumers find valuable. Organisations can sell their products on deal sites where products are sold in discounts or in bundles to consumers without having to acquire huge capital to set up physical retail shops. These costs and efforts are relatively small compared to outbound marketing.

In the case of outbound marketing, it requires huge investments in promotional materials such as signs and banners, and stationeries. Organisations are paying huge amounts just for a 30 second commercial on radios and television. Peak hours such as in the evening will raise the cost even further. Large billboards often require additional materials and components to set up as well as the bureaucratic approval from the government. For newspapers, advertising on front page is costly and the larger the size of advertisements on each page, the costlier it is. Cold calling requires the hiring of additional employees, increasing wage expenses. Above all, even when organisations has paid for outbound marketing, there is no guarantee that the target audience will respond, which could plunge organisations into massive debts.

Accessibility of Products

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As of 2018, the Internet is available almost everywhere around the world (Internet World Stats, 2018; Statistica, 2018). Governments in both developed and developing countries are enabling Internet access to its population. Inbound marketing centres the Internet as its main platform. By marketing on the Internet, organisations are assuring that their products are reaching to consumers regardless of their geographical location. Even if organisations are not able to establish outlets or branches in other countries due to lack of capital or government regulations, information on products could still be reached out to consumers through the Internet. As a result, instead of investing time and money to expand, consumers themselves would spend the time and money to find and purchase the products that they like. The Internet is the perfect medium for organisations who wishes to sell products at international as well as local markets.

By contrast, outbound marketing involves a lot of advertisements on physical medias. The issue is that coverages such as on televisions and radios vary from country to country, and in some cases, districts or regions. For instance, certain television programmes are normally broadcasted in a single country and not in another country, limiting the number of audiences. In the case of newspapers, local newspapers are only available on selected regions in a country. Radio stations are only available within a specific broadcast range, depending on how far the broadcast stations are. Consumers in remote rural or inaccessible village areas are out of range for radio signals. Organisations relying on cold calling often find themselves unwelcomed as it involves unsolicited telephone calls or house visits. Furthermore, landline phones are on decline and are steadily being replaced by mobile phones (Richter, 2018, Jan 8). For direct mails, it often requires going through paperwork and procedures in postal services and hiring them to deliver mails to consumers. The further the consumers are, the more expensive organisations have to pay for postal services. Organisations would also have to make the difficult decision on determining the best possible site to place a billboard for advertisements, to ensure that the placement can be seen by the majority of the people.

Aside from geographical areas, there is a growing number of Internet users (Internet World Stats, 2018), and consumers are substituting physical media in favour of the Internet. Despite the television being media's biggest platform, it is on decline as consumers have now resorted to streaming television as well as radios on the Internet (Mark Sweney, 2017, July 7). Unless outbound marketing involves using the Internet, physical medias are slowly losing ground. Due to this trend, it is vital that organisations exploit this large amount of traffic users.

Feedback

Another important reason to adopt inbound marketing is the capability of obtaining valuable feedback. Reactions from consumers towards products being launched or sold by organisations can easily be acquired on websites. Organisations with their own online stores often provide a space for consumers to post their product reviews and ratings. At a push of button on computers, tablets and smartphones, consumers are able to key in their personal thoughts on said products to either give a positive or a negative outlook. Above all, these electronic devices are portable and are capable of connecting to the Internet for consumers to give feedback anywhere. Social networks such as Facebook, Twitter and Instagram also serve as a hub for product discussion because these social networking sites are often where consumers often connect with friends and socialise amongst one another. Social networks are often called Internet Highways due to the large number of user accounts. Organisations could then put consumer considerations into account and improve upon each aspect of the next products.

The one-way communication of outbound marketing has prevented any sort of useful feedback to be catered back to organisations. Once consumers have bought the products thanks to effective advertisement on paper media such as newspaper, magazines and journals, they have no means by which to give their feedback and opinions. Television and radios also offer no avenue for feedback. As a result, organisations are left without knowing whether their products are being liked or otherwise, and would have no clue as to how to create the next products.

Educational Content and Enhancement of Brand Image

The Internet is a centre for users to share information amongst one another, especially quality and useful information that can benefit everyone. Industry reports, eBooks and videos are forms of content that consumers often value. Nowadays, consumers only want relevant products that suits their needs and wants, and not waste precious time reading information on products that does not suit them. For instance, teenagers are often drawn in by humorous content, and websites filled with colourful design would be aesthetically pleasing for children. For health-conscious consumers, organisations can indirectly encourage them to buy fruits and vegetables by can be educated on the importance of eating fruits and vegetables, as well as the dangers of alcohol consumption and smoking.

Aside from increase in sales, brand image would be enhanced, driving in more consumers towards the organisations. This is contrary to the methods of outbound marketing. Instead of directly promoting an organisation's brand like an outbound marketing, organisations could slowly generate interests from consumers by making them aware of the benefits of said products. Outbound marketing tends to be too direct for consumers, as it gives the impression that organisations just want to maximise profit without putting consumers into consideration. Above all, because inbound marketing utilises the Internet, useful content tends to spread around due to its benefits, causing quality leads and chain reaction which would further increase sales.

Annoyance Level

Perhaps the most off-putting reason regarding outbound marketing is that they are intrusive and aggressive in nature. Consider when consumers watch, hear, or read the news on television, radios, and newspapers respectively, how often they are brought to a video, audio or page segment filled with advertisements that they have to sit through. Viewers may in the middle of their favourite programmes when suddenly, an interruption occurs. In the case of newspapers, there are always at least one page full of advertisements.

Even when outbound marketing is wholly focused on the Internet, organisations would still have a difficult time in attracting consumers. While the advertisement would reach most consumers, the philosophy of outbound marketing is still based on interrupting consumers regarding products. For instance, when consumers browse websites, pop-ups would suddenly appear, and upon reaching a website's homepage, they are bombarded by display and banner advertisements. More often than not, these advertisements tend to be dismissed as they are seen as irrelevant and irritating. This crude and direct method of marketing would easily put off most consumers, rendering outbound marketing as visual and noise pollution.

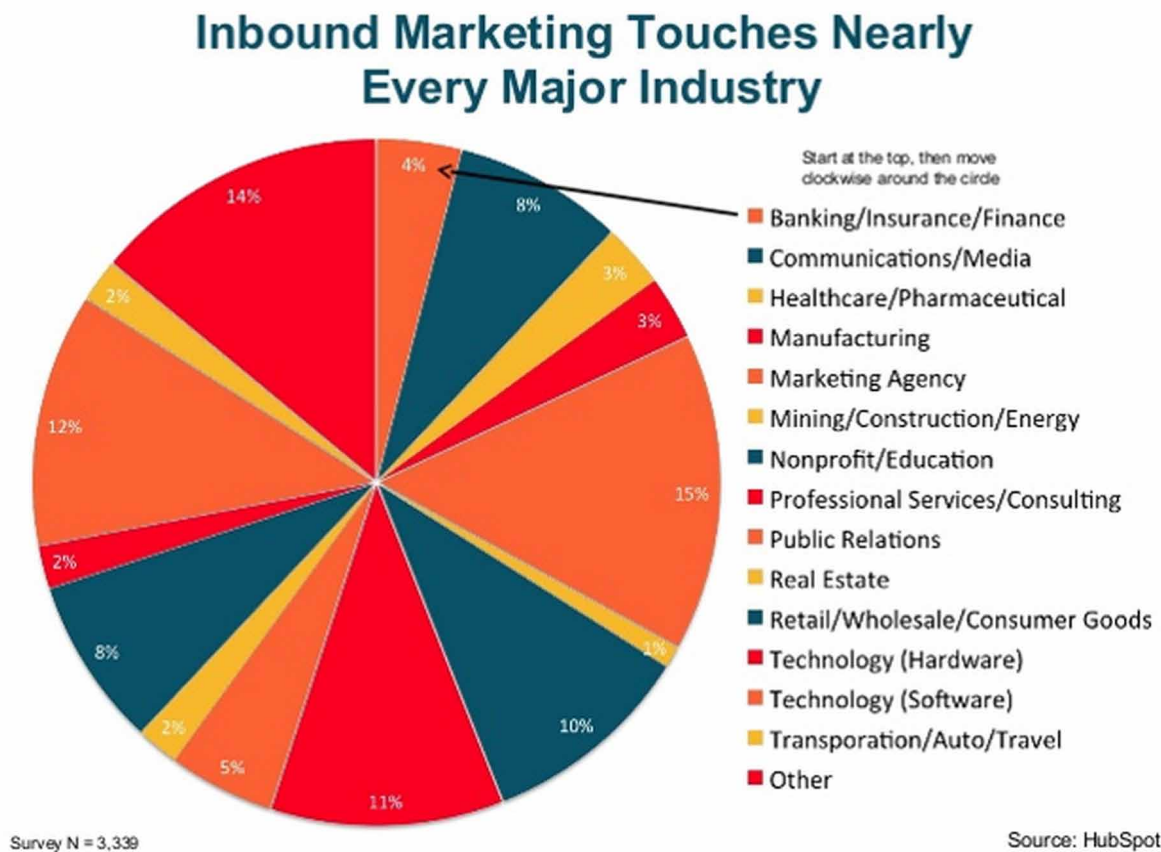
Inbound marketing simply relies on subtlety and indirect approaches to marketing. Consumer interests are intrinsically stimulated until the point where they are genuinely interested in the products. Because of this, inbound marketing is considered not disturbing in nature, and consumers will more likely to buy products.

SOLUTIONS AND RECOMMENDATIONS

The next section will discuss how to encourage organisations everywhere to adopt the new methods of inbound marketing while at the same time, convince those organisations to shun outbound marketing. Some organisations are resistant to changes, so this section will provide the necessary data to persuade them.

According to Hubspot (2014), 86% of people skip TV advertisements, 44% of people never open their direct mail and 200 million people are on the 'do not call' list. These statistics show that the use of outbound marketing will be ineffective, as the people are no longer accepting advertisements in the form of outbound marketing. In other words, there is no guarantee that consumers will be buying the products even after organisations spend huge sums of money on advertisement.

Figure 1. The impact of Inbound Marketing in Major Industries (Source: Hubspot, 2014)



From Figure 1, inbound marketing has made a profound effect on major industries, and this coincides with the rapid rise in the number of Internet users (Internet World Stats, 2018). Industries have begun to embrace the use of electronic or digital media, and smart organisations will take the opportunity to advertise to this huge flow of traffic on the Internet.

Another solution is the role of education in both public and private sectors. Schools should make it their main curriculum to study inbound marketing techniques especially when it comes to studying the

subject of business or marketing. This will expose teenagers to the world of online marketing and they could potentially start their own business at such a young age due to the relatively small costs of inbound marketing to promote products. Students would also need to be educated on outbound and inbound marketing, for them to differentiate between the two.

FUTURE RESEARCH DIRECTIONS

The discussion of the distinction between the two types of marketing has paved the way for future research on marketing, where a more in-depth analysis as to the benefits and drawbacks of both inbound and outbound marketing can be conducted, in order to provide a non-bias distinction. However, future researchers could also argue that outbound marketing is still beneficial in many ways. This is especially true with the rise in the number of organisations using inbound marketing, where eventually, the competition for advertisements on the Internet will be intense. Subsequently, it is hoped that future studies would be inspired by this paper to study and analyse on the relative importance of inbound marketing in relation to e-commerce, as there is a rise in the number of online shopping users (Wolfenbarger & Gilly, 2001).

CONCLUSION

To conclude the above article, inbound marketing has risen in importance while outbound marketing has shown that its methods are relatively obsolete. With the comparisons between inbound and outbound marketing thoroughly covered, it is the opinion of this paper that organisations everywhere should adopt an inbound form of marketing, as the benefits of inbound marketing far outweighs outbound marketing. Inbound marketing has a way of forming a lasting impression in the minds of consumers, whereas outbound marketing tends to be seen as one-off and easily forgotten. Even if organisations are not ready to shun outbound marketing, a synthesis of both inbound and outbound marketing would still be beneficial, although emphasis must be placed on inbound marketing due to its enormous sales potential. The greatest benefit of inbound marketing is that organisations of all sizes can use them as the costs are relatively affordable.

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KEY TERMS AND DEFINITIONS

Affiliate Marketing: The hiring of external service or arrangement to help organisations acquire more consumers.

Blogging: A keyword-rich personal website, where information is being freely shared to the public. Blogs are usually well-indexed by Search Engines.

Content Marketing: The process of exposing consumers to useful and relevant information on the Internet, especially regarding products that may benefit them.

Deal Sites: An online retailing platform where organisations can sell their products in discounts or bundles with the purpose of promoting their own products to the public. A well-known example is Groupon.

Inbound Marketing: A form of marketing where the Internet acts as a main platform for advertisement, but only shows relevant and useful content to consumers, and is not aggressive in nature.

Lifetime Value of Consumers (LTV): The amount of money an organisation is going to make from a customer throughout their entire life.

Outbound Marketing: Intrusive and interrupting in nature, it is a form of marketing where products are being advertised regardless of consumer interests and needs. Its main platform includes physical media such as newspapers, radios, and televisions, although some forms exist on the Internet as well.

Physical Medium: A platform that is not digital and can typically be touched by hand.

Search Engine Optimisation (SEO): The process of maximising number of consumers on the Internet by having an organisation's name or products high on Search Engines.

Social Media: A general term for websites that enable users to freely share information on the Internet, normally on Social Networks such as Facebook, Twitter, and Instagram

Social Network: A network interconnecting many users on the Internet for them to communicate and socialise. Common examples of social network are Facebook, Twitter, and Instagram.

Micro Organization Use of Social Media for Business-to-Business Customers

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INTRODUCTION

Micro Organizations Use of Social Media for Business to Business Customers

The availability of new electronic media has had a profound impact on marketing communications that has led to the development of greater interactions between business organizations. This technology has created a marketing environment where barriers to communications have been broken due to the emergence of several options for speedy communication channels that has increased firm competition. Today, the firms must not only consider traditional media and forms of communication but also allocate their communication budgets to reach customers through the new and emerging media (Agnihotri, Dingus, Hu, & Krush, 2016). Prior to these developments, smaller organizations have had to balance their limited resources when designing their integrated communication strategies. They were unable to grow their business, increase their reach to the customers, or manage their customer relationships as they lacked the resources to hire employees on a large scale to manage these functions efficiently and effectively. E-commerce has brought about the possibility of handling many marketing and communication tasks without requiring the resources previously thought necessary. The competitive advantage of larger organizations in being able to communicate on a large scale because of their resources, appears to be compromised as the smaller organizations and businesses have started realizing the potential offered by social media and e-communication channels. With the increased use of e-channels of communication, it is proposed that the competitive gap caused by limited resources between the larger and smaller organizations has been reduced.

Micro organizations typically have the fewest resources because of their size. For the purpose of this study, micro organizations are defined as those with less than 50 employees and are typically associated with entrepreneurial organizations. A number of studies have looked at how these smallest organizations contribute to economic growth (e.g., Chovancová, Nedu, & Ogbonna, 2015; Jha & Depoo, 2017; Reddy, 2007; Toma, Grigore, & Marinescu, 2014). The ability of these micro organizations to create sustaining relationships with their business to business customers has become increasingly important in many regions of the world as a pathway to economic growth (Collins & Reutzel, 2016; Stel, 2006). Similarly, much has been written about the effect of these new communication channels and how they can be used to retain consumers. However, little evidence has been presented to show how these chan-

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nels of communication are used by smaller (micro) organizations, particularly, when serving business to business customers. The research presented here, builds on the earlier exploratory work of Brink (2017) and Atanassova and Clark (2015), which provides empirical evidence on the importance of social media usage for small organizations when serving business customers. However, unlike Brink (2017), this research separates small firms from medium size organizations and focuses on the subcategory of micro organizations (less than 50 employees).

Brink (2017) states that because of the limited resources of small and medium size organizations, they have more often used social media in B2C (serving consumer markets) communications than B2B (serving business customers). This conclusion by Brink (2017), was based on findings from the literature and a case study combining small and medium size firms, without looking at the most entrepreneurial firms, the micro organizations. Brink (2017) found the digital networking media used by small and medium size enterprises (SMEs) play an important part in the performance of the organization, as defined by their ability to form sustaining relationships. These customer relationships have been shown to be critical to the performance of the firm (Battor & Battor, 2010). Furthermore, communication strategies have been shown to support these relationships when serving business customers (Tuominen, Rajala, & Moller, 2000). The empirical research, presented here, attempts to identify if there is any difference between the micro and larger organizations in the use of social media as a part of their communication strategy and how these organizations allocate resources in their promotion mix. The objective of this study attempts to answer the question not addressed by Brink (2017): whether social media may or may not be used by micro organizations to reach business customers in a way different from those organizations that are larger and employ more than 50 employees.

BACKGROUND

The landscape of marketing has changed dramatically over the past several decades. The type of communication channels used as well as the audience to which products and services are marketed has compelled organizations to change marketing communication strategies to reach their present and potential target markets and to sustain continuing customer engagement. Danaher and Dagger (2013) found that a chain of department stores were successful using digital media, in addition to traditional media options. Their study found empirical evidence that e-mail and sponsored Google searches had an influence on purchase outcomes for the consumer market. However, the focus on sales alone failed to identify the effect of building a brand relationship through social media and the long-term effect on performance. Studies such as that by Go and You (2016), found that large firms in consumer products industry sectors (e.g., IKEA and JetBlue) are likely to use social media communication channels to build consumer relationships. Not only do recent studies look primarily at the consumer market, they also report on the use of social media by medium and large firms. The important contribution from these studies is the understanding of how these organizations build sustaining relationships with their customers through a change in communication strategies.

Moreover, developments such as increased competition, technological developments, and consumer sophistication, especially with the growing technology savvy generations – or the new consumer, have contributed further to evolving communication strategies (Okazaki & Barwise, 2011). This has resulted in a shift in the funds the firms allocate to advertising in mass marketing campaigns using traditional media alone, to multi-pronged efforts for building brand communities that include social networking channels (Colliander & Dahlen, 2011). Researchers have assessed the effects of the use of multimedia

at the brand level (Naik, Raman, & Winer, 2005). A topic of importance in this line of research has been the allocation of resources across media (Naik et al., 2005; Raman & Naik 2004); and the finding that the optimal design of communication programs is based largely on external, consumer driven factors (Voorveld, Neijens, & Smit, 2011). More recently, similar effects have been seen when communicating with all the organization's stakeholders, including their business customers (B2B).

The increase in market competition and advances in promotion mix enabled by electronic commerce and social media have had several implications for organizations and its customers including a change in the buyer-seller relationships (Agnihotri et al., 2016; Katona, Zubcsek, & Sarvary, 2011). The sales force and its level and quality of communications has been shown to be an important contributor to the success of the business to business transactions (Brooksbank, 1995; Schaefer & Pettijohn, 2006). However, the limited resources of micro organizations, adversely impacted their ability to build important relationships with such customers using more traditional communication strategies that were more expensive and time consuming and offered little interactivity (Atanassova & Clark, 2015).

Agnihotri et al. (2016) found empirical evidence that social media helps to expand the impact of the organization's salesforce. They concluded that social media can be used to develop relationships with B2B customers by enhancing the role of the salesforce to increase brand loyalty. Katona et al. (2011) attribute the impact of personal connection as key to diffusing information through social media. Hence, communication strategies have changed considerably as a result of the interaction between organizations and the engagement of stakeholders through electronic media. Most of the existing literature fails to differentiate between medium, small and micro organizations as part of the analysis. It can be hypothesized that if social media enhances the brand management for medium and small firms it should also enhance these relationships for micro organizations: the entrepreneurial start-ups and those with the least resources. Wamba and Carter (2014) looked at how industry sector and firm size had an influence on the use of social media by small and medium size enterprises in the B2B market. However, they failed to identify how micro organizations used these same social media tools when compared to SME. Based on the work of Katona et al. (2011), it appears that personal connections will enhance the effectiveness of social media and the interactions of the salesforce with B2B customers to build relationships, regardless of the size of the firm.

One challenge for all organizations, especially micro organizations, is how to best allocate resources on the ever-expanding social media technologies (Rufer, 2014). Due to the fact that micro organizations have a visible impact on economic growth, it is important to know how social media is used by them when serving business customers. While some of the recent studies cited above have explored whether there is a relationship between the use of social media to build relationships with the firm's customers, particularly in the consumer market (B2C); very few have studied the impact of use of social media in building B2B relationships and even fewer have focused on how micro organizations use social media. The previous studies have primarily focused on medium and larger organizations. Those that studied SME, have not differentiated between medium, small, and micro organizations or on the B2B selling situations. This study attempts to fill this gap. It defines micro organizations and explores how they use social media to reach their stakeholders and to build their B2B customer relationships. It also compares micro organizations' social media use to that of firms with more than 50 employees in order to reach their stakeholders through e-commerce channels.

FOCUS OF THE ARTICLE

This study investigated the relationship between company size with the allocation of monetary resources on social media; the use of social media or digital networks to reach different stakeholders; and differences in the use of social media and the type of industry for the business customer (B2B). To better define the relationship between size of company and the use of social media when serving business customers, the first analysis determined if the company size made a difference in social media usage. This was followed by an analysis that just looked at those just serving business customers. For this purpose, the companies were categorized into micro organizations (less than 50 employees) and larger companies that employed more than 50 employees.

METHODOLOGY

Data Collection Procedures. Data was collected via a mail survey sent to all members (1000) on the mailing list of a Chamber of Commerce in an Upstate New York county consisting of organizations that conduct business across the service, manufacturing and government sectors. Each business received an envelope with instructions, the survey, and a pre-addressed stamped return envelope. The response rate for this survey was approximately 9% (92 respondents), which has been proven to be an acceptable response rate for collecting data from businesses (Rasmussen & Thimm, 2009).

One respondent from each organization, holding the position of either the marketing manager or director, was asked to participate in the survey. The survey asked respondents to indicate the importance of Facebook, Twitter, Yelp, Four Square, Tumblr, Pinterest, Blogs, LinkedIn, Text Messaging, and Mobile Marketing in reaching the organization's stakeholders on a 1 (Very Unimportant) to 5 (Very Important) Likert-type scale. Respondents also answered questions regarding the size of their company; percentage of money allocated towards use of social media vis-à-vis other media including print, radio, television, direct mail, and personal selling; whether they served the consumer market, both consumer and business market, or only business customers; and finally, the company's industry.

HYPOTHESES

Based on previous literature, the size of the firm varied for most industries: some were large and some SME (small and medium sized enterprises). As large companies have better financial resources and larger budgets for promoting their products across different media, they are also likely to spend more on social media as compared to the micro organizations. In addition to the size of the organization, respondents were asked if they served the B2C market, B2C and B2B, or solely served the B2B market. The sample was divided into firms by size (micro and those with more than 50 employees) and then limited the study to those that served B2B customers only. The following six hypothesis were tested based on the size of the firm and their usage of social media to reach different stakeholders. This study identified firms with less than 50 employees because the current literature provides evidence for both large organizations and SME but not the micro organizations.

H1a: Larger size organizations (with more than 50 employees) allocate more money to social media out of their communication budget compared to micro organizations (with less than 50 employees).

H1b: Larger size organizations allocate more money on social media out of their communication budget compared to micro organizations, when serving business customers.

In order to identify whether the type of social media used varied by firm size, the following social media were included: Facebook, LinkedIn, Twitter, Blogs, Tumblr, Yelp, Pinterest, Short Message System (SMS), Mobile marketing, and Four Square. The second hypothesis explored whether the social media usage differed amongst large and micro organizations and whether different social media platforms were used to reach their different stakeholders. Accordingly, it was hypothesized that:

H2a: The use of social media or digital networking channels to reach different stakeholders differs for firms with larger size organizations and micro organizations.

H2b: The use of social media or digital networking channels to reach different stakeholders by B2B firms differs for firms with larger size organizations and micro organizations.

Finally, in order to determine if the use of social media differed on the basis of types of industry as found by Wamba and Carter (2014), the industries were classified into the following categories- service, manufacturing, and government agencies. It was important to study responses from different industries as they differ in their decision-making policies, procedures, communication with stakeholders, and building customer relations. It was hypothesized that:

H3a: There is a difference between the percentages of the communication budget spent on social media in different types of industries based on different sizes of the firms.

H3b: There is a difference between the percentages of the communication budget spent on social media in different types of industries based on different sizes of the B2B firms.

SOLUTIONS AND RECOMMENDATIONS

Prior to any statistical analyses to answer the research questions, descriptive statistics and correlations were calculated. In order to measure differences in social media usage, one-way ANOVA tests were used for testing Hypothesis 1a and 2a. The independent variable was the grouping based on the size of organization and the dependent variable was either money allocated towards social media (H1a) or type of social media used to reach stakeholders (H2a). Company size was used as a categorical variable and was measured in terms of the number of employees: resulting into two groups, micro organizations (less than 50 employees) and larger size organizations (greater than 50 employees). For hypothesis 3, an ANCOVA was run to examine the main effects and interaction effect of size of organization and industry on the dependent variable of the percentage spent on social media. Industry was a categorical variable that was grouped into three categories: service, manufacturing, and government agencies. As in the study by Wamba and Carter (2014) industry became the control variable and size of the organization was the independent variable. However, Wamba and Carter (2014) focused on the use of Facebook by SMEs but not on how much was spent on social media. This analysis was then replicated with only those organizations that served business customers.

Descriptive Statistics: Descriptive statistics and select frequencies for the size of the organization and the percentage of money allocated to social media were evaluated. On average companies allocated 33% of monetary resources towards social media; 31% on print advertising; 25% on Direct Mail; and 11%

on TV or Radio advertising. Seventy-five percent ($n = 68$) of respondents reported that their company had less than 50 employees. Additionally, out of the total firms surveyed, 44% belonged to the service industry; 18% to government and approximately 38% to manufacturing. Since 75% of the firms were micro organizations, many technology startups and innovators, this could likely skew the data toward the manufacturing industry. The decision-makers here were primarily the director of the organization ($n = 37$) or the marketing manager ($n = 33$). Following the analysis of the descriptive statistics, each of the three hypotheses were tested comparing social media usage for micro organizations to that of larger firms.

Money Allocation to Social Media Usage

H1a: Larger size organizations (with more than 50 employees) allocate more money on social media out of their communication budget compared to micro organizations (with less than 50 employees).

Monetary allocation of resources towards social media was treated as a continuous variable as it was measured by the percentage of money companies were allocating towards social media usage. An independent t -test was used to compare the percentage of the promotion budget used for social media, print advertising, and direct mail for micro organizations compared to larger firms. The results of the t -test did not find significant differences between micro and larger firms for social media ($t(65) = -.135, p = .89$) or print advertising ($t(50) = 1.69, p = .09$). Descriptive analysis showed that both larger and micro organizations spent 33% of their promotion budget on social media. On the other hand, the results of the t -test revealed that the differences were significant for use of direct mail ($t(59) = 1.96, p = .05$). Larger organizations spent around 28% of their budget on direct mail, whereas micro organizations spent approximately 39% on direct mail.

Use of Social Media to Reach Stakeholders

H2a: The use of social media or digital networking channels to reach different stakeholders differs for larger size organizations and micro organizations.

An ANOVA analysis was conducted to examine if different types of media were used to reach specific stakeholders such as customers, employees, community, marketing channels, suppliers, and stockholders/investors by micro and larger organizations. There was no statistical evidence found that there was a significant difference between larger size firms and micro organizations when using social media as a communication vessel with channels and suppliers. However, there was evidence that when communicating with employees, larger firms were more likely to use Facebook ($p = .03$) than micro organizations. Furthermore, when communicating with customers, larger size organizations were more likely to use mobile marketing ($p = .01$) as compared to micro organizations. Lastly, micro organizations are more likely to use text messaging to reach stockholders ($p = .002$) and employees ($p = .05$) as compared to larger size organizations. These results are shown in Table 1.

Social Media Usage, Type of Industry and Micro and Larger Organizations

H3a: There is a difference between the percentages of the communication budget spent on social media in different types of industries based on different sizes of the firm.

Table 1. Analysis of Variance between Larger and Micro Organization using different digital platforms serving all customers (consumer and business)

		Sum of Squares	df	Mean Square	F	Sig.
The use of Mobile Marketing to reach your customers	Between Groups	12.055	1	12.055	6.389	.01
	Within Groups	166.045	88	1.887		
	Total	178.100	89			
The use of Facebook to reach your employees	Between Groups	7.278	1	7.278	5.075	.02
	Within Groups	119.027	83	1.434		
	Total	126.306	84			
The use of text messaging to reach your employees	Between Groups	3.742	1	3.742	3.425	.05
	Within Groups	90.681	83	1.093		
	Total	94.424	84			
The use of text messaging to reach your shareholders	Between Groups	7.601	1	7.601	6.138	.01
	Within Groups	96.599	78	1.238		
	Total	104.200	79			

An ANCOVA was run to test differences between different types of industries and the amount of money spent on social media. There was insufficient evidence to support this hypothesis ($p = .573$). Thus, when looking at the amount spent on social media, there appeared to be no difference between micro organizations and larger firms regardless of the industry in which they operate.

Focusing on B2B Customers

For those firms that only serve business customers, it was important to know whether there was a difference in the percentage of the integrated communication budget spent on social media between the micro organizations and larger size organizations. It was hypothesized that:

H1b: Larger size organizations allocate more money on social media out of their communication budget compared to micro organizations, when serving the business customers.

Using ANOVA, it was found that there was no significant difference between the percentage of the total communication budget spent on social media when comparing micro organizations and larger firms that serve business customers. In fact, for both micro organizations and larger firms serving B2B customers, approximately 28% spent 70% of their communication budget on social media and almost 27% spent 10% of their budget on print media. This shows that there is a shift in the importance of print advertising and social media advertising for reaching B2B customers. The three remaining questions are 1) whether this is different for the type of stakeholder being reached; 2) does the digital channel used differ when reaching B2B stakeholders; and 3) if the type of industry makes a difference in use of social media when trying to reach B2B customers.

When serving all consumers including business customers, it was found that larger organizations and micro organizations differed in using social media to reach different stakeholders except for communicating with channels and suppliers. In order to find out whether larger firms used different digital

media to reach different stakeholders as compared to those used by micro organizations, when serving B2B customers, the following hypothesis was examined:

H2b: The use of social media or digital networking channels to reach different stakeholders by B2B firms differs for those with micro organizations and larger size organizations.

Using an ANOVA, it was found that there were significant differences between the use of LinkedIn to reach different stakeholders when serving business customers amongst micro organizations and larger firms (see Table 2). Micro organizations were more likely to use LinkedIn to reach their business customers compared to larger firms ($p = .001$). In the previous analysis reported by the authors, it was revealed that larger firms were likely to use mobile marketing, particularly when serving the business to consumer and a combination of consumer and business customers. However, no significant differences were found in use of mobile marketing between the larger and micro firms when serving the B2B customers ($p = .74$).

While the descriptive analysis indicated that there was no difference between larger and micro organizations when communicating with channels and suppliers, there is statistical evidence that for firms just serving B2B customers, there is a difference between larger organizations and micro firms. The statistical evidence is presented in Table 2. Larger organizations were more likely to use LinkedIn ($p = .03$) to reach their channel members and micro organizations were more likely to use twitter ($p = .05$) for those firms only serving the B2B customers. The other statistically significant finding was that instead

Table 2. ANOVA for Digital Media used To Reach Different Stakeholders

		Sum of Squares	df	Mean Square	F	Sig.
Use of mobile marketing to reach your customers	Between Groups	1.027	2	.514	.292	.74
	Within Groups	151.198	86	1.758		
	Total	152.225	88			
Use of LinkedIn to reach your customers	Between Groups	21.311	2	10.656	7.143	.001
	Within Groups	128.284	86	1.492		
	Total	149.596	88			
Use of Twitter to reach channels	Between Groups	9.890	2	4.945	3.435	.03
	Within Groups	105.096	73	1.440		
	Total	114.987	75			
Use of LinkedIn to reach channels	Between Groups	9.892	2	4.946	3.039	.05
	Within Groups	118.792	73	1.627		
	Total	128.684	75			
Use of Facebook to reach your employees	Between Groups	.600	2	.300	.190	.82
	Within Groups	127.817	81	1.578		
	Total	128.417	83			
Use of Twitter to reach shareholders	Between Groups	7.747	2	3.873	3.365	.04
	Within Groups	87.469	76	1.151		
	Total	95.215	78			

of using text messaging to reach shareholders, B2B micro organizations were more likely to use twitter to reach shareholders ($p = .04$) compared to larger organizations.

In order to determine whether or not the type of industry impacts social media expenditure when comparing larger firms to micro organizations, the following hypothesis was tested:

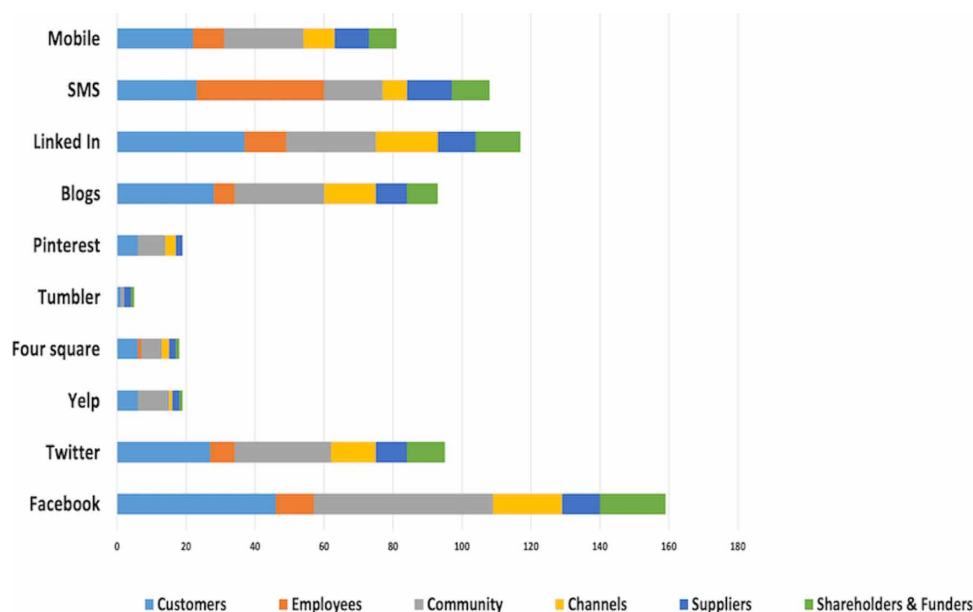
H3b: There is a difference between the percentage of the communication budget spent on social media in different types of industries based on different sizes of the B2B firms.

Once more, an ANCOVA was used to test the hypothesis. There was insufficient evidence to support this hypothesis ($p = .729$). Thus, when looking at the amount spent on social media, there appeared to be no difference between micro organizations and larger firms that serve only business customers, regardless of the industry in which they operate.

Recommendations

Social media has become an important communication strategy for micro organizations. This may be in part because of the limited resources of micro organizations; however, the evidence showed that even for larger firms, there has been a shift from print advertising to the use of digital networking media. In fact, there was no statistical evidence that firms with more than 50 employees allocated a larger proportion of their promotional budget to social media as compared to micro organizations. Furthermore, there was no statistical evidence to support that there was a difference between organizations in different industries for the importance of social media, as found by Wamba and Carter (2014). Since this proved to not be a supported hypothesis for our data set, the recommendations are made across industries as opposed to focusing on the data for each industry. As mentioned earlier, these results may be due to the fact that 75% of our respondents were from micro organizations. The results of this study show that using social media may now transcend industry boundaries, regardless of the size of the organization

Figure 1.



or type of industry. Thus, micro organizations have effectively used social media to reach a variety of stakeholders, particularly when serving both consumers and business customers, improving their reach and communications. The bar chart in Figure 1 presents the number of firms indicating the importance of the use of social media to reach each stakeholder.

This study adds to the literature because it provides statistical evidence of how micro organizations that serve only B2B customers successfully use social media differently than larger organizations. Whereas no statistical evidence was found regarding any difference in how micro organizations communicate with channel members when serving either the consumer market or both the consumer and business markets, there was statistical support that micro organizations use twitter and larger organizations use LinkedIn to reach channel members. It was not that micro B2B organizations, did not use LinkedIn to reach other stakeholders; there was statistical evidence that they used LinkedIn more often to reach their business customers compared to larger firms. Liu (2018) stated that the key to B2B marketing is interpersonal relationships, thus larger firms with more resources may use more personal selling to create these relationships. This study adds additional support to earlier studies, which have reported that digital media can be used to increase the effectiveness of personal selling. It appears that this may be the reason that micro organizations, faced with limited resources, are likely to use LinkedIn to reach their B2B customers. They may also want to consider delivering messages to their channel members via LinkedIn, learning from larger firms. Micro organizations may also want to continue supporting the use of Facebook, Twitter, and mobile marketing to enhance the effectiveness of their sales force when serving B2B customers.

FUTURE RESEARCH DIRECTIONS

The limitations of this study will be used to inform future research. The first consideration is based on the little variance in the size of companies; 75% of the respondents had less than 50 employees. Thus, future research should try to encompass a more diverse company breakdown with regards to size. A second limitation of this study is that the data was collected from one county and thus the results may not be as generalizable as would be desired. Future research should focus on collecting data from different counties within the US and countries to be as generalizable as possible. Despite these limitations, this study starts to fill in gaps in how companies are utilizing social media for reaching different stakeholders, particularly for micro firms serving B2B customers. It also confirms the widespread use of social media by businesses regardless of the industry.

CONCLUSION

This empirical study adds to the body of literature by providing evidence that there is no difference between micro firms and larger organizations that serve just business to business customers in the proportion of money allocated to social media. What this does provide is statistical evidence that micro organizations can effectively use social media to reach their business customers, channels, and shareholders. Facebook, Twitter, and mobile marketing were shown to be important communication platforms across organizations to reach customers and the community, and that they were equally important for larger and micro firms, consistent with the findings of Cesaroni, and Consoli, (2015). However, this study, points to a significant use of LinkedIn by micro organizations to reach their business customers. The contributions

of this empirical study confirm that the same social media strategies may be effective for larger and micro organizations in both service and manufacturing sectors and that micro organizations may want to explore different social media, leveraging their current expertise in the use of LinkedIn for reaching more of their stakeholders.

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KEY TERMS AND DEFINITIONS

ANCOVA: A statistical tool used to examine differences between three or more groups while using a continuous variable as a control variable between the groups.

ANOVA: A statistical tool used to examine differences between three or more groups.

Business-to-Business Marketing: Selling products or services to organizations that utilize these products or services for use in their products or services that they sell to their customers. As opposed to consumer marketing that sells products or services to customers that use these products or services for their own personal consumption.

Entrepreneurial Firms: Are typically characterized by small organizations that spur economic growth through innovation. These organizations are typically risk takers that identify new ways of doing business.

Micro Organizations: An organization that has less than 50 total employees.

SME: Small and medium enterprise; an organization classified as a small and medium enterprise is classified as an organization with less than either 500 or 250 employees.

Social Media: Digital networking services that provide avenues for connecting with individuals with shared interests.

Social Media Mining

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INTRODUCTION

Today, Social Media is a relevant part of human life, because it provides easily an accessible platform for users to share information, and it is truly the reflection of today's society, so the pervasive use has generated unprecedented amounts of social data. The result is large quantity of social data and user-generated content that, if properly mined and analyzed, could help the public and private sectors improve the quality of their products and services while reducing costs.

The aim of this contribution is to describe some technologies and methodologies to compute Social Media Mining, in order to collect information about individuals and entities, measure their interactions, and discover patterns to understand human behavior. The chapter also discusses background, knowledge, challenges and critical factors necessary for successful analysis.

BACKGROUND

Social media is the collective of online communications channels dedicated to community-based input, interaction, content-sharing and collaboration. social media can be considered a world of social atoms (i.e., individuals), entities (e.g., content, sites, networks, etc.), and interactions between individuals and entities (Zafarani, 2014). Social network is a social structure composed of individuals, organizations, company etc. which are connected by relationships and interactions.

Social media are used intensely to communicate, to publish resources (personal data, photo, video, blog), to establish relationships of a different type share information, make decisions, and do business in many ways, with hundreds web platforms in the world collecting the information of more than one billion registered users. Categories of social media regards: blogs, discussion forums, blogs, social networking, news discussions, media sharing sites, collaborative websites. Well-known online platforms are: Facebook as generic social network, LinkedIn as business social network, Twitter as micro-blogging. It is possible to seek social media as the tool for marketing (Goyal, 2018).

SOCIAL MEDIA MINING

Social Media Mining (SMM) is the process of representing, analyzing, and extracting actionable patterns and trends from massive raw social data, that are publicly available on social media web platforms (Bonzanini, 2016; Ravindran, 2015; Zafarani, 2014).

SMM discusses theories and methodologies from different disciplines such as computer science, data mining, machine learning, social network analysis, network science, sociology, ethnography, statistics, optimization, and mathematics.

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The term mining is an analogy to the resource extraction process of mining for rare minerals, as stated in typical data mining approaches that analyze the huge volumes of data and seeks out patterns, trends and clusters. The goal of work (Injadat, 2016) is to analyze the data mining techniques that were utilized by social media between 2003 and 2015, conclusions suggest that more research be conducted by both the academia and the industry since the studies done so far are not sufficiently exhaustive of data mining techniques.

Data generated on social media sites are different from conventional attribute-value data for classic data mining. Social media data are largely user-generated content on social media sites. Social media data are vast, noisy, distributed, unstructured, and dynamic. These characteristics pose challenges to data mining tasks to invent new efficient techniques and algorithms.

SMM requires human data analysts and automated software programs to sift through massive amounts of raw social media data in order to discern patterns and trends. SMM cultivates a new kind of data scientist who is well versed in social and computational theories, specialized to analyze recalcitrant social media data, and skilled to help bridge the gap from what we know (social and computational theories) to what we want to know about the vast social media world with computational tools (Zafarani, 2014). The key questions for researchers are:

- How to derive information from unstructured data as textual, image, video?
- How to form analysis to assist in decision making based on the information derived from unstructured data?
- How to grasp opportunities for business success based on the generated report?
- Which source of social information should a user use?
- How can to identify communities in a social network?
- Which pieces of information are popular and receive a lot of attention?
- How quickly to uncover insights about customers? Who is customer talking to? Who are his friends? Who is influencing him?

Nowadays, sentiment analysis and influencer detection are relevant research areas. Social media data are vast, noisy, unstructured, and dynamic in nature, thus novel research areas arise. SMM is a burgeoning multidisciplinary area, where researchers of different backgrounds can make important contributions that matter for social media development.

APPROACHES

SMM integrates many approaches to provide a coherent platform to understand the basics and potentials of social media platforms. A methodology to integrate several techniques for analyzing and comparing social media content from business competitors is detailed on (Wu et al, 2015). The work of Adedoyin-Olowe et al (2014) discusses different data mining techniques used in mining diverse aspects of the social network over decades going from the historical techniques to the up-to-date models.

The book (Ravindran, 2015) provides a theoretical background, comprehensive instructions, and state-of-the-art techniques through explanations of implementation of various use cases using R programming language. Tools for data analysis in Python programming language are discusses in Bonzanini (2016).

In this section, some representative research issues are discussed.

Competitive Intelligence

Competitive intelligence is defined to be “the art of defining, gathering and analyzing intelligence about competitor’s products, promotions, sales etc. from external sources” (Dey et al., 2011), allowing a company to predict or forecast what is going to happen in its competitive environment (Bose, 2008). Competitive intelligence refers to the information collecting and analyzing conducted by a competitive party in order to maintain its advantage. The purpose of the work of Colakoglu (2011) is to investigate the literature and applications in business world about the competitive intelligence, and especially evaluating and developing competitive intelligence. Comparison between the literature and applications will be done and the results of comparison will be given as conclusion. Types of competitive intelligence include analysis of competitors, the competitive environment, competitive trends and strategy.

Competitive analysis help to compare your competitors’ performance and uptime to your own search and ranking tools to understand how well competitors are viewed by the rest of the web, how test users interact with competitors’ websites.

The competitive analysis section is a relevant section of business plan, because it is devoted to analyzing both your current competition and potential competitors who might enter your market.

To identify your current competitors there can be two ways of doing an analysis: look at them from a customer’s point of view, look at them from their point of view. By looking at them from a customer’s point of view, you are looking at their major strengths and flaws, think like a customer would. On the other hand, looking at them from their point of view will help you try to see what their weaknesses are, how you would compensate for them their firm better, how you would play them in the marketing field.

Some suggestions on why do social competitive analysis:

- To get ideas for how brand can engage in the social media channel;
- To gauge the overall marketing for product or service engages in social media;
- To identify opportunities your competitors may be missing;
- To study what type of content works on which network or even if a specific network is worth your effort, by seeing what is working for others, especially those in your niche or industry;
- Get ideas for how, your brand can engage in the social media channel.

The work of Dey et al. (2011) discusses methodologies to obtain competitive intelligence from different types of web resources including social media using a wide array of text mining techniques.

Opinion Mining and Sentiment Analysis

Using a listening platform and a range of selected keywords, it is possible to collect a large amount of social customer conversations measuring the volume and the opinion of the mentions of the brands and the products. These tools allow businesses to understand product sentiments, brand perception, new product perception, and reputation management, help users to perceive product opinions or sentiments on a global scale.

Twitter network analysis can be suitable for communities detections: using specific hashtag, visualizing communities and clusters of customers, prospects and influencers.

Mining also the social photo data of the brand consumers, it is possible to analyze the behaviors and the attitudes or the real contexts of usage of the products.

Sentiment analysis (also known as opinion mining) refers to the use of natural language processing, text mining and computational linguistics to identify and extract subjective information in source materials. Sentiment analysis is widely applied to reviews and social media to determine the attitude of user with respect to some topic or the overall contextual polarity of a post, image, etc. Sentiment analysis is hard because languages used to create contents are ambiguous.

Text mining is an extension of data mining to textual data that attempts to extract meaningful information, trends, patterns, or rules from unstructured textual data, such as: frequency counts of words, length of the sentence, presence/absence of certain words, etc. Case study and the power of text mining as an effective technique to extract business value are described on (Gémar, 2015).

Tools based on text mining and sentiment analysis can provide an in-depth analysis of a particular situation. The book of Pozzi et al. (2016) explores both semantic and machine learning models and methods that address context-dependent and dynamic text in online social networks. Open source tools for sentiment analysis is presented in the work of Younis (2015), throughout which, Twitter data has been collected, pre-processed, analyzed and visualized for analyzing user contributed online reviews.

Social Network Analysis

A social network can be modelled as graph-based visualization composed of individuals (organizations, company, etc.) also called nodes, which are connected by links represent relationships and interactions between individuals, a rich relational interdependency and content for mining. In this way, the social graph shows friendships or user interactions.

Social network analysis (SNA) is a mathematical technique developed in modern sociology, in order to understand structure and behaviour between members of social systems, to map relationships and social connections between individuals in social network, also to serve up business intelligence on the ties. SNA assumes that individuals are all interdependent, instead other approaches to business problems assume that what individuals do, think, and feel is independent of who they know.

SNA is related to network theory and graph theory, so the network topology helps to determine a network's usefulness to its individuals. It is possible to classify objectives in: static to find community structures, dynamic to monitor community structure evolution and to spot abnormal individuals or abnormal time-stamps.

Some typical problems in SNA include discovering groups of individuals sharing the same properties (Schwartz, & Wood, 1993), evaluating the importance of individuals (Kautz, Selman, & Milewski, 1996). Another goal of SNA regards to explain the observed network, identification of subgroup, inferring real-world connections and discovering, labelling, characterizing communities (Adamic, & Adar, 2007).

Evaluation of people location in network, that is the centrality of a node, is relevant to understand networks and their participants. These measures provided by social network analysis give us insight into the various roles and groupings: who are the connectors, leaders, bridges, isolates, the clusters existing and who is in them, who is in the kernel of network and who is on the periphery.

Using matrix algebra on adjacency matrix it is possible to evaluate some numerical features useful for SNA, such as computing the intensity of relation between person (Kolaczyk, 2009; Scott, 2000). To answer these and similar questions, one first needs to define measures for quantifying centrality, level of interactions, and similarity, among other qualities. These measures take as input a graph representation of a social interaction, such as friendships (adjacency matrix), from which the measure value is computed. Betweenness centrality assumes that central nodes act as hubs connecting other nodes, and closeness centrality implements the intuition that central nodes are close to all other nodes. Node central-

ity measures can be generalized to a group of nodes using group degree centrality, group betweenness centrality, and group closeness centrality. Linking between nodes (e.g., befriending in social media) is the most commonly observed phenomenon in social media. Linking behavior is analyzed in terms of its transitivity and its reciprocity.

Graph mining can handle thousands of nodes and millions of edges in a graph using a specific set of algorithms tailored to extracting knowledge from massive graph data structure (Chakrabarti, & Faloutsos, 2006). The social graph can be considered as simple visual representation of network, it shows you and your friends, the networks they belong to, and the social cliques they are part of. It is possible to see who is central to a particular group and which friends are connectors between two groups.

SNA software facilitates quantitative or qualitative analysis of social networks, by describing features of a network either through numerical or visual representation. SNA software generates the above detailed numerical features from raw network data formatted in an edge list, adjacency matrix, often combined with individual/node-level attribute data.

Influencer Analysis

In social media marketing influence play an imperative role. Consumers influence other consumers in several ways. Although there are different means of communication, the most popular and classical way to spread information is via Word of Mouth. A network of interpersonal influence can operate to form agreements among customer, also called influencer, that is people who potentially have the power to convince others to stay or switch to another brand. It presents an account of consensus formation that is unique in its integration with friends from the fields of social psychology and sociology concerned with group dynamics and social structures. There are three aspects to be considered to identify an influencer a social network: who one is (identification), what one knows (his competence), who one knows (his positioning in the global network). The challenge lies though in the fact that influence vary continuously within the members of a community.

Social influence network theory presents a mathematical formalization of the social process of attitude changes that unfolds in a social network of interpersonal influences. Literature review on approaches for influencer detection in social networks is discussed in (Puigbò, 2014). Books of Friedkin (2006) and Friedkin et al. (2011) brings the theory to bear on lines of research in the domain of small group dynamics concerned with changes of group members' positions on an issue.

Social Recommendation

A social recommendation system makes use of user's social network and related information in addition to the traditional recommendation means. Social recommendation is based on the hypothesis that people who are socially connected are more likely to share the same or similar interests (homophily), and users can be easily influenced by the friends they trust and prefer their friends' recommendations to random recommendations (Ma, 2011).

METHODOLOGY

There are five main steps to achieving competitive SMM:

Step 1: Allocating resources.

Step 2: Preliminary analysis.

Step 3: Social metrics.

Step 4: Tool.

Step 5: Report.

The process can be considered as a cycle, to re-start from the first point, if necessary, in order to obtain more in-depth results or to try another approach.

Allocating Resources

As suggested in Håkansson et al. (2015) important parts of methodology are budgeting the process and allocating personnel and financial resources.

The ideal situation is to get high quality insight rapidly and at a low cost. However, the three parameters of quality, speed and cost are interdependently related and it is not possible to optimize one without sacrificing another. Therefore, this step requires the definition of ambition level of quality insight.

A timetable is needed to specify the deadlines for the different activities and for the final result, because information which comes too late is often useless.

In this kind of analysis can be accumulating and analyzing a lot of data, the only way to make sense of it all is to keep it as organized as possible.

Preliminary Analysis

Before to embark on any analysis, it is a clear vision of goals, necessary to ask yourself why you care, what to collect and how to report it, how social media channel fits into accomplishing them.

Data pre-processing cleaning includes the elimination of duplicates, verification of values in the proper range, make information easy for processing in mining algorithm. Data structure can be examined to establish how to store and analyze social media data. An important thing to grasp about the storage of social data is that it comes in high volume but that each piece is relatively small.

Social Metrics

Before conducting a competitive analysis, it's imperative to identify which metrics are important to analyze and why, across all regions and social channels. Some example of metrics:

- community size and growth, to answer the following questions: "Which channels are my competitors seeing the most growth in terms of fans/followers?";
- volume of interactions and engagement rate, by a variety of different terms depending on the social channel;
- volume and type of publications, type of publications;

Social trends and strategies are constantly evolving, therefore it is imperative to choice a set of metrics to segment the data by social media or geographic region, to get even deeper insights relative for benchmarks.

Tools

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There are four ways to begin conducting an analysis based on publicly available social media data: manual operations, API, free or paid automated tools. Also, in case of automated tools, humans are still needed to transform the data into actionable intelligence.

Choosing an analytics tool is relevant to prefer a tool that enables to analyze data for total community sizes in aggregate and at an individual level over a set period of time. This means having the ability to slice and dice data based on social accounts by media type, region, language, and brand.

To get more specific, it is necessary to drill down into data obtained by social channel or region to get a detailed snapshot of each community, segmenting data by region, language, or social account depending on which metrics are most important to the social marketing benchmarks you have set.

Regarding manual operations, it is possible to aggregate metrics from each social channel individually by visiting social media pages regularly and copying data into a spreadsheet. This could be somewhat tedious, but it is an option for brands on a limited budget.

It is relevant to prepare a list of competitors, to keep continuously update, to visit competitors' sites regularly using browser on desktop and smartphone, to detect when there is a change to these sites.

In order to obtain a complete picture of competitor and benefit from their best thinkers, it is necessary to follow key influencers that they are most active on competitor's social pages.

Regarding API, Social Media platforms enable researchers and data analyzers to access a variety of social data by providing public Application Programming Interface (API). The advantage of streaming API is the immediate availability of new information. Facebook and Twitter application development platform, respectively on <https://developers.facebook.com/> and <https://developer.twitter.com/> supports a lot of SDKs for the ease of its developers. OAuth API offers a technique for clients to allow third-party entry to social platforms resources without sharing their credentials.

Regarding free or paid automated tools, while it often requires some monetary investment, you can expect to save time and gain actionable insights that may not find by manually monitoring pages or using free tools.

Digimind Social Analytics

Available on web site <https://www.digimind.com> is a smart software to listen, engage, analysis, and report, allows brands to monitor hundreds of social accounts.

Facebook

Learn about their Facebook fans and their interest by using graph search, to determine what kind of content your audience responds to. As example of Facebook graph search, on the top search box typing "Pages liked by people who like [name of competitor]" it is possible to obtain some interesting results.

Note what post work best, quantity of comments, sharing, likes etc. see what type of content is working for them and adapt it to your audience.

Fanpage Karma

Available on web site <http://www.fanpagekarma.com> is useful to see where your competitors are succeeding in the social universe with the best analytics, statistics tool, insight reports.

Google

Many questions can be answered directly searching on Google for specific terms adding keyword based on name of famous social media website, examples: brand name site:facebook.com, brand name site:twitter.com, first name second name site:facebook.com, first name second name site:linkedin.com.

A reverse image search on Google Images can be useful for locating the origins of an image.

Google Alerts can also be used to help with new content ideas, link acquisition for unlinked brand mentions, guest post opportunities, and to discover new topically relevant content.

Press release sites have a search and it is possible search “social media campaign” to see what other brands are doing or have done. Reading about and follow the links to see what they did, it is possible to see what worked and adapt it to your industry.

Hootsuite

Available on web site <http://hootsuite.com> can be used to follow your competitors’ activity in real-time, how their customers perceive them, how many followers your competitors have on each network, if the number of followers trending up or down and how quickly.

HubSpot

Available on web site <https://www.hubspot.com> is an inbound marketing and sales platform, the Analysis Competitor tool allows to run a competitor analysis in the most efficient and easy way, also recording social ranking over time.

NodeXL

Available on web site <http://nodexl.codeplex.com> is a free, open-source template for Microsoft Excel. It is possible enter a network edge list, click a button, and see the network graph in the Excel window. It is easy customize the graph’s appearance, dynamically filter vertices and edges, find clusters of related vertices and calculate graph metrics. Built-in connections are available for getting data networks from Twitter, Flickr, YouTube, local email.

Social Mention

Available on web site <http://www.socialmention.com> is a social media search and analysis platform that aggregates user generated content from a large amount of web resources into a single stream of information. It allows to easily track and measure in real-time what people are saying about you, your company, a new product, or any topic.

Trackur

Available on web site <http://www.trackur.com> is a reliable, cost effective, usable measurement tools for gathering good content and listening to relevant conversations, with multiple ways to get results.

UCINET

Available on web site <https://sites.google.com/site/ucinetsoftware/home> is a famous software package for SNA.

VOZIQ

Available on web site <http://www.voziq.com> can be used to glean industry-specific marketing intelligence, by first creating a social media sentiment benchmark (He, 2015).

Report

The final report could help to identify weaknesses, find new opportunities and adjust the social media strategy. All this social data remains just that data, until you analyze it and transform it into insights. The purpose of a mining report is to give your internal audience an at-a-glance understanding of key performance indicators you're tracking.

In this kind of report can be identify gaps and opportunities for creating and developing successful digital marketing campaigns, but to obtain considerable results it is necessary to provide comparable data on yourself.

Using a social analytics tool is one of the easiest ways to not only quickly create a competitive analysis, but visualize the data in a meaningful way.

Characteristics of good report: be objective, conduct fearless and thorough research, write well.

Once you start to publish reports at regular intervals, an updated report can be sent via an internal mailing list, or an internal wiki so that it can be accessed by others doing research

Legal and Ethical Factors

Ethics is a key issue in all types of research activity. SMM is particularly prone to ethical assessment and is also subject to legal constraints, because there are many who regard it as an invasion of privacy, and therefore inherently unethical, and partly because there have been widely publicized situations in which the methods used to collect information have been open to criticism.

The legal and ethical issues must be aware are:

- Copyright law, prevents the copying and redistribution of all written material without the permission of the author.
- Criminal law, protects companies and individuals from theft, fraud and trespass.
- Data protection legislation, protects the privacy of individuals by controlling the content and use of databases containing personal information.

One of the key concerns hinges on the extent to which social media data should be treated as public versus private data. Even though social media data are publicly available, social media users may not intend or wish for their data to be used for research. Users may not be aware that their social media data is publicly available and may have expectations of privacy even in public settings. The distinction between public and private data becomes additionally complicated by the fact that machine learning algorithms can make inferences about private attributes, even if not explicitly stated in public data.

CASE STUDY

A case study which applies text mining to analyze unstructured text content on Facebook and Twitter sites is explained in the work of Wu et al. (2013), related to the three largest pizza chains. The results reveal the value of social media competitive analysis and the power of text mining as an effective technique to extract business value from the vast amount of available social media data.

Analysis, similarities and differences and comparison of social media content on the Facebook sites of the three largest drugstore chains in the United States are discussed in the work of Wu et al. (2016).

Government and nongovernmental organizations have been faced with challenges to effectively respond to crises such as natural disasters. This approach is useful in gathering information during and after a crisis (Goolsby, 2010). A case study evaluating Twitter as a Social Media interaction tool in the US Open Government Initiative is discussed in the work of Unsworth (2012) to achieve goals such as transparency, participation and collaboration.

The potential of mining Twitter data to gauge users' response to popular smart phone brands and their underlying operating systems is discussed in the work of Arora et al. (2015).

Students' informal conversations on Social Media shed light into their educational experiences, opinions, feelings, and concerns about the learning process. The work of Chen (2014) presents a methodology and results that show how informal social media data can provide insights into students' experiences.

Regarding health application, SMM is suitable to identify cohorts of pregnant women and follow them over time to analyze crucial health-related information (Pramod Bharadwaj, 2017).

FUTURE RESEARCH DIRECTIONS

Social media data are vast, noisy, unstructured, and dynamic in nature, and thus novel challenges arise. The future research area focuses on to track real-time data and apply advanced data mining, text mining, sentiment analysis to analyze all social data, reasoning process for linking data, to generate intelligent alerts. Emphasis will also be given to assessment of data quality.

Social media sites are dynamic and continuously evolving. The dynamic nature of social media data is a significant challenge for continuously and speedily evolving social media sites.

Maintaining individual privacy in studies of social networks is very relevant, because while much of the research on large-scale social systems has been carried out on public data, richest sources of social interaction information come from e-mail, instant messaging, or phone communication by strong expectations of privacy. A compromise between such availability and protection of privacy of the individuals must be adopted. Standard approaches consist on anonymization: the names of individuals are replaced with meaningless unique identifiers, in this way the network structure is maintained and private information has been deleted.

CONCLUSION

This chapter has explored some technologies and methodologies to compute Social Media Mining, that represents the virtual world of social media in a computable way, measures it, and designs models that can help us understand its interactions. This is an effective way to get a competitive advantage, by providing insight and understanding of the competitors' products and services, as well as increased market

knowledge, information useful to create a winning social media strategy. Future trends and important research topics are presented along with additional readings.

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KEY TERMS AND DEFINITIONS

API: Set of procedure definitions and protocols that describe the behavior of a software component, such as a library or remote service, in terms of its allowed operations, inputs, and outputs.

Ethics: What is deemed to be good or bad in human conduct.

Social Analytics: The extraction of valuable hidden insights from vast amounts of social media data to enable informed and insightful decision making.

Social Media Marketing: The process of gaining website traffic or attention through social media sites. Social media marketing programs usually center on efforts to create content that attracts attention and encourages readers to share it with their social networks.

Social Media Mining: The process of representing, analysing, and extracting actionable patterns and trends from raw social media data.

Social Network Analysis: Mathematical technique developed to understand structure and behaviour between members of social system, to map relationships between individuals in social network.

The Ubiquitous Role of Mobile Phones in Value Co-Creation Through Social Media Marketing

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INTRODUCTION

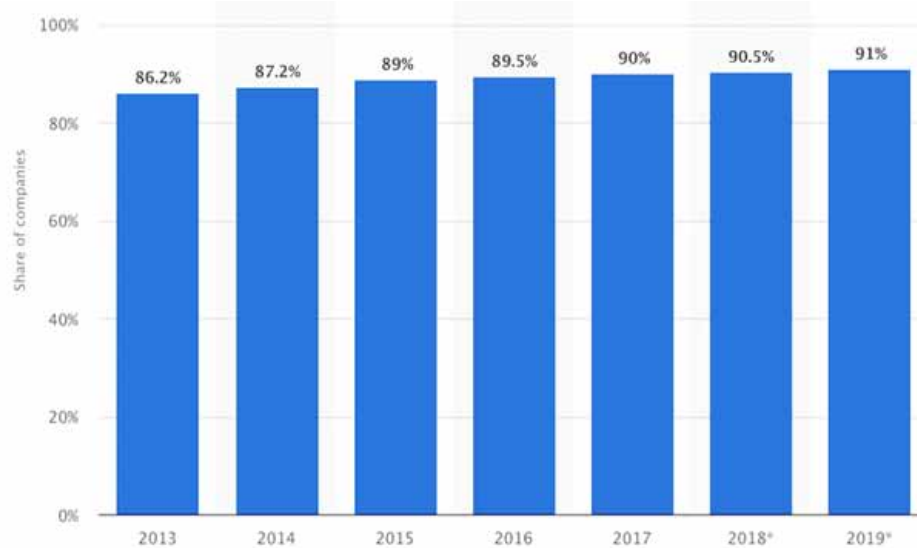
As per recent statistics, seven out of ten people use at least one social media in the USA and 88% of companies use social media as a marketing tool (Seoexpert, 2018). It is expected that the monthly average expected social media users may reach as high as 3.02 billion by 2021 (Statista, 2019). In the contemporary arena, mobile phones, in particular, smartphones have a reciprocal connection to social media. As social media received immense popularity regardless of age, gender or generation (Hossain, Ying, and Saha, 2019); it has intentionally or unintentionally become a tool for marketing. Usually, social media is to interact with friends and family members and to get in touch in a smart way of communication such as sharing something like photos, videos or even status update. However, the use of social media has become a regular habit among human being in the twenty-first century. People who have no basic need to communicate with family members may use social media to communicate with friends or even strangers. Many people want to share their achievements, happiness, sadness, etc. with the help of social media (Liu, Wu, and Li, 2019) in order to feel relaxed. Mobile phones made this easier and more comfortable to get in touch with each other. As people carry a mobile phone and get uninterrupted internet facilities now a day, they can always be connected with social media. Although a mobile phone is a basic device to make and receive phone calls, the reality is, mobile phones are used mostly for using social media either for sending text messages, audio call, video call, and group messaging, sharing moments in various ways, etc.

BACKGROUND OF THE STUDY

Mobile phone or mobile devices are part and parcel of our life and people are getting used to operating smartphones due to its attractive features and multidimensional usage (Almunawar et al., 2018). Such a strong reciprocal relationship with a device and a human being has not been observed before. For example: if we compare other devices such as computers, television, radio or any other devices, undoubtedly, mobile phone is the device used most among people now a day and this use has a strong

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Figure 1. Twitter Social Media Users Statistics



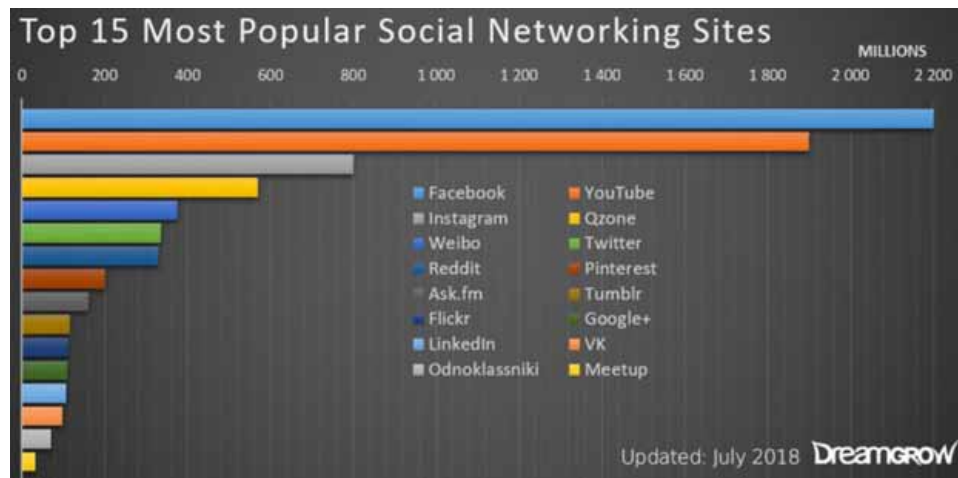
connection with a various social media platform. Based on geographical location, the type of social media may differ, nonetheless, the ultimate result is the strong inseparable connection between smartphones and social media. Based on the contemporary scenario, the author (s) attempted to discover the role of mobile devices in value co-creation with the help of social networking.

LITERATURE REVIEW ON SOCIAL MEDIA MARKETING AND VALUE CO-CREATION

Most literature on social media marketing to date focused on reputed companies, multinational organizations, various case studies of reputed brands, etc. In comparison, very little has been discovered about value co-creation through social media marketing or entrepreneurial activities (Khajeheian, 2013). Consumers attitude toward social media marketing has been discovered recently (Shareef et al., 2019) which indicate the strong focus of companies toward social media advertising in order to reach the customer in a more effective way. Social media marketing has proven as a well-structured content which may flexibly broaden the horizon of a company and its customer base (Prasad & Saigal, 2019). Recent research also talks about innovation in social media marketing (Pacauskas, Rajala, Westerlund, & Mäntymäki, 2018). Although this innovative marketing activities are well defined and analyzed, the unique way to conduct innovation marketing is still under the shadow. The mobile phone may be an option which can be used to conduct innovation marketing in generating value co-creation. In order to expose business activities, social commerce is discussed as an advanced tool for marketing (Schaupp & Bélanger, 2019). Also, a reciprocal attempt at social and mobile media can boost marketing communication activities (Yang, Kang, & Wang, 2019). Kasemsap (2019) investigated that with the benefit of social media, marketers can be in touch with innumerable potential customers than ever before but selecting or choosing the proper media could be the most challenging tool for strategic marketing mix activities.

Value co-creation from a social perspective is a combination of generating value through three different stakeholders includes managers, employees, and customers (Devereux & Gallarza, 2019). As a

Figure 2. Most popular social networking sites. Source: Dreamgrow, (2018)



result, a company can generate value for the customers through social media marketing using smartphones and at the same time, end users who are usually involved with other jobs may also generate value-co creation in participating social marketing activities or sometimes defined by researchers as media entrepreneurship (Khajeheian, 2013). Sharing knowledge, values, and information through social media as well as representing views and comments about a particular platform such as Facebook can furthering value co-creation (Sahni & Appiah, 2019). The reasons why people engage in social media marketing are realistic as well as a mean to earn extra money to survive. It is obvious that some people want to earn money for living and some people want to earn money for a better living. Khajeheian and Arbatani (2011) investigated a few numbers of causes why more and more people are involved with social media marketing. The main reasons are ease of entrance, less or no investment and specialized digital sector to conduct business activities. The mobile phone is working as the most suitable supporting device in this value co-creation activities for all the stakeholders involved.

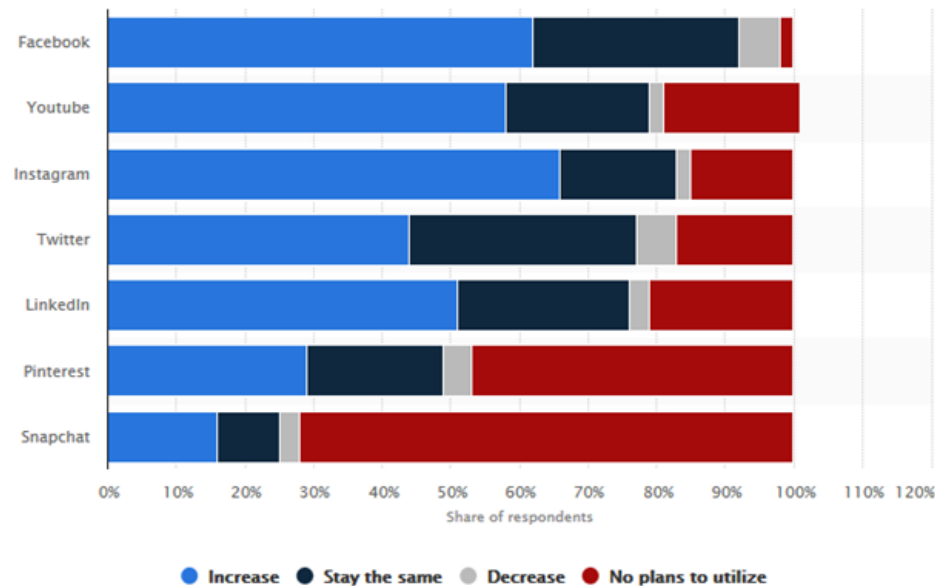
MOBILE PHONES IN VALUE CO-CREATION

It might be a question why people want to buy products through the mobile phone without proper information or knowledge about it? Why people pay online to a stranger? What is the guarantee that the product will be delivered without any trouble? The only answer in this regard is “trust”. Social media marketing most of the time people trust each other. Mobile phones can’t create any value if there is no trust. Most people buy and sell things in a social media group. In these days people are more connected to each other so that they can trust each other (Van Huy, Tinh, Pham, & Strickler, 2019). People like to share their feelings about a particle purchase or any other activities. Many people are interested to buy products while they realize a very attractive offer.

Some people have no time to find a particular product or they don’t have any time to go to shopping complexes. Some friends in the social media group are always involved with some buying and selling activities. Although it’s a bit difficult to match the product one member may need, however, there are always various types of customers. For instance, in a social media group, there are 500 people consisting of women and men. If someone wants to sell cosmetics item, for example, he or she might get a response

Figure 3. Selected Social media for marketing activities

Source: Statista, (2019)



from some women in the group. In this case, the interesting thing is, group members, trust each other because they are connected for social media activities and that is why the group is formed for. Each and every group used in social media may have some particular reasons or rules, however, some people always try to enter with the permission of the admin and try to conduct some social media marketing activities. This is simply a value co-creation process with the frequent usage of mobile devices in the contemporary era. When some people are addicted to the mobile phone for only recreational activities, this concept can be a breakthrough which may generate some extra earning as well as save some people from unnecessary excessive use of mobile phones for non-productive activities (Leung & Liang, 2019).

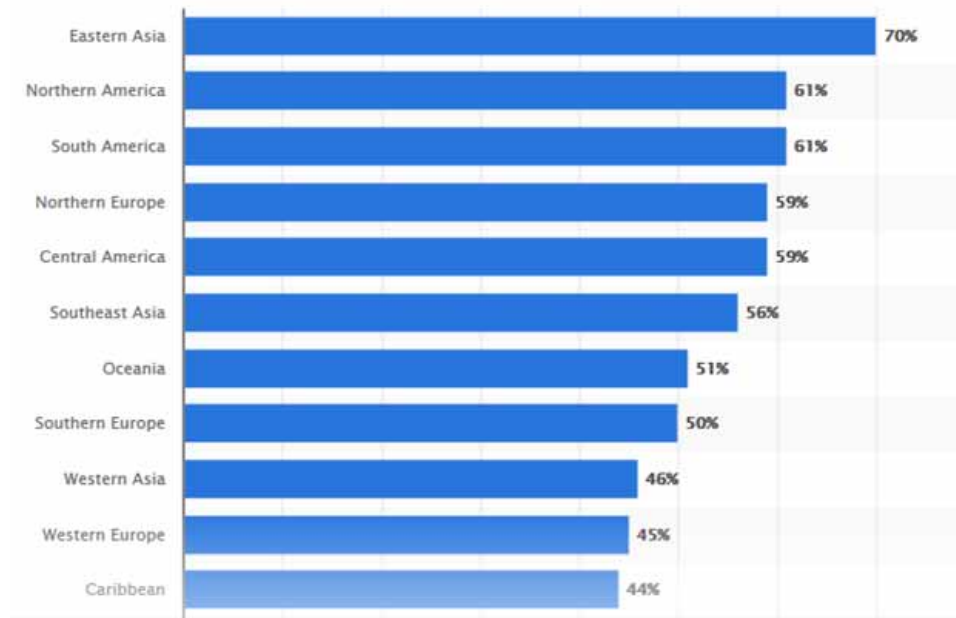
CONTEMPORARY SOCIAL MEDIA MARKETING AND OPPORTUNITIES

Hossain et al. (2019) discussed variety seeking tendency of people in various issues. Buying and selling products is sometimes not a necessity but a hobby these days. People either try to sell or buy products only for curiosity or to earn extra money apart from regular work. Case 1: Alice, a thirty-two years old woman work as a full-time English teacher in China. She is married and has a baby girl. She teaches English in the kindergarten with average income.

To earn extra money, she sells cosmetic items online. She uses WeChat as a platform to advertise products like lipsticks, facial cream, facial masks, make-ups, jewelry, etc. Alice is a little tricky in this business to choose the products. She knows which products are not highly available in the local markets. She also knows the potential buyers and their budget. Alice choose products based on these factors and always set a competitive price to attract customers. Within just one year time period, Alice received about 1200 new friends request from various sources who purchased from her and felt happy about it. Alice initially invested one thousand RMB (USD 147 approx.) to buy some items to sell. At this mo-

Figure 4. Regional rate of mobile phone penetration, January 2019

Source: Statista, 2019



ment she doesn't have any specific accounts to inform that how much she earns every month, however, she confirmed that the income is getting more than her actual salary and she is planning to quit her job soon. Although this is a simple business opportunity due to less investment and low risk, to date, there is no effective legal restriction found. If the companies consider it positively, they might come up with new opportunities such as individual App, tax return to government, the identity of the sellers and so on to make this process valid and smooth.

Case 2

Bai Jie Ru is a 24 years girl. Dance is her passion and she teaches dance in a dance school. She only can work part time as the students and classes are limited. Logically the income is not satisfactory enough. Recently, she was motivated by one of her friend who only sells products online and earns a noticeable amount of money in the last few months. As she was closely connected to the parents of her students, she used social media group as a platform to sell her products. In the beginning, she decided to sell only lipsticks which are with good quality and affordable price. She received noticeable responses from the social media group. Now, she expanded the product line, created a dedicated social media group for selling products, offered a discount to members who can introduce a new customer and that is it. All are simple strategies without high investments and very low risk compared to traditional business set up.

From the cases above, one matter is evident that the parties involved in this activity are generating value for the customers (Hossain, 2019) by introducing a new product to them. On the other hand, it's a favor for the marketers to boost their selling without and additional advertising or promotional cost. Value co-creation is observed here from manufacturer to end users. However, this business set up should have a legal platform so that the society or country may also be benefited from the tax credit. If local government adopt some rules or regulations to perform online business activities then this phenomenon

may change the scenario of the society where many people are jobless, deprived and struggling to survive in the society.

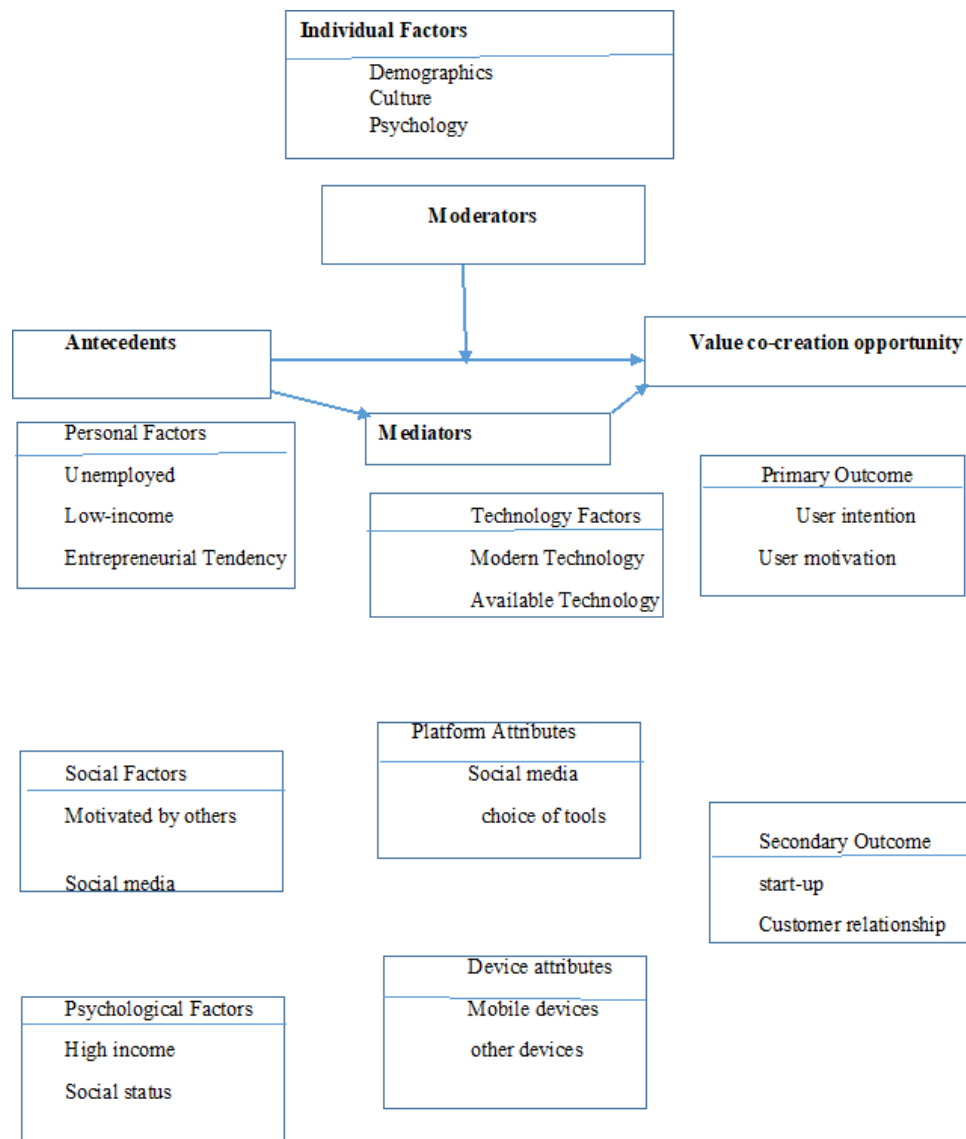
Social media marketing activities usually make people happy with introducing unknown products, discount, and trust. Another influencing factor at the same time to discuss here is about socio-economic development. This is such an opportunity which can be taken by anyone who really wants to involve with this activity. Mostly, the people involved with this activity, has no personal website, business identity or logo. However, some of them are renowned due to social media marketing. Social media marketing is an opportunity for new marketers who can enter the market without the risk of wasteful investment in the advertisement (Keswani, 2019) and promotional activities. Instead, if they emphasize more on social media marketing, the chance is more to become successful in the market due to the trust earned by sellers sell through social media. It is extremely difficult to make people believe about a product or service for the advertiser, marketers or even celebrities. Customers know about the promotion and advertising and do not want to trust the quality of the products easily. However, social media marketing can play a vital role to generate satisfactory sales due to the trust of the sellers.

THE FRAMEWORK OF VALUE CO-CREATION THROUGH MOBILE PHONES IN SOCIAL MEDIA MARKETING

Without opportunities and challenges, the business does not exist. Mobile phones created limitless opportunity with a new business framework. There is no doubt about the concurrent increase of mobile shopping especially with the use of social media. The contextual situation is in favor of social media marketing, however, the popularity varies based on geographical locations around the globe. As a result, numerous research conducted based on a unique country as well as a unique industry to further investigate the issue and build a favorable business model. As value co-creation through social media marketing with the help of mobile phones has not been investigated enough, a new framework is suggested here to highlight the contemporary issues, opportunities, and challenges regarding social media marketing. This framework is an indication of social media marketing with the specialized assistance of mobile devices. This framework may offer cornerstone for the decision makers as well as future researchers in the development of social media marketing in multidimensional ways which might be more effective and a strong marketing strategy in the near future. The framework is not specifically quantitative or qualitative, rather, it's a blend of both so that the intended framework can be extended in the future to discover more about the phenomenon and represent how the consumers may behave due to the changes (Solomon et al., 2012).

In the first phase of the framework, three types of antecedents are resented which are: Personal factors, social factors, and psychological factors. These antecedents with the influence of some moderating and mediating factors, represent the final opportunity of social media marketing with mobile devices as a unique idea to conduct business. The overall value co-creation process lies within the whole process. The framework consists of one moderating variable, three mediating variables and the outcome of this study which is “opportunity”. The next sections will discuss these in details. In order to reach in depth of the issue, a questionnaire has been designed and conducted for this study. The questionnaire consists of different scales along with multiple choice questions and short answers. The reason behind conducting the questionnaire is to discover the real scenario of social media marketing with the help of portable devices to generate value co-creation such as advantages, barriers to start-up, flexibility, affordability,

Figure 5. Structure of social media marketing



etc. The result indicates unique ideas and opportunities of social media marketing in a different way to create value in society.

The findings in this study basically based on descriptive analysis. A sample of 22 social media entrepreneurs was chosen to find out the opportunity of social media marketing with the help of mobile devices in order to generate value co-creation. The respondents are actively involved with media entrepreneurship and use a mobile phone as a mean of conducting the business process. Person administered interview was conducted to figure out the contemporary scenario of media marketing especially in the social media marketing platform and mobile devices as a tool. After conducting the full interview, the researcher utilized and coded key points in analyzing the study further. Interview finding is helpful to develop a theory with further modification from experts in order to come up with a more trustable unique theory. With the same procedure and modifications accordingly, the final framework was developed and

confirmed. The overall framework which consists of four variables and nine various factors has been discussed below in details.

RESEARCH DESIGN

There are some moderating factors involved according to the framework shown in the study which may affect the relationship between dependent and independent variables in this study. These moderators are mostly individual factors. Firstly, the demographic information is important. For example, Age, sex, marital status, income, race, education, religion, etc. may affect to grab an opportunity to become an entrepreneur even though the facilities are available. In some developing countries, women are not allowed to even communicate with people outside the family. In this circumstance, the cultural issue as well as the psychology of people to become socialized act as a moderator and affect the relationship between dependent and independent variables.

Mediating variables act as mechanisms which can bring changes in between independent and dependent variables. The first mediator in this study is technology factors. In this era, modern technology like 5G mobile internet, internet of things, cloud services, Wi-Fi, LiFi (will be introduced soon with LED technology), VR, AR, Web-based communication in real time (WebRTC) technology are blessing for the human being. The more availability of these technologies mediates more positively to enjoy more opportunity for social media marketing and generate more value. Availability of technology is another important mediator in this regard. In some countries, technologies related to social media marketing activities are available and affordable. Even, the technology which may help to send the desired product to the customer within a short period of time is also available. In this case, the value of co-creation will be positively affected. Platform attributes is another mediator in this study. Social media is a platform for many entrepreneurs to start a new business with a low possible risk involved. Choice of tools like selecting a certain app or to be involved with so many groups in the social media world may mediate independent and dependent variables of this study. Finally, device attributes are the other mediating factor which indicates the type of mobile devices or other portable devices and their usage in social marketing activities to generate more value.

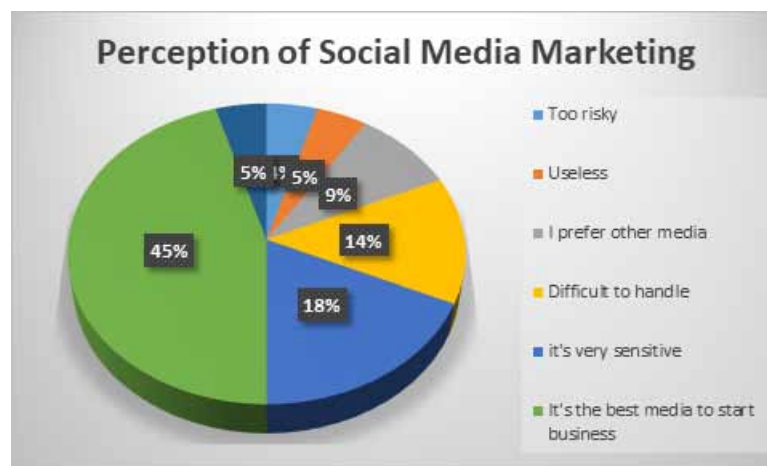
There are three antecedents represented in the framework. The first one is personal factors. The main personal cause behind motivating to be an entrepreneur is having no job or unemployment problem. People want to earn money as well as want to find a job for income, security and social status. However, the recent increase of graduates and a shortage of good jobs motivated some people to become an entrepreneur who chose social media as a marketing tool for value co-creation. Low or limited income is another personal factor which drives people to be involved with additional activities or earning source. The two cases discussed in this study are mainly based on low or limited income. In addition, some people have an entrepreneurial tendency. They are usually motivated to business and do not like to work for others. For this kind of people, social media marketing is a blessing as they can start a particular business very easily. There are some social factors which work as an antecedent in this study. This first one is motivated by other people. This happens when people are connected to each other due to sharing information on social media. Some people share it for business purpose and some people get motivated to do the same. Social media itself is also a social factor in this circumstance. Social media is the most powerful and reachable now a day and capable to generate more value for the customers with more buying and selling in various ways. There is another antecedent which is psychological factors. Some people dream to earn a lot of money and become rich. Jobs always have fixed or limited income. As a

result, higher income tendency motivates people to conduct marketing activities especially with the help of mobile devices and this phenomenon is effective for more value co-creation.

THE SURVEY

The authors decided to conduct a survey among social media marketing users and entrepreneurs regardless of age, gender, and profession. In order to assume the length and the comprehensibility, a pretest among 4 participants was conducted. In order to make it flexible, the survey was then re-designed that is the authors edited, added or removed some questions. A final survey was designed and administered.

Figure 6. Perception of social media marketing



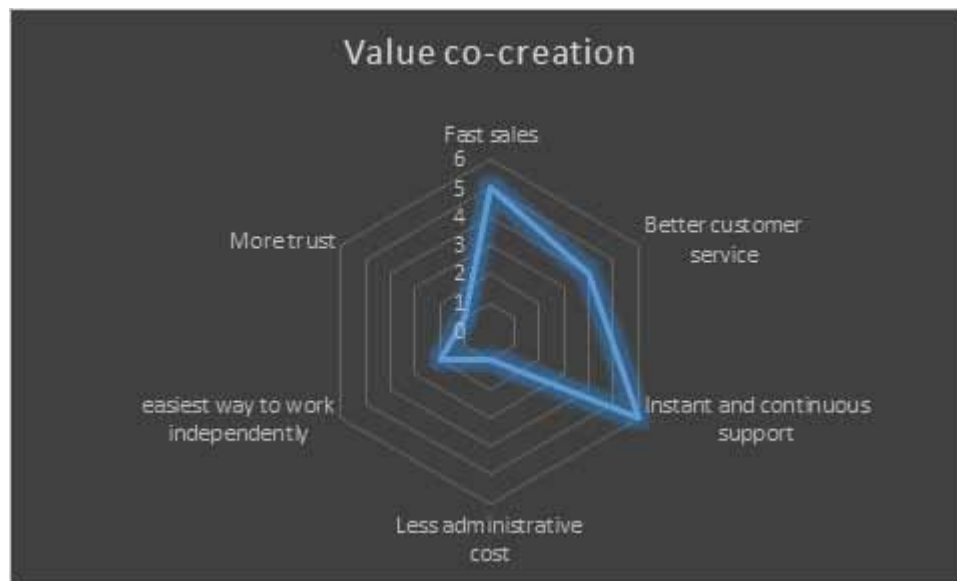
Perception of Social Media Marketing

The first question in the survey was about the perception of respondents about social media marketing. 45% of the respondents said that it's the best media to start a business however, 18% believe that it is quite sensitive due to recommender system, star rating and dissatisfaction of some buyers for unusual reasons which may affect other potential customers. 14% claimed that it's very difficult to handle if the number of customers too many and less manpower support.

Value Co-creation

The chart above represents various ways of value co-creation in society with a specialized focus on mobile devices. According to the result shown in the diagram, customers perceived more value due to instant and continuous support from the seller. Usually, sellers are either known or highly trusted in a social media marketing group. They try their level best to keep the goodwill up to mark. In addition, respondents also focused on better customer service and trust issue. Sometimes, in terms of traditional purchase, it's comparatively more complex to reach the responsible authority. For example, Customers try to connect them via call center or customer support helpline and then they need to wait for getting the desired service. Conversely, in terms of social media marketing, customers usually enjoy the freedom

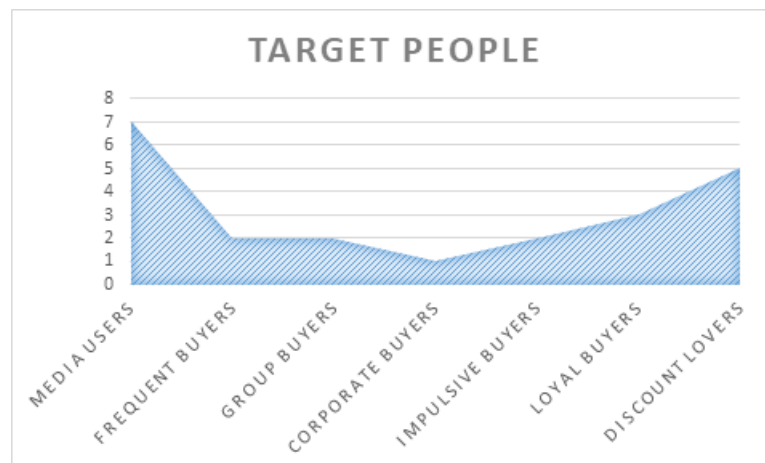
Figure 7. value co-creation



of instant help and support. Although the easiest way to work independently is a crucial concern in this research, the author has received comparatively low feedback in terms of value co-creation.

Target People

Figure 8. Target people



According to the respondents in this study, the largest number of target customers are social media users. There are certainly other media users along with social media but in this study, the author focused particularly on social media users and found that they are the highest target customers for social media marketing. In addition, there are some people who like to buy goods only for the sake of a discount. They are well known as discount lovers. They are the second largest target customers. Conversely, group

buyers and corporate buyers are fewer targets for this kind of marketing. However, loyal and frequent buyers can be a good target market for social media marketing.

Handling Difficulty

Figure 9. handling difficulty



According to the survey conducted in this study, the respondents answered positively about handling difficulty. Especially, usage of Facebook and WeChat as a platform to conduct social media marketing considered as the easiest tool as per the respondents. Here, one matter to draw attention is that the user of a particular platform may find it easier than another platform. For example, Facebook is not allowed to use in China, as a result, most users use WeChat as a platform or QQ. They are not familiar with Facebook. On the other hand in some other Asian countries like India, Pakistan, and Bangladesh, Facebook is considered as the major platform for social media communication.

DISCUSSION

Social value co-creation (Devereux & Gallarza, 2019) has been investigated recently with an attempt to satisfy various stakeholders and to increase their benefits. Social media marketing can generate more social value co-creation with more and more business activities performed with the help of social media with less expense and more affordable price for the consumers. Value co-creation mostly refer to creating more value for the business and the customers' perspective, however, social value co-creation refers the same with an additional focus of societal and economic development perspective. Mobile

phones may play the most vital role in creating social value co-creation by conducting business activities including information sharing, advertising, selling, collecting feedback from the users and sometimes ensuring warranty for the buyers. Social value co-creation is more crucial in this aspect due to social media marketing. If social media goes against a particular seller, it's hardly possible for the seller to stay in the market. According to Khajeheian and Arbatani (2011), the social media platform has changed the business circumstance in a different way where low barriers exits to enter ($M = 1.40$, $SD = 0.5$), exit market is considered as a major drawback in terms of developing country ($M = 1.89$, $SD = 0.7$), competition is observed as a medium level ($M = 3.47$), profitability rate is medium as well ($M = 2.80$). The result indicates that the social media market is not a noticeably enhanced market in the developing countries, however, due to social value-co creation, this may form a unique business opportunity in the future. Even small investors and entrepreneurs are interested to invest on advertising using social media more and more recently.

This is the ultimate outcome of this study. Value-co creation through more use of mobile devices along with the benefit of social media marketing. It has been represented in two different categories. The first one is the primary outcome and the second one is a secondary outcome. The primary outcome includes user intention and motivation. When people decide to start a new business, they look for a suitable platform. With various antecedents, moderators and mediators, the final decision depends. The opportunity for value co-creation primarily depends on user intention and motivation at this stage. So the primary stage is just to make a decision but not the actual start-up. However, the secondary outcome of this framework is to start-up the actual business with the help of social media and mobile devices and maintain proper customer relationship. In this kind of business, value co-creation can be affected positively and adversely due to a simple mistake or misunderstanding. As a result, maintaining a proper customer relationship may result in a successful start-up and more value co-creation.

CONCLUSION

As per the findings in this paper, mobile phones, in particular, smartphones play a vital role in value co-creation via social media marketing. The emergence of smartphones with multidimensional facilities helps users to enjoy shopping. Mobile phones in the present era not only improved communication system but also changed the way of social media marketing and created more value by a recent increase in online shopping via mobile apps. The countries who are not yet successful with social media marketing may think about adopting more strategies via mobile phones and adopt flexible apps for shopping. In addition, a secure and flexible mobile payment may enhance the probability of increased purchase by potential customers. The proposed framework in this study is an exemplary way to generate more value in social media marketing using mobile devices. With the antecedents, moderators, and mediators, the framework motivates social media entrepreneurs to go ahead and conduct more and more social media marketing activities.

This study is an attempt to enhance social media marketing activities with the usage of mobile phones which may create more value for the concerned parties associated in this activity. It can be a cornerstone for social media entrepreneurs, stakeholders and managers and also it contributes the theory by adding the new framework.

FUTURE RESEARCH DIRECTION

This study could be a base study for further experimental research which may exploit tremendous opportunities in social media marketing with the help of mobile devices. Due to limited number of data and individual case study, this research may not generate same result for any regions in the world. So, future research may try to discover the same on European or American perspective or even compare the differences among different regions.

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KEY TERMS AND DEFINITIONS

Media Entrepreneurs: Entrepreneurs who primarily and mostly depend on various media including social media to sell their products.

Smartphones: The recent updated creation of mobile telephones which has multidisciplinary usage within a single device apart from making phone calls and sending text messages.

Social Media: The most powerful and popular media which has been recently attracted by the marketers and entrepreneurs.

Social Media Marketing: It is a proven tool which indicate the strong focus of companies toward social media advertising in order to reach the customer in a more effective way.

Value Co-Creation: Combination of generating value through different stakeholders involved in business activity.

Crisis Communication in the Age of Social Media and the Case of Dairy Khoury

13

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INTRODUCTION

The rise of social media was a game changer for consumers and companies alike. It gave the consumers clear and direct voice in many aspects related to the products they consume. On the other hand, it provided the organizations with a new tool to communicate with their audiences everywhere, especially in response to an occurring crisis.

At times, crisis strike due to factors beyond the company's management control (natural disasters, war, stock market drop, boycotts, competition's malevolence etc...), and sometimes due to the management's misconduct, deception or lack of values. For a reason or another, "crises are considered to be common parts of the social, psychological, political, economic and organizational landscape of modern life" (Matthew et al. 2003). Consequently, a predetermined crisis-management plan and an adaptable communication strategy will always play a pivotal role in defining the survival of an organization or an industrial sector as a whole.

According to Willmer (2016), organizations should invest in preparing crisis-management plans on different scales, supported by comprehensive analysis of the organization's environment, activity and potential risks. Risks are known to be all the potential activities or events that could harm the organization's finances, revenues, reputation, market position and capacity to deliver services.

Whereas, crises are known to be unforeseen events that may occur at a specific point in time and they tend to:

- Place the organization in serious financial jeopardy
- Cause damage to the employees and the public
- Cause image and reputation damages:
 - Threaten the viability of the organization
 - Alter the reputation of the company and its leadership
 - Weaken or destroy the confidence of stakeholders and consumers in the company.

Furthermore, the SCCT (Situational Crisis Communication Theory) developed by Coombs (2011) classifies different types of crises as follows:

The rise of social media made it very difficult for any company to survive a failure in responding to a crisis through social networks, such as Facebook and Twitter. "Crises affect more people than ever before, are more widely reported in the media, and have a wider impact on increasingly interconnected, dynamic and complex social-technical systems" (Matthew et al. 2003).

For instance, 2017 witnessed on huge failures of some organizations that didn't have the experience, nor the right knowledge to sail with the company on social media during the crisis. Therefore, we will present three cases:

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*Table 1. SCCT (Situational Crisis Communication Theory) CRISIS TYPES**

Crisis cluster	Crisis type	Description
Victim	Natural disaster	Earthquake, flood, etc would damage an organization
	Rumor	A rumor is disseminated about an organization
	Hacking	Attackers perform computer hacking
	Workplace violence	An employee attacks other employees
Accidental	Challenges	Stakeholders claiming that the organization is operating inappropriately
	Technical-error product harm	A technology failure resulting in a faulty product
	Technical-error accident	A technology failure causing an accident
Preventable	Human-error accident	A human error causes an accident
	Human-error product harm	A human error results in a faulty product
	Organizational-misdeed	Management taking actions that it knows may place stakeholders at risk

* (Adapted from Coombs, 2011).

The first is when Pepsi launched a new advertising campaign featuring the basketball star Kendall Jenner while joining a street protest, then, she hands a can of Pepsi to a police officer who takes a sip and smiles at his partners. The company was accused of taking advantage of serious social issues and the crisis began. Pepsi pulled the video and apologized, but the social media audience was not merciful and blamed Pepsi for trivializing the demonstrations.

The second is when the Environmental Protection Agency accused Volkswagen of selling vehicles that didn't meet environmental requirements. The company recalled millions of vehicles and promised to reimburse some of the customers. On social media, the customers expressed their suspicion that the company was handling the crisis in an inconsistent and dishonest way by publishing contradictory statements as to whether they knew or didn't know about the cheating.

The third is when the United Airlines told a passenger to give up his seat for airline staff due to flight overbooking. When the passenger (69-year-old doctor) refused to leave the plane, he was forcefully dragged from his seat and was struck in the process. The crisis started when a cell phone video recording of the incident was published on social media. The CEO Oscar Munoz apologized for "having to re-accommodate" the customer. This statement triggered a huge amount of criticism accusing the CEO for being disrespectful and lacking accountability. This case demonstrates how an apology on social media should be carefully put into words and communicated, taking into consideration the feelings of the victims.

In an era of growing consumption consciousness in the Lebanese market, the conventional media created frenzy about the Labneh (strained yogurt) production in Lebanon. The case gained public interest and triggered public health concerns when the media framed the Natamycin as a carcinogen.

Suddenly Dairy Khoury was at the center of a product harm/food safety crisis (Yehya& Coombs, 2014) and decided to counter campaign via conventional media. But the social media forced itself as a medium to be reckoned with, when the consumers started to voice their opinions on Facebook. What distinguishes the Dairy Khoury case is its being one of the earliest cases in Lebanon in which a dairy

company, facing a crisis, used the social media to generate support for its cause. And yet, no apologies were addressed and there were no recalling for the product in question.

The main purpose of this paper is to provide a clear understanding of the crisis communication strategy adopted by Dairy Khoury on social media, at a time when the social media's full potential was yet to be recognized.

As a case study, the author will highlight the elements in dealing with Dairy Khoury's crisis via social media, and what are the efficient and inefficient elements of this communication strategy in today's standards. Hence, the author will highlight the necessity of a preset crisis communication strategy and a vigilant use of social media platforms while dealing with crisis.

This paper will be divided as follows: first the author will draw a theoretical background followed by a description of the research method, and then the author will present the findings. Finally, a few remarks and suggestions will be offered.

After determining the cause of crisis, a carefully-prepared communication plan should be able to minimize most of these negative impacts and, in some cases, ultimately stanch the damage.

BACKGROUND

Long before the rise of the Social Media, an impressive number of scholars have been studying crisis and many researchers have agreed that a crisis is an unpredictable event which results in uncertainty and is perceived as a threat to high priority values of the organization goals.

Table 2. What is crisis according to the scholars?

Scholar	Definition
Fearn-Banks (2010)	"A crisis is a major occurrence with a potentially negative outcome affecting an organization as well as its public, products, services, or good name".
Coombs (1999)	"Crisis is a risk manifested... an event that is an unpredictable, major threat that can have a negative effect on the organization, industry, or stakeholders if handled improperly".
Seeger et al. (2003)	"An organizational crisis is an unexpected, non-routine organizationally based event which results in uncertainty, threat, or perceived threat to an organization's high priority goals."
(Matthew et al. 2003).	"The term crisis evokes a sense of threat, urgency and destruction, often on a monumental scale. Crisis suggests an unusual event of overwhelmingly negative significance that carries a high level of risk, harm, and opportunity for further loss".
Hermann (1963)	"Crisis includes three main conditions: (1) threatens high priority values of the organization goals, (2) presents a restricted amount of time in which a decision can be made, and (3) is unexpected or unanticipated by the organization".

Managing a Crisis Through Communication

Richardson (1994), Coombs (2007), and Maisonneuve (2010), classify the crisis communication strategy into three main: pre-crisis, during crisis and post-crisis.

a. Pre-Crisis

Pre-planned emergency response is most effective for the immediate tackling of any unpredictable event. The author emphasized in the afore-introduction the importance of having a pre-crisis plan to deal efficiently with potential external and internal hazards. The author hereby names the EXXON Valdez oil spill as an example of the absence of pre-planning, which drastically affected the management of the crisis.

The Exxon Valdez tanker ran aground on Bligh Reef in Alaska on March 24, 1989, releasing nearly 11 million gallons of crude oil into Prince William Sound.

More than anything else, the running aground of the tanker Exxon Valdez underscores the fact that crises in business are inevitable and companies must have crisis-management plans in place well before disaster strikes (The New York Times – April 30, 1989).

b. Key Factors During and Post Crisis: Reputation, Image, and Public Response

Watricks (1992) states that “A reputation is an aggregate evaluation that the stakeholders make about how well an organization is meeting stakeholder expectations, based on its past behaviors”

Table 3. Benoit’s Typology of Image Restoration Strategies

Strategy	Specific Tactic	Course(s) of Action
Denial		Denying the act or shifting the blame
Evading responsibility <i>With 4 tactics</i>	1- Provocation	the firm declares that its action was a response to another’s offensive act
	2- Defeasibility	the firm alleges a lack of information or knowledge related to the situation
	3- Inadvertent	claiming that the act in question happened accidentally, unintentionally
	4- Good intentions	suggesting that the action was based on good intentions
Reducing offensiveness <i>With 6 tactics</i>	1- Bolstering	reminding the audience of previous positive acts
	2- Minimization	telling the audience that the act is less serious than it appears
	3- Differentiation	comparing the act with other more offensive acts
	4- Transcendence	putting the act in a broad context so it looks less offensive
	5- Attacking accuser	questioning the credibility of the source
	6- Compensation	suggesting offers (payments, reimbursement, ...)
Corrective Action	Restoring the state of affairs existing	promising to correct the situation and prevent its reoccurrence
Mortification	Confessing	By admitting the responsibility of the occurrence and asking the audience’s forgiveness

Source: <https://www.ou.edu/deptcomm/dodjcc/groups/98A1/Benoit.htm>

The Image Repair Discourse and Crisis Communication theory focuses on message options (Benoit, 1997) and consider that the communication strategy is a goal directed activity in order to maintain a favorable reputation for individual or organizations when their image is compromised. This theory outlines a typology for image restoration as follows:

Moreover, Sellnow et al. (1998) suggests “Corrective Action” as one of the successful strategies in image restoration. They recommend corrective action in order to ensure the priority of safety for stakeholders and thus reduce pressure.

Pushing the Image Restoration Theory ahead, The Situational Crisis Communication Theory (SCCT) designed by Coombs (2007) provides an evidence-based framework for understanding how to maximize the reputational protection through *post crisis* communication strategy. Coombs SCCT identifies how key facets of the crisis situation influence attributions about the crisis and the reputations held by stakeholders. In turn, understanding how stakeholders will respond to the crisis informs the post-crisis communication. In this empirical research, Coombs (2007) provides a set of guidelines for how crisis managers can use crisis response strategies to protect a reputation from the ravages of a crisis, as follows:

Furthermore, Szczepanik (2003) considers that the public support is especially important when facing a crisis. The public can both turn against an organization and harm its credibility and reputation, or it could provide support and assist in efforts to solve the crisis. In her study she stresses on the fact that a proper communication during a crisis is fundamental to gain public support. For her, organizations that face crises unprepared, such as Exxon, fail to address the importance of public perception and damage the company’s reputation, maybe forever! And because a corporate reputation is a valuable asset (Fombrun and Van Riel, 2004) and a crisis is a threat to the corporate reputation, crisis communication can be an *integral part* of repairing that harm/protecting the reputational assets (Barton, 2001; Benoit, 1995). Therefore, reputational attacks can be defended through communicative effort called corporate apologia. In his qualitative research, Coombs (2010) found that corporate apologia is the key point upon which crisis communication should be developed. It is a communicative effort to defend the corporation against reputation attacks.

Table 4. SCCT crisis response strategy guidelines - (Coombs, 2007)

1	Informing and adjusting information can be enough when crises have minimal attributions of crisis responsibility (victim crises), with no history of similar crises and a neutral or positive prior relationship reputation.
2	Victimhood can be used as part of the response for workplace violence, product tampering, natural disasters and rumors.
3	Diminish crisis response strategies should be used for minimal-attribution crisis responsibility (victim crises), coupled with a history of similar crises and/or negative prior relationship reputation.
4	Diminish crisis response strategies should be used for low-attribution crisis responsibility (accident crises), which have no history of similar crises, and a neutral or positive prior relationship reputation.
5	Rebuild crisis response strategies should be used for low-attribution crisis responsibility (accident crises), coupled with a history of similar crises and/or negative prior relationship reputation.
6	Rebuild crisis response strategies should be used for strong-attribution crisis responsibility (preventable crises), regardless of crisis history or prior relationship reputation.
7	The deny posture crisis response strategies should be used for rumor and challenge crises, when possible.
8	Maintain consistency in crisis response strategies. Because mixing the deny crisis response with either the diminished or the rebuild strategies will erode the effectiveness of the response as a whole.

Source: <https://link.springer.com/article/10.1057/palgrave.crr.1550049>

Corporate apologia is also a key factor for Chung (2011) who investigates how corporate apologies can relieve the level of public anger under a crisis situation. In his study, he proved that an apology statement with active responsibility is more likely to relieve public anger than that with passive responsibility.

All the above studies were made prior to the advent of the social media as a key player when handling a crisis situation. Nowadays, with social media tools, individuals and organizations have new ways to engage interactively by means of creative and collaborative platforms. Thus, social media can be seen as the means for gathering a variety of information, in order to enhance the understanding of a crisis.

c. The Role of Social Media in Crisis Communication

Social media has been recognized as an increasingly important source of information that supports decision making processes during crisis situations.

By definition, social media is “an umbrella term that is used to refer to a new era of Web-enabled applications that are built around user-generated or user-manipulated content, such as wikis, blogs, podcasts, and social networking sites” (Pew Internet & American Life Project, 2010). Because social media possesses characteristics of participation, openness, conversation, community, and connectedness (Mayfield, 2006), it allows private individuals to become sources of information and ‘sharing opinions, insights, experiences and perspectives with others’ online (Marken, 2007). Therefore, the news of a crisis can be shared and reach millions of people without the “traditional” control of the “news room”. While there can be a considerable lag between the occurrence of a crisis situation and news reports about it, social media has been recognized for its potential to provide complementary and relevant information for crisis management in near real-time (Meier, 2013).

However, disseminating information about organization crisis on social media can be a double edged sword and a contestable opinion because they give a vast spectrum for users to voice their opinions, which can lead to new challenges facing crisis managers. On that behalf, Coombs (2011) advises that when meeting a crisis, a quick response is an active response because it tries to fill the vacuum with facts. A slow response allows others to fill the vacuum with speculation and misinformation.

MAIN FOCUS: THE DAIRY KHOURY CASE

Social networks can instigate rumours, amplify the damage of a crisis, bypass a crisis or even put out its flames. Therefore, the author decided to examine the case of “Dairy Khoury”- a dairy products company in Lebanon-through observation, and also through analysing its crisis management by means of social networks. It is important to mention that the author gave a particular attention to Dairy Khoury because it is considered to be the first Lebanese dairy company to face such a crisis, while the use of Social Media in Lebanon was growing exponentially and imposing new communication practices on the Lebanese scene.

By means of conducting a case study, the author has the chance to go beyond the limitations of quantitative and statistical limitations (Zainal, 2007). Case study allows the researcher to explore, describe and provide an in depth-explanation of the problems in question. It helps explain both the process and the outcome of a phenomenon through complete observation, reconstruction and analysis of the cases under investigation (Tellis, 1997).

For the purpose of this case study, the author decided to conduct an email in-depth interview with Mr. Ziad Akiki the *Project & Process Improvement Director at Dairy Khoury*, who was in charge of

dealing with the crisis. An email in-depth interview provides necessary information from people who prefer to be interviewed online rather than face-to-face. It also overcomes many boundaries such as time constraints and geographical difficulties.

E-mail in-depth interviews can be employed quickly, conveniently, and inexpensively and can generate high-quality data when handled carefully (Lockman, 2006). Aware of the method's challenges, the author found that an in-depth e-mail interview can be viable and efficient for the qualitative approach adopted in this study.

Further, and in order to shed the light on the context in which Dairy Khoury was trying to encounter the damage of the crisis, the author found it interesting to examine the comments made by the audience on the Dairy Khoury's Facebook page during and post crisis. The time frame of this study covers the following years of the crisis which allows us to make a critical examination of the efficiency or inefficiency of Dairy Khoury's communication strategy.

1. Data Collection

A. The Interview

Mr. Ziad Akiki, the *Project & Process Improvement Director at Dairy Khoury*, confirmed that the Dairy Khoury's crisis broke up on the 18th of March 2014, because of the usage of a natural mold inhibitor called Natamycin in Labneh. First, the traditional media spread the news and treated the Natamycin as a chemical dangerous ingredient to be aware of. At that time, Dairy Khoury didn't anticipate such a claim, because for them, Natamycin is a natural mold inhibitor with no harm on human beings health's.

According to Mr. Akiki, their first response, when the crisis stroke and became widely spread, was to hold a press conference and to explain the truth about what happened. Dairy Khoury's strategy was to recognize the fact of using the Natamycin. Mr. Akiki stated "...recognition, because we believed that we were rather advanced in our production method". In the press conference, it was clear that the board took full responsibility of using the Natamycin. Board members held speeches to share responsibility in dealing with the crisis.

Part of their strategy to respond through media, Mr. Akiki said that they used both traditional and social media. They held press conferences and invited TV stations to produce TV documentaries on the subject, all for transparency reasons.

The author asked Mr. Akiki whether they used the social media during or after the crisis and why? He answered: "We only used the social media after the crisis, because back in 2014, social media were not active as much as they are nowadays".

Nevertheless, during the crisis, Dairy Khoury's crisis manager focused on communicating with the partners. He communicated with them via Facebook, also addressing their social media audiences with the same message. Dairy Khoury made a clever move by resorting to opinion leaders and active partners on social media, particularly Facebook, in order to ease the tension of the crisis.

As a post-crisis response, always according to Mr. Akiki, Dairy Khoury followed-up on the information that was circulating on social media. He confirmed that the impact of social media on the crisis was "positive, because social media users made researches about for Natamycin and found out that it is not a harmful substance". Nevertheless, for Mr. Akiki, it is not possible to overcome a certain crisis solely by conducting a communication campaign on social media. Because when facing the crisis "we also had to target older people who did not use the social media".

The damages due to the crisis (material, reputation, market share...) were estimated to have reached 12 million US dollars. Surprisingly, Dairy Khoury didn't conduct a post-crisis assessment in order to measure the effectiveness of its adopted communication plan!

Figure 1. Candia (One Competitor)'s reaction to the crisis

Source: <https://blogbaladi.com/the-lebanese-labneh-scandal/>



Mr. Akiki revealed that, in the aftermath of the crisis Dairy Khoury developed a communication plan in order to face any potential crisis, based on the experience gained from dealing with the Natamycin crisis. Mr. Akiki confirmed to the author, that eight months after the crisis, Dairy Khoury started to recover gradually until it totally did.

B. Dairy Khoury's Facebook Activity

Examining the Facebook's page, the author found that Dairy Khoury's usage of Facebook was not limited during the crises period, contrast to what M. Akiki had told us about social media's limited impact during the time of crises.

- We can see on the 23rd of March, the announcement of TV press conference will take place, the date and the TV channel (LBC, Lebanese Broadcasting Channel at 5:00 PM.).
- There are also photos of M. Khoury, owner of Dairy Khoury, in a dinner with the Health minister and other important Lebanese personality
- Photos of Dairy Khoury's team receiving the CPC (Colder Products Company) certificates from the Lebanese Health Minister
- The speech of Mr. Girgi Khoury during the CPC's awarding ceremony on the Facebook page
- The video made on TV in a program called "Tahkik" (Investigation), as the photo below
- An announcement that the crises will be the subject matter of a TV program called "Lilnacher" (to be spread)

Figure 2. Announcement of “Tahkik” on Dairy Khoury Facebook’s Page

Source: Dairy Khoury’s Facebook Page

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- Articles taken from local newspapers
- Photos from the factory and for the products
- Photos of the cows Milking and being showered
- Photos of the team during HORECA’s (HOTel, REstaurant, CAfé) exhibition in Lebanon and photos of the Health Minister eating Dairy Khoury’s products in the exhibition.
- We can read also a message from Dairy Khoury Dairy thanking the Facebook users for their “kind and gentle support” and asking them to invite their friends to like Dairy Khoury’s Facebook page and to “share the press conference videos so the truth can spread as much as we can to beat all these rumors” (March 23, 2014).

C. Crisis Type, Reputation, and Crisis History

Firstly, it is important to mention that according to the crisis typology determined by Coombs (2007), and presented in Table 1, the Dairy Khoury’s case fall into the “Preventable” type; because the crisis was provoked when the “Natamycin” was intentionally added to a dairy product, in this case the Labneh. Secondly, based on the SCCT crisis response strategy guidelines elaborated by Coombs (2007), Dairy Khoury has no history of similar crises and the company has a positive prior relationship reputation. No prior crises information was found in the conventional media nor on the Internet platforms. Finally, none of the unit of analysis (comments) referred to prior dishonesty.

D. The Dairy Khoury’s Facebook comments

In order to corroborate the information deduced from the in-depth interview, and in order to give a better understanding of the use of social media by Dairy Khoury for crisis communication, the author found it interesting to examine the comments written on Dairy Khoury’s Facebook page. From March 20th till May 24th 2014 (Date where Dairy Khoury resumed to a normal activity), 193 of Dairy Khoury’s Facebook comments during the crises were collected and analyzed qualitatively. These comments were made accessible to the public and provided invaluable opportunities for studying the crises.

The guidelines that the author followed for messages classification are suggested by Helsoot & Groenendaal’s (2013). They are comprised of (1) questions (2) giving information (3) suggestions and

(4) messages intended to be funny. Roshan et al. (2016) enlarged this cluster and added three clusters comprising (5) objections (6) appreciations and (7) comparison of the organization with others. This study identified one additional cluster which is (8) support

Table 5. Audience's Comments on Dairy Khoury's Facebook Page

Qualification	Category	Comments
Positive	Suggestions	Comments suggested that the competitors and the media of being the responsible of this coup and how they could help
	Appreciation	Especially mothers, claiming that they and their families are consuming the Dairy Khoury's products every day, appreciating and testifying that these products are the safest and the best in the Lebanese market.
	Support	Many users supported Dairy Khoury and said that they are the best, trustworthy and professional, ideal, being the leader in the market, having delicious products, respecting hygiene standards... also, we read encouragement statements such as: "God be with you"; "go forward"; "go gogo"; "wish you the best"; "Best of luck"... As well as congratulating comments, for example, those who are congratulating the Dairy Khoury's owner and team after receiving the CPC certificate.
	Messages intended to be funny	Using cheering phrases such as "خوري الأساس وعلم كل الناس" Meaning "Khoury is the basis and it taught everyone else"
	Comparison of the organization with others	Comments compared Dairy Khoury's product with all the others dairy products companies in Lebanon: "If you see what other companies are producing, you would stop eating Labneh and cheese".
Negative	Accusations/Condemnation	People also accused the Health Minster for celebrating the CPC award ceremony with the owner of Dairy Khoury and said that "it is a condemnation that the minister is celebrating with you. The minister also wants to fill (his pocket with money), like the others". In addition, users accused Dairy Khoury for not respecting the ISO's certificates they hold, and for using.
	Objections	Objections on the fact that Dairy Khoury for using harmful additives and some call for boycotting Dairy Khoury's products
Inquiry	Question	Inquiries about Natamycin, about the media and about Dairy Khoury's production
	Giving information	One of the Facebook users gave explanation about the Natamycin based on the demanded of another Facebook user. As aforementioned, Dairy Khoury invited those who commented positively on Facebook to circulate the true facts and to help fighting the rumors.

Source: <https://www.facebook.com/DairyKhoury/>

Accordingly, the author tried to classify and categorize the audience's comments on Dairy Khoury's Facebook Page. The author adopted a qualitative approach in order to analyze and classify into categories this unstructured data. Therefore, the author:

- Read every unit (Facebook's comment)
- Identified the different categories
- Put the unit of analysis into the corresponding category
- Highlighted the recurring patterns
- Defined the different categories of the recurring patterns.
- Qualified the categories: positive, negative, inquiry

It is important to note that when the collected data didn't match the above prefigured categories, new category was developed

2. Discussion

In Lebanon, few studies on social media content are being conducted. This study may contribute to a better understanding of the use of social media platforms during certain crises. The findings suggest several gaps in the response of Dairy Khoury firm according to what the crisis communication literature implies.

Firstly, through the analysis of Dairy Khoury's Facebook users comments, and based on the findings of Helsloot & Groenendaal's (2013) and Roshan et al. (2016), the author were able to identify a new category cluster which was the "support" category that comprised messages defending the company, encouraging its team and congratulating the company on new achievements.

Secondly, the author states that no response to stakeholders on Dairy Khoury's Facebook Page could be identified, at a time when a "Corrective Action", such as recalling the Labneh from the market and promising to replace the Natamycin by a safer component, would have reduced stakeholder's pressure. Scholars stresses that if an organization fail to communicate with stakeholders in a timely manner, negative content and rumors will start circulating via social media affecting organizational reputation and stakeholders' behavioral intention (Roshan et al., 2016)).

Thirdly, the organization didn't address any apology neither to the public nor to the stakeholders, while Chung (2011) considers that those corporate apologies are crucial to decrease public anger when facing a crisis. Surprisingly, none of the Facebook users and none of the consumers of Dairy Khoury's Labneh did ask for an apology. And the reason maybe that the concept of demanding an apology from the company's management was not mature enough among the Lebanese consumers.

Fourthly, the author didn't find full status updates about the crisis as studies suggest (Freberg, 2012; Veil et al., 2011). Therefore, due to the increase use of social media in crisis communication, Lebanese organizations are invited to fully understand how to take advantages of these interactive platforms in times of crisis. Since, a lack of understanding can result in mishandling a crisis and endangering the organizational competitive position (Roshan et al., 2016).

Fifthly, in terms of organizational response to stakeholders and public's messages in a social media context as classified by Helsloot & Groenendaal's (2013), this study found that Dairy Khoury didn't use Facebook to address messages to stakeholders, but only replied to specific comments of some of the users, although the public had been using Facebook platform to express their feelings and support towards the firm, as already mentioned. The reason that kept Dairy Khoury from using Facebook to address stakeholders maybe because, as M. Akiki stated, back at the time of the crisis, social media platforms were not considered to be an essential part of a crisis communication strategy.

Sixthly, this case meets the “Rumor” type in the SCCT elaborated by Coombs (2002), which is the circulation of information designed to harm an organization. This fact is solidified by the claims of Mr. Akiki, and supported by some of the comments on Dairy Khoury’s Facebook page. “Weird is that the TV program addressed a totally legal additive when there is 127 unlicensed dairy factory” (Jack Al Kallasi – President of Lebanese Dairy Board)

These rumors created a domino effect and shook the whole sector of dairy production in Lebanon “The expose had a negative impact on the dairy’s sales, dropping by 60 or 70 percent”. Executive Magazine – issue of December 22, 2014

Seventhly, the study showed the predominance of “one-way communication” on Dairy Khoury Facebook Page, although some “two-way communication” or selective responses exist. For instance, we can recall the message posted from Dairy Khoury on their Facebook page thanking the Facebook users for their “kind and gentle support” and asking them to invite their friends to like Dairy Khoury’s Facebook page and to “share the press conference videos so the truth can spread as much as we can to beat all these rumors” (2014). According to Stenger (2014), such behavior might be due to the lack of persons trained and prepared to face such situations or fear of aggravating the crisis.

Eighthly, the study highlighted that the organization didn’t have a pre-crisis plan as suggested by several scholars such as Richardson (1994), Coombs (2007) and Maisonneuve (2010). The organization didn’t anticipate such a pre-plan crisis, as Mr. Akiki confirmed, and as per the findings of a study conducted by Steven Fink (2000) who found that 89 percent of the chief executive officers of Fortune 500 companies reported that a business crisis was almost inevitable, and yet, 50 percent admitted that they did not have a prepared crisis management plan!

Ninthly, Dairy Khoury, appears to have violated multiple crisis response guidelines due its lack in preparedness of a potential crisis, yet, according to Mr. Akiki the company succeeded to sail through the crisis and recover by 90 percent. As suggested by Yehya and Coombs (2014), this was possible due to a large and long-term crisis response strategy that is still ongoing until today.

At the end, this study highlighted some key differences between the findings and some of the literature’s suggestions. It is important to mention that, according to the SCCT for example, a few theories on crisis communication were developed in the social media context. Therefore, we suggest a reassessment of these theories, in order to verify their applicability in a social media context.

FUTURE RESEARCH DIRECTIONS

Crisis communication is an expanding field where numerous theory-based approaches and practices aim at dealing with hazardous and sudden situations. However, crisis communication has been an increasingly complicated type of management, due to the ongoing and fast progress of social media. Therefore, the communication strategies of crisis management should be developing towards:

- Tailored messages for multiple audiences that use a variety of media outlets
- Envisaged plans for a two-way communication process.
- Understanding how the crisis is perceived by the audience
- Researchers must shed the light on the possibility of having a proactive discourse aiming to help an organization to defend itself toward critics. Future researches should verify to what extent this type of proactive discourse can help the organization during a crisis to minimize the audience’s tension and neutralize critics.

- Moreover, researchers should be more sensitive to the new trends in corporate communications (considering reputation as a currency, keep feeding fresh stories, the death of press releases... etc.). They should aim at providing the elements that'd help the crisis management to situate its corrective messages in a Corporate Social Responsibility context. And that requires working towards an after-crisis communication strategy, within the margins of local and global norms and values, which can contribute to furthering social good.

CONCLUSION

This paper explored the use of social media by Dairy Khoury during the crisis that stroke in 2014. The study used an in-depth email interview conducted with Mr. Akiki combined to a qualitative content analysis of Facebook messages posted during the crisis. The author provided important understanding of how the organization used Facebook during the crisis, suggesting the establishment of a well-tailored communication plan to resolve a crisis.

The author was able to identify that the organization didn't fully benefit from the added value of social media platform such as Facebook in the Dairy Khoury's crisis communication. However, this study highlighted modest use of Facebook due to an underestimation of the usefulness of such platforms back at the time of the crisis. Moreover, the study shed the light on a total absence of apology supported by Chung (2011).

The author was able to provide insights from the study, suggesting that organizations exhibited little understanding of the effectiveness of social media in a crisis situation. Given that in Lebanon, social media usage especially Facebook, developed exponentially since Dairy Khoury's crisis, the author suggests more research to be done in this area.

Thus, when an organization recovers from a crisis, it can benefit from the experience and improve its communication strategies, in order to avoid such impromptu incidents and increase preparedness for any unexpected crisis. Whether an organization is on high or low risk activity, crisis should always be considered and efficient crisis plan should always be maintained.

Researchers note that an individual's need to obtain information increases in times of conflict and ambiguity in order to provide comfort, mitigate tension and cope with uncertainty (Hong and Cameron, 2018). And as underlined by Kim and Rhee (2005), people tend to read others 'online comments in order to explore the climate of opinion before they establish their own perspectives.

Therefore, the author suggests more reliance on social media as part of crisis communication strategy, for the benefits of communicating the information on time with transparency and expertise. And this can't but have a positive impact, improve the organization's recovery and minimize the loss.

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KEY TERMS AND DEFINITIONS

Communication Strategy: A set of communication activities to reach an organizational objective(s). It targets a well-defined audience with strategic messaging, using a choice of communication tools that would best reach that audience. A communication strategy aims to achieve a high level of performance, create values for its shareholders and satisfaction for the target audience in a competitive market

Corporation: The legal entity of a group of companies or a large company owned by shareholders. The Corporation is liable by law to conduct the actions and finances of the business, while the shareholders are not.

Crisis Management: The actions taken to deal with unpredictable and sudden events often based on pre-designed strategies, in order to limit – and eventually halt- the occurring damages as quickly as possible.

Image: Is the public perception of an organization/corporation, and the way it presents itself to the public. As it is a perception, it might not be a real reflection of the actual state of the organization/corporation nor of its brand (s). The main challenge is to match reality with the desired image.

Organization: It is the process of organizing a group of people in a given structure and being managed to pursue and meet particular purposes. Organizations have an authority that structures and determines activities, roles, tasks, and responsibilities that members should carry out. Organizations are shaped by their member's relationships. Organizations are dynamic structures that affect and are affected by their environment. Organizations are units, in which offices, or positions, have distinct but interdependent duties, working to achieve financial or on-financial goals. An organization can be part of a corporation.

Reputation: Is the trust and confidence (or the lack of) of consumers and shareholders in an organization. It is what people hear and say about an organization and how its good or bad standing is reported in the media. It affects the number of customers, operations, and profit margins. Good reputation takes a lot of efforts to build and requires excellent crisis management to maintain in times of adversities.

Social Media: Are computer-based platforms that enable people to connect with each other's, to share and generate content (opinions, ideas, photos, videos...), to establish and maintain relationships. These platforms allow organizations to reach, to engage with and persuade their target audiences. Social media includes forums, blogs, social networking sites and other forms of online discussions.

Social Advertisements and Recall

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INTRODUCTION

Kotler (1971) proposed the concept of social advertising as “the design, implementation and control of programs calculated to influence the acceptability of social ideas and involving considerations of product planning, pricing, communication and marketing research”. Social advertising approach is used for informing, educating and persuading the society on basic issues (Cismaru, Lavack, and Markewich, 2009). Social advertising identifies social problems and it informs about them, but it does not try to offer immediate solutions (Choi, Eldomiaty, and Kim, 2007; Elliott, 1999). Social advertising do not promote any product, firm or service; its main goal is to evoke a sense of responsibility or to make people do a change in their behavior and attitudes. Social advertising is also an important part of Indian public policy where that policy relates to communications, Family Welfare, Education, Health, and Environment and National Integration (Chauhan, 1995).

Research in the area of social advertising is very narrow as majority of the studies are done in European Nations with few exceptions in India (Biener, Keeler, and Nyman, 2000; Hawkings et al., 2011). Causes that have been studied in the area of social advertisements include tobacco television advertisements (Biener, Keeler, and Nyman, 2000), ethical challenges (Brenkert, 2000), sexual social marketing (Reichert, Heckler, and Jackson, 2001), attitude of college students towards economic, social and ethical consequences (Beard, 2003), AIDS prevention messages and condom usage (Pfeiffer, 2004), cigarette advertising (Gibson et al., 2010; Bansal, John, and Ling, 2005), gambling issues among Youths (Messerialian and Derevensky, 2007), effectiveness of obesity programmes and health behaviour (Suarez-Almazor, 2011; Cismaru and Lavack, 2007), consumer trust and ethics of welfare exchange (Choi, Eldomiaty, and Kim, 2007), and drunk driving (Cismaru, Lavack, and Markewisc, 2009).

There are many social causes existing in a highly diverse country like India. Central as well as State Governments are running many social advertisement campaigns related to these social causes so as to spread awareness to target audiences. For policy makers, evaluation and measuring the effectiveness of these social advertisements is an important part that needs to be evaluated. Cornwell, Weeks and Roy (2005) studied the outcomes of one form of communications, sponsorship, and argued that recall or top-of-mind awareness is an important test to judge its effectiveness. Similar views were presented by other researchers in similar domain (Wakefield and Bennett, 2010; Wakefield, Becker-Olsen, and Cornwell, 2007, Lardinoit and Derbaix, 2001, Boshoff and Gerber, 2008). Same could be applied to social advertisements also where one can judge the effectiveness of various social advertisements by measuring their recall among target audience.

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BACKGROUND

Social advertising tries to bring change in the perception of individuals, which at large would bring change in the society. Generally, individuals want them to be the cause of a good cause. It is highly welcomed by all ages than action, humor and sexual appeal in commercial. Research in the area of social advertising is not new though initial researches were carried out in the area of advertising related to tobacco marketing, HIV and similar diseases (Sharma, 2012; Cismaru, Lavack, and Markewisc, 2009). Doing an ethnographic study, Ritson and Elliott (1999) explored the social uses of advertising, within an adolescent audience, arguing that social implications of advertising changes consumer behaviour positively. Advertising text can provide an independent source for rituals that are enacted in a variety of social contexts in order to confer meaning onto their participants and audience. Advertising can form the basis for a wide variety of social interactions that can potentially influence both the qualitative nature and quantitative magnitude of the effect of a particular execution on members of the target audience.

Sharma (2012) conceptually explored the impact of creativity on advertising and discusses campaigns that have left strong impressions on consumers. The presented review study tries to come up with some evidence of creativity by reviewing expert views, past literature in advertising, advertising campaign and marketing activities. Cismaru, Lavack and Markewisc (2009) examined social marketing programs using protection motivation theory (PMT) for preventing drunk driving, and explored how protection motivation theory (PMT) can be used to create effective anti drunk driving communications using qualitative analysis of anti-drunk driving communication materials posted on Internet. The campaigns described are designed to motivate the public to undertake a variety of behaviors, including drinking in moderation or abstaining from alcohol use, choosing a designated driver, or choosing a safe ride home such as a taxi or public transit. The researcher found that social marketing campaigns aimed at preventing drunk driving in English-speaking countries were very successful, and the research showed that PMT can be successfully used in this type of campaigns.

Tangari and Netemeyer (2007) also worked on similar lines and studied the impact of anti-tobacco campaigns and smoking status of user beliefs and intentions. They found that social anti-smoking campaigns and efforts are successful in preventing of trial behavior of adolescents potentially offer a room for considerable profits. Also, young adult smokers had stronger beliefs about secondhand smoke and were also likely to consider quitting. Such young smokers give receptive market for future considerations of antismoking campaigns. Biener, Keeler and Nyman (2000) assessed adults' receptivity to the Massachusetts television anti-tobacco campaign as a function of respondents' demographics, baseline tobacco control attitudes, and changes in smoking status during the campaign, and advertisements' affective qualities. Findings of the study revealed anti-tobacco media campaign achieving high levels of penetration into the adult population and a favorable reaction to the television campaigns. The results suggest that social advertisements depicting suffering as a result of tobacco use may be instrumental in promoting cessation or reinforcing the decision to quit.

Gibson et al. (2010) studied the impact of social advertisements on HIV prevention among injecting drug users (IDUs) and social advertisements were found as a cost effective strategy to prevent HIV among IDUs. This study also represented the involvement of social marketing in applying marketing principles to promote social goods. The research is all about success of social marketing campaign in reaching majority of the estimated 7000 heroin users in Sacramento, California. It was found that exposure to HIV prevention messages with small posters and a newsletter significantly reduced the community-wide prevalence of HIV-related injection risk behavior. On similar lines, Yaminidevi (2014) studied the relationship between peer education and change in behaviour of people towards HIV and other similar

issues using social advertisement campaigns and also shows personal interaction with volunteer as an effective way to convey the social message and information of the cause to educate people. It summarized the impact of different tools like peer to peer education, brochure, documentary movies etc through the in depth interview with different NGO of the Tamil Nadu area.

Maheshwari and Suresh (2013) studied the preference of social advertisement among youths and conceptually examined the adoption of social advertisements by gathering views from respondents who are mostly influencing the success of social advertising. They found that social advertisements are mainly attracting youths and argued that present youth is expecting changes in advertisements without compromising the India's value system. The internet (email, videos, research articles, and Social media) is a big platform to do this thought provoking exercise. Singh et.al (2013) also assessed the awareness, perception and myths regarding Swine Flu among educated common public in Patiala District of Punjab. They found that around 88% of the study population had heard of Swine flu out of which only 36.5% respondents know that hand washing as a mode of prevention and around 40% of the population has myths regarding mode of spread. Authors were of the view that social advertisement campaigns play an important role in spreading awareness for such kind of issues in rural areas and government should focus more on providing scientific and effective information through the prime media. There are plenty of researches focusing on social advertisements and measurement of their effectiveness. Majority of these researches are done in European context and very few studies have focused the measurement of effectiveness of social advertisement campaigns in Indian context. The present study, thus, aimed at empirically measuring the effectiveness of popular social advertisement campaigns that are running in India.

FOCUS OF THE ARTICLE

This study is an attempt towards exploring the popularity of various social advertisement campaigns of India among youths via measuring their recall. One of the main objectives of the current study is to measure the recall of these social advertisements and exploring the most recalled (popular) social advertisements in India. Another objective of the current study is to explore the reasons for the high recall of these social advertisements by doing exploratory study with target audience. The scope of the study is limited to the rural areas of Jalandhar, Kapurthala and Hoshiarpur districts of Punjab. The measurement of social advertisement effectiveness was divided into two phases. Initially, an exploratory study was done to explore popular social advertisement for the study followed by measuring their recall and the reasons thereof. The detailed procedure is discussed in the research methodology section followed by discussion of results and conclusion.

RESEARCH METHODOLOGY

Sampling Procedure and Participants

The sample of this study consists of students enrolled in a large Private Indian University (Lovely Professional University, Punjab). Convenience sampling technique was used for data collection from the respondents. Data was collected from 350 students intercepted at different locations within the university using a structured questionnaire. After omitting outliers and half-filled forms, 300 were kept for further analysis with a response rate of 86%. The participation of the respondents was entirely voluntary.

Instrumentation and Measurement

A structured questionnaire was designed in order to achieve the objectives. The questionnaire was divided into two sections. Section A consists of demographic related information of respondents whereas Section B consists of measurement of respondent's awareness of the select social advertisement campaigns. Section A of the questionnaire consists of questions about the demographic and psychographic characteristics of the participants related to participant's gender, age, nationality, education. Filler question was also asked in this section. Section B was designed to measure the awareness towards different social causes by asking respondents to rank these social causes in order of their preference in a way similar to Maheshwari and Suresh (2013). Open ended questions were also asked in this section to know about the reason for the recall of these campaigns individually.

Demographic Profiling of Respondents

Data analysis revealed that 52.33% (47.67%) of the respondents were male (female) showing an equal (approximately) gender distribution. Majority of the respondents were in the age group of 20-25 years (50%). In terms of the place of residence, it was found that 35.33% respondents were from Kapurthala district, 30% were from Hoshiarpur district and 34.67% were from Jalandhar district. The district wise regional break includes Kapurthala district including Mahehru, Chaheru and Domeli village where as Hoshiarpur includes Sangowal and Badowal village and Jalandhar includes Randhawa Masandan and Nakodar. Data analysis revealed that the respondents for the current study have a good educational background with 41.67% graduate respondents and 35% post-graduates.

A filler question was asked initially regarding respondents awareness of the concept of social advertisements. It was found that 98% respondents were aware about social advertisements and only 2% were not aware of the various social advertisements. In terms of the importance of social advertisements, 96% respondents reported that social advertisements are important for the society whereas only 4% think that social advertisements are not important. Also, 91.33% of the respondents find social advertisements being telecasted attractive while 8.67% find the social advertisements unattractive.

Selecting Social Advertisements

Pilot Study 1

In the first phase of the research a focus group was conducted and data was collected from 37 respondents aged between 18 to 35 years having awareness about various social advertisements being aired by government (NGO) agencies, both state and central. The main purpose of this focus group was to generate a pool of social causes that could be used for further use. The respondents were asked to recall three social advertisements/causes that come to their mind first. The pool of social advertisements / causes that were generated after the first focus group were the social advertisements related to Aids, Cancer, Polio, Drug Abuse, Female Foeticide, Tuberculosis, Malnutrition, Child Labor, Female Illiteracy, Swachh Bharat Abhiyaan, Human Trafficking, Sanitation, Dowry, Gambling, Domestic Violence. It is important to mention that all these are prominent social causes existing in India and social advertisements are being aired by the state as well as central government via different media.

DISCUSSION OF RESULTS

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Measuring Effectiveness of Social Advertisements

Few questions were asked to respondents in Section A related to social advertisements. Analysis of these questions generates interesting findings. 53.67% of the respondents feel that social advertisements telecasted on television are the most attractive whereas 26.67% of the respondents find social advertisements on social media like Facebook, twitter etc. the most attractive. 11.67% of the respondents feel print media social advertisements are the most attractive. 4% respondents feel outdoor media like bill boards and hoardings etc. are the most attractive medium for social advertisements followed by 4% respondents being attracted through radio advertisements.

When asked about what purpose social advertisements solves, respondents were divisive in their opinions. 24% of the respondents believe that the social advertisements create reasonable social impact 19% respondents think it forces to think about the social issue. 13% of the respondents say that social advertisements gives information. 11.67% of the population says that social advertisements generates curiosity, 11% respondents think that it increase the level of knowledge, 10% of the respondents think social advertisements transfers beliefs and values to the society, 9.67% of the respondents think that social advertisements creates awareness about prevention and cure of the epidemics. 39.67% respondents believe social advertisements to have a positive impression on their minds. 25.67% respondents think that social advertisements have the desire to explore their minds. 24% respondents are interested in the social advertisements. 8.67% of the respondents have the impression to recall the social advertisements. 2% of the respondents are not interested in the social advertisements. 31.33% respondents believe that picture depicting a scene /story advertisements are more attractive, 28.67% respondents think that a moving action oriented advertisements are attractive. 20% respondents reported in favor of words with the visuals make the social advertisements attractive. 10.33% respondents say words with sound social advertisements are attractive. 8.33% respondents think celebrity endorsements social advertisements are attractive. 1.33% respondents think just the printed words in the social advertisements makes it attractive.

Another important dimension was the duration of impact of social advertisements on the respondent's memory. 38.33% respondents say social advertisements have the impression on their minds for one week. 16.67% respondents say social advertisements have the impression on their minds for one month. 15.67% respondents have the impression of social advertisements on their minds for only one day. 15% respondents say the impression of the social advertisements on their minds lasts for more than a month. 9.33% respondents say social advertisements have the impression on their minds only for few hours. 4.67% respondents are least bothered about the impression of the social advertisements. 0.33% respondents have the impression of social advertisements for one week. 34.33% respondents think that the message is the important aspect in the social advertisements. 23.67% respondents think punch line of the social advertisements is the important aspect of the advertisements. 14% respondents say the captions in the social advertisements are important aspects of the ad. 13.33% respondents think theme of the social advertisements are important. 13.33% respondents think that models in the social advertisements are important aspects. 1.33% respondents think the background of the social advertisements is the important aspect of the advertisements. 69% respondents think that the celebrity endorsing the social advertisements is more influential. 31% respondents think that the non-celebrity social advertisements are more influential.

Table 1. Evaluating Social Advertisements on Various Parameters*

PARAMETER	Mean	Std. Dev
Creative	3.71	1.07
Informative	3.98	1.00
Memorable	3.42	1.03
Strong Social Message	4.02	1.10
Entertaining	3.31	1.01
Effective	3.80	1.02
Presence of celebrity is influential	4.11	1.04
<i>*mean measured on a 5-point Likert scale</i>		

Evaluation of Social Advertisements on Select Parameters

In terms of reasons for recalling social advertisement campaigns, it was found that social campaigns that have the presence of celebrity (mean = 4.11, s.d = 1.04), strong social message (mean = 4.02, s.d = 1.10) and are informative (mean = 3.98, s.d = 1.00) and effective (mean = 3.80, s.d = 1.02) are the best determinant of enhancing people to recall them. Please see Table 1. Analysis of data revealed that respondents agree that the social advertisements that are telecasted are creative. The ad elements used to convey the story to the target group involves a good amount of creativity, informative and add to the information and awareness of the audience. Respondents also agree that the social advertisements having celebrities as social cause ambassadors are influential and change target audiences behaviour. Respondents also agree a celebrity endorsing a social cause give a positive image and creates a lasting impression regarding the social advertisement campaign. Regarding the message content of the social advertisements, respondents agree that the social advertisements leave a strong social message for the audience and have a neutral opinion on the entertainment aspect of social advertisements. Respondents also agree that the social advertisements telecasted are effective in delivering the social value they are meant to deliver and that the social advertisements with celebrity endorsements create more awareness due to the presence of celebrities agreeing to the fact that presence of a celebrity in a social advertisement campaigns is influential in bringing attention towards social causes.

Top Recalled Social Advertisements

Out of the social awareness campaigns mentioned in the questionnaire “Clean India (Swachh Bharat)” was recalled by 87.66% of the surveyed respondents which was followed by Polio advertisements (recalled by 82.33%). Please see Table 2. Results of exploratory study revealed that heavy participation of top political leaders and celebrities in these causes have led to their high recall. Also, Celebrity endorsements and catchy slogans also play a very important role in social advertisement, which cannot be denied. For example, the campaign slogan of Polio advertisements “Do boond zindagi ki” and the presence of Mr. Amitabh Bachchan lead to this campaign among the top recalled social advertisement campaign. The awareness advertisement that runs before the movie starts in a cinema hall depicting a cancer patient struggling for his life left a great impression on the population which was recalled by 69.66%. This was followed by the social advertisement of female foeticide which was recalled by 67.33% respondents.

Table 2. Recall Of Select Social Advertisement Campaigns

S. No	SOCIAL ADVERTISEMENTS	PERCENTAGE RECALL	RANK
1	Swachh Bharat Abhiyaan (Clean India)	87.66	1
2	Polio	82.33	2
3	Cancer	69.66	3
4	Female Foeticide	67.33	4
5	Female illiteracy	64	5
6	Child labor	62.33	6
7	Aids	59.33	7
8	Domestic violence	53	8
9	Drug abuse	49	9
10	Sanitation	47	10
11	Dowry	44.33	11
12	Malnutrition	37.66	12
13	Tuberculosis	36.33	13
14	Human trafficking	33.33	14
15	Gambling	30	15

Reason for the same can be attributed to the “Beti Bachao, Beti Padhao” campaign recently launched by Central Government of India. Beti Bachao activities include large rallies, campaigns, wall paintings, billboards, and television commercials and short animations and video films. Also people were able to recall the advertisement because celebrities such as Priyanka Chopra are involved in “Save the girl child” initiatives. Moreover, Bollywood actor Aamir Khan devoted the first episode “Daughters Are Precious” of his show “Satyamev Jayate” to increase the awareness about this issue, focusing primarily on Western Rajasthan. In addition to it, 64% of the respondents were able to recall the awareness campaigns aimed on female illiteracy. Sarva Shiksha Abhiyan aimed at providing free education to children also have a good recall followed by “National Programme for Education of Girls at Elementary Level (NPEGEL)”. Child labor was also one of the social campaign that was recalled in good numbers by respondents (62.33%) because of the Indian TV drama show “Udaan - Sapno ki” which telecast a girl child being practiced upon child labor by the master who owns her.

FUTURE RESEARCH DISCUSSIONS

Social advertisements are quite popular and governments of different countries have laid emphasis on their awareness from time to time. Our study provides various insights into the awareness of social advertisement campaigns run in India and highlight the most popular campaigns. Despite the efforts made, like other studies, this study too has few limitations which needs to be taken care of by future researchers. We have made a descriptive attempt to explore the popularity of social campaigns in India but failed to explore why these campaigns are more popular relative to other campaigns which were given the same resources. Future researchers can do an analytical or qualitative research into this issue to explore why few campaigns are more popular over other campaigns and completely dominate consumer recall. Also, the detailed impact of celebrities endorsing social cause needs to be studied by future researchers.

Government needs to prepare more advertisement campaigns and need to create more awareness among rural population. Also, future researchers also need to study the role of collaboration between non-govt agencies and government agencies to market a social cause. Government agencies, NGOs, other regional bodies and advertising agencies need to focus on the issues like human trafficking, gambling, sanitation, dowry and need to come up with some creative and interesting campaigns so that it can leave an impression on the minds of the viewers and they can recall it easily even after a long time.

CONCLUSION

Previous studies have focused on social advertisements in different contexts but to our knowledge no study has made an attempt to study their relative effectiveness and reasons for the same. Results revealed that social advertisements having a strong and informative message as content are rated high by target audience. Selection of print media also plays a very important role in achieving its objectives. Social advertisements telecasted on television and social media sites are believed to have a strong impact and are believed to create impact and generate awareness about the social issue and gives information to the target audience. It was also explored that social advertisements are believed to have a positive impression on the minds of target audience generating curiosity to know more about the cause. While measuring the recall of different social advertisements it was found that out of all select social advertisements “Swatch Bharat Abhiyaan” was having the highest recall followed by social advertisements of Polio and Cancer campaign. Results of open ended questions revealed that social causes having celebrity (ies) and politicians as ambassadors have high recall and acceptability among target audience. The findings of the study can be used in public-policy making. In direction with the findings of the study, policy makers can make effective use of various communication tools and media to achieve their objectives. For example, the social issues related to youths need to use television and social networking sites as communication media. Also, policy makers need to identify celebrities having a high fit with the social cause who can convey the message to target audience to spread maximum awareness of social advertisements.

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KEY TERMS AND DEFINITIONS

13

Advertising: Is a means of communication with the users of a product or service. Advertisements are messages paid for by those who send them and are intended to inform or influence people who receive them.

Advertising Recall: Is a measure of advertising effectiveness in which a sample of respondents is exposed to an ad and then at a later point in time is asked if they remember the ad.

Celebrity Endorsements: Are forms of advertising that uses famous personalities or celebrities who command a high degree of recognition, trust, respect, or awareness amongst the people. Such people advertise for a product lending their names or images to promote a product or service.

Social Advertising: Advertisements that promote a community's health and well-being, such as programs that educate people about drugs, diseases, and other social issues.

Social Advertising Effectiveness: Is a measure of effectiveness of the social advertising in a way similar to measuring the effectiveness of the campaign.

Social Marketing: Is an approach used to develop activities aimed at changing or maintaining people's behaviour for the benefit of individuals and society as a whole. Social marketing aims to develop and integrate marketing concepts with other approaches to, in turn, influence behaviors that benefit individuals and communities for the greater social good.

Social Marketing Campaigns: In public health, many social marketing campaigns include a specific behavior change component.

Impact of Advertisements on Demand for Fairness Products Among University Students in Pakistan

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INTRODUCTION

Pakistani cosmetics industry is flourishing at a rapid pace; which is evidenced by its presence in different markets at a global level. It has more comprehensively been enlightened that the local cosmetic industry of Pakistan makes its mark not only at the domestic level, but also at the global level. Kalsoom (2011) elaborated that the demand for fairness creams exist and is rising in female as well as male consumers. This rise in demand leads to an increase in its supply in different South Asian regions.

The dilemma in Pakistan is standardization. Individuals have a propensity to link beauty with a lighter skin tone. This has driven females to take excessive measures to apply dangerous chemicals to their skin, because they promise mesmerizing fairness. Consequently, there has been an immense demand of skin brightening items in Pakistan.

There are in addition social as well as monetary implications with respect to beauty. It takes a lot of endeavor to embellish as well as modify one's appearance in order to look stylish. The inspiration to be forever young as well as appealing exists in every society. Society imposes the rules of beauty. Today, what is considered as beautiful, might be mocked in the future. The perception regarding beauty changes with the evolution of society (Sunaina, 2016).

Society plays a significant function regarding the concept of attractiveness. For example, youthfulness is the aim of attractiveness in USA, whilst in Europe unblemished skin is considered as being ideal. In most Asian countries, fairness is desirable. As the globalization progressed, individuals started associating beauty by means of contentment as well as affluence. Thus, females from Asia started to crave the Western idyllic of attractiveness, i.e. being fair, slim, and tall (Sunaina, 2016).

In the contemporary era, despite women are more powerful and have a professional success. A new type of social control exists in the form of beauty myth. It is an obsession with physical perfection that traps women in an endless spiral of self-consciousness, hope, and self-hatred as they try to accomplish society's impossible explanation of being a flawless beauty (Wolf, 2013). This chapter focuses on the impact of television advertising on the demand for fairness products among university students in Pakistan.

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BACKGROUND

Beauty lies in the eye of the beholder. The sensitivity regarding attractiveness is led by social influences as well as a notion of aesthetics decided by elites. Females and sometimes males go as far as possible to achieve that 'ideal' look. The quest for perfect looks has been as old as time itself. (Sunaina, 2016).

Moral beauty was considered to be the *telos* (purpose) of human virtues by Aristotle. Displays of moral beauty have been shown to inspire the moral sentiment of elevation and can cause an aspiration to become a better individual. Researches propose that by encouraging individuals to connect with moral beauty can amplify their wish to become more humane. As, moral emotions stimulate ethical behavior (Diessner, Iyer, Smith, & Haidt, 2013).

Different methods are employed to accomplish fairness in Pakistan. One of the most prominent is 'formula cream'. It is usually made at home and often sold at beauty parlors across Pakistan. Bleaching agents are its main ingredients. Fairness products mostly contain steroids according to dermatologists, and often lead to pigmentation, telangectasias, acne, scarring, early aging, as well as massive facial hair growth. Females use these products and later wax their facial hair, which leads to loss of skin elasticity, thus leaving it old as well as saggy ("Attitude: Obsession with fairness," 2012).

In the process of lightening the skin tone, layers of melanin are depleted from skin. It is actually a pigment which determines skin color. Darker skin means higher content of melanin. Melanin absorbs the ultraviolet solar radiation, and thus it is transformed into nontoxic heat. Its basic purpose is to protect the skin from DNA damage. Thus, it is a human's natural defence against the UV. Fighting with nature could have detrimental effects. When the melanin layer is depleted for fairness, it also depletes healthy skin. Skin whitening creams makes the skin thin and deprive the skin of melanin. Because, skin color is strictly genetic and to some extent is influenced by environmental factors ("Attitude: Obsession with fairness," 2012).

Kapoor (2012) highlights that time and the concept of beauty are related to fair skin complexion. Carreiro (2009) has discussed regarding current fairness trends developed in India and Pakistan revealing that with Indians, Pakistanis are also getting crazy to get fairer complexion. Venkataswamy (2016) stated that the biggest consumer market of skin whitening products fall under the age bracket of 20 to 29 years.

From the review of literature, it is apparent that neither any previous research covers the impact of product claims and frequency of fairness TV advertisements on demand for fairness products in Pakistani context, nor any one of them studied the relationship between them. This was the very inspiration behind this study. Hence, to some extent, this research gap was visible, which was also evidenced by the review of detailed literature.

This research intended to study the impact of two factors, namely, product claim and frequency of fairness TV ads. It also aimed to find out the factors which had a stronger influence regarding the demand for fairness products in Pakistan. On the basis of detailed review of above literature, respective hypotheses and conceptual framework were formulated.

FOCUS OF THE ARTICLE

This study assesses and analyzes the impact of advertisements on demand for fairness products among university students in Pakistan. The purpose of this research is to assist legislators, marketing executives, academicians, students, as well as other professionals.

PAKISTANI COSMETIC INDUSTRY AND DEMAND FOR FAIRNESS PRODUCTS

Components of success with regards to beauty business include particular kinds of creativity, fashion sense, and cultural affinity that are not easily quantified or readily susceptible to analysis. Moreover, the industry has always lacked a cohesive identity as the business enterprise, encompassing significantly different sectors in fragrances, color cosmetics, hair care, skin care, and toiletries that often have little in common (Jones, 2010).

According to Memon (2000), when Pakistan came into being, i.e., 1947, the Pakistani cosmetic industry was also nascent. Now, there exists many local as well as foreign brands of fairness products that sell hopes worldwide and particularly in Pakistan (Andrew, 2011). For instance, Fair & Lovely, Fair & Lovely Menz Active, Fair & Lovely Max Fairness for Men, Emami Fair & Handsome, Emami Naturally Fair Pearls Intensive Herbal Fairness Cream, Stillman's Skin Bleaching Cream, Olivia Bleach Creams, Skin White Goat Milk Whitening Cream, Soap & Face Wash, etc.

Business Recorder (2010) discussed about the establishment of Pakistani cosmetic industry. It claimed that the Pakistani cosmetic industry is flourishing tremendously. Local brands of Pakistan are also now getting much more popular along with global brands introduced in Pakistan. According to Ashaduzzaman and Rahman (2011), TV advertisements have a great impact on consumers' buying attitude and product selection usually leads to an increasing demand for respective products.

In South Asian countries, the trend of consumption of fairness products began specially during the last decade. Fairness TV ads through their dramatic stories greatly influence the young population of Pakistan, who often buy these fairness products (Kamran, 2010).

Venkataswamy (2016) discussed about the new emerging market of fairness products. Females are the target market for beauty products for many years. Many fairness brands are now stepping into the new emerging market, which comprises of the male along with female consumers. It can be evidenced from the survey of KuicK Research (2012) conducted in India that currently there is a significant increase in the male consumer market for personal care products, like fairness creams. For this reason, in this research study, males are also included.

TELEVISION ADVERTISEMENTS

Advertising can be understood in terms of a non-personal way to communicate with an audience about ideas, goods or services by means of a recognized sponsor (Kotler & Keller, 2005). The main purpose of advertising is to provide satisfactory information about product's attributes, to persuade consumers to buy those products and repeatedly reminding them regarding the product's existence within the market. This can only be possible when the content of the advertisement is sound enough to obtain audiences' reaction as it is anticipated (Soliha & Dharmmesta, 2012). Advertising helps to retain potential buyers that can lead the companies to improve their income (Eze & Lee, 2012).

It is believed by most of the consumers that television advertising also has a strong impact on their buying behavior (Priya, Baisya, & Sharma, 2010). According to Shabbir, Kirmani, and Hassan (2008), television advertisements play an essential part in the propagation of messages around the world. According to Daud, Farooq, and Anwar (2011), advertisements have a major impact on human thoughts, beliefs, and attitude. Because, they use different techniques and appeals like, slice of life, humor, romance, adventure, etc., in order to stimulate human mood.

A number of TV advertisements in Pakistan portray that a dark complexioned girl is undesirable and utterly unhappy and after discovering and using a magical skin whitening cream all her dreams come true — not only does she get married, but also gains self-confidence. These advertisements project the notion that girls who are of a darker skin tone are worth nothing — they don't deserve success in any aspect of their lives, let alone marriage. In Pakistani society, while prioritizing people, after nepotism skin color surely takes the lead (“Attitude: Obsession with fairness,” 2012).

FACTORS IN TV ADS AFFECTING DEMAND OF FAIRNESS PRODUCTS

Different early researches have discussed about various factors in TV advertisements that are accountable for influencing the demand of product. The claims in fairness TV ads have a significant impact on viewers. Such ads exaggerate the product promise and often lack credibility. Sometimes, they are even considered unacceptable by the viewers (Kamran, 2010). Female consumers are more influenced by the promises made in TV advertisements. One of the main aspects of advertisements is to raise sales rate by making big product claims and promises (Ashaduzzaman & Rahman (2011).

According to Vikkraman and Kumaravel (2012), the viewers are often influenced by deceptive claims in advertisements promising hope for their better future. Today, the majority of fairness TV ads are involved in exploiting product benefits, which often results in raising an inappropriate demand within the market. As, these ads portray that their products can change dark complexion to fair. Unfortunately, the overstatements stated in fairness TV ads are not true at all in reality (Kamran, 2010).

According to Ashaduzzaman and Rahman (2011), the repeated exposure of TV ads can persuade viewers towards buying behavior. The repeated exposure (frequency) of advertisement helps to boost the demand for products, because a direct relationship exists between TV advertisements and increased demand (All-share & Salaimah, 2010). The high rate of repeated exposure of viewers towards ads consequently upsurge the demand in the market. The young population as well as housewives are more inclined in buying items which are repeatedly advertised on TV (Ashaduzzaman & Rahman, 2011). Vikkraman and Kumaravel (2012) are of the view that, the buyers tend to purchase more advertised goods and services.

OBJECTIVES OF STUDY

1. To find out the relationship between product claims in fairness TV ads and demand for fairness products in Pakistan.
2. To find out the relationship between the frequency of fairness TV ads and demand for fairness products in Pakistan.

RESEARCH QUESTION

Do factors in fairness TV ads cast a negative or positive impact on demand for fairness products in Pakistan?

RESEARCH LIMITATIONS

1. The sample size was small because of the limitation of resources.
2. The financial constraints did not warrant taking samples from other big cities of Pakistan besides Karachi.

RESEARCH METHODOLOGY

This research is descriptive in terms of research design, while the approach adopted was deductive. It is a quantitative research by nature. One of the non-probability sampling techniques employed in this research study was convenience sampling. The size of sample units comprised 200 students from the University of Karachi, Federal Urdu University of Arts, Science and Technology, Allama Iqbal Open University, i.e., three government operating universities in Karachi, Pakistan. A self-administered questionnaire was designed as an instrument for conducting research. The Five-Point Likert scale was used to generate the questionnaire for this research. It consisted of 12 questions that were closed-ended. The responses received from the questionnaires were evaluated by using SPSS.

Hypothesis #1

H_1 = There is a relationship between product claims in fairness TV ads and demand for fairness products in Pakistan.

H_0 = There is no relationship between product claims in fairness TV ads and demand for fairness products in Pakistan.

Hypothesis #2

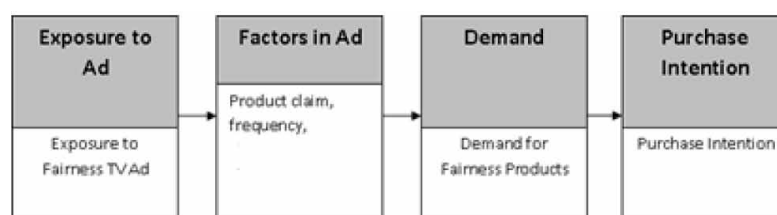
H_2 = There is a relationship between the frequency of fairness TV ads and demand for fairness products in Pakistan.

H_0 = There is no relationship between the frequency of fairness TV ads and demand for fairness products in Pakistan.

CONCEPTUAL FRAMEWORK

In this research, different factors in TV ads were discussed under review of literature in order to calculate the impact of TV advertisements on demand for fairness products. The conceptual framework used in this research study can be illustrated in the following figure.

Figure 1. Factors Affecting Demand for Fairness Products

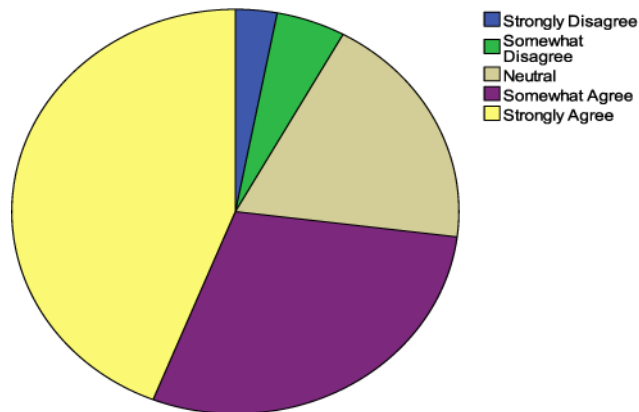


DATA ANALYSIS

Demand for Fairness Products

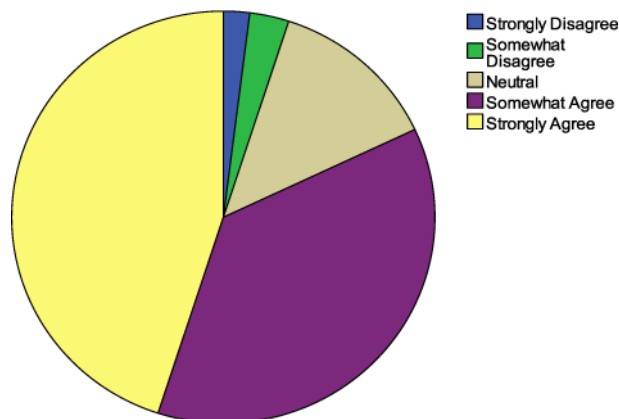
When respondents were asked whether there exists a demand for fairness products within their friends/peer group? 44% of respondents strongly agreed, 29% were somewhat agreeing, 19% were neutral about it, 5% somewhat disagreed and only 3% of respondents strongly disagreed.

Figure 2.



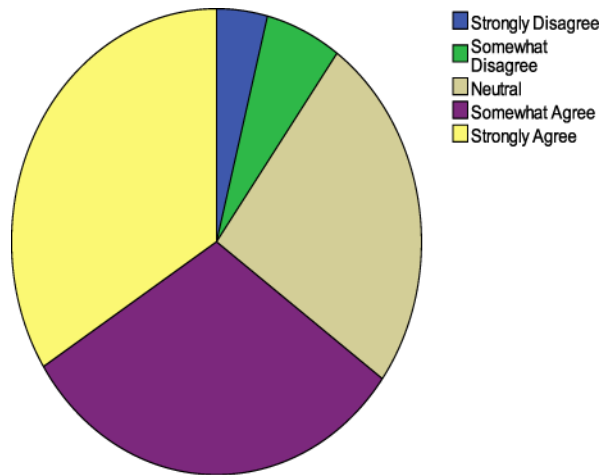
When respondents were asked, whether their friends/peer group often made use of fairness products? 45% of respondents strongly agreed, 37% were somewhat agreeing, 13% were neutral about it, 3% somewhat disagreed and only 2% of respondents strongly disagreed.

Figure 3.



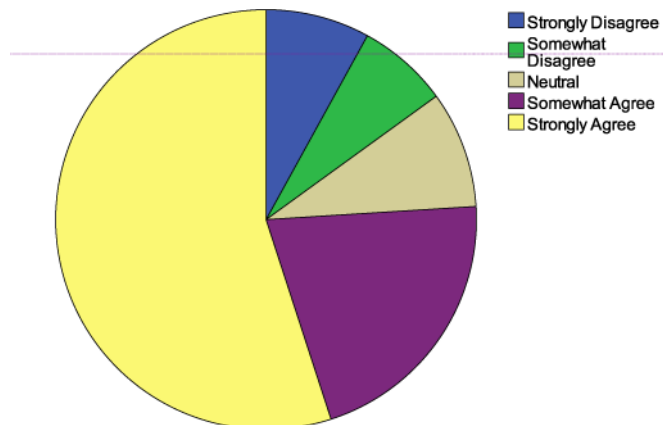
When respondents were asked whether their friends/peer group give priority to fairness products over other skin care products? 34% of respondents strongly agreed, 31% were somewhat agreeing, 25% were neutral about it, 6% somewhat disagreed and only 4% of respondents strongly disagreed.

Figure 4.



When respondents were asked, whether fairness products are now in demand due to increasing desire to get fairer skin complexion? 55% of respondents strongly agreed, 21% were somewhat agreeing, 9% were neutral about it, 7% somewhat disagreed and only 8% of respondents strongly disagreed.

Figure 5.



Product Claims in Fairness TV Ads

When respondents were asked whether product claims/promise was an important element to create demand within the market? 32% of respondents somewhat agreed, 27% of respondents strongly agreed, 21% of respondents somewhat disagreed, 14% of respondents were strongly disagreed and only 6% of respondents were neutral about it.

When respondents were asked whether the product claims/promise in fairness TV ads diverts their attention? 41% of respondents somewhat agreed, 39% were strongly agreeing, 10% somewhat disagreed, 5% were neutral about it and only 5% of respondents strongly disagreed.

Figure 6.

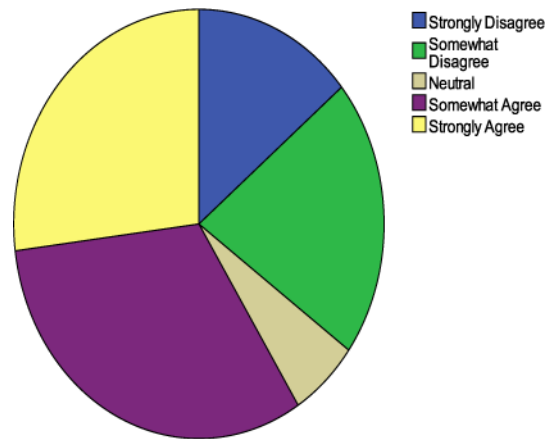


Figure 7.

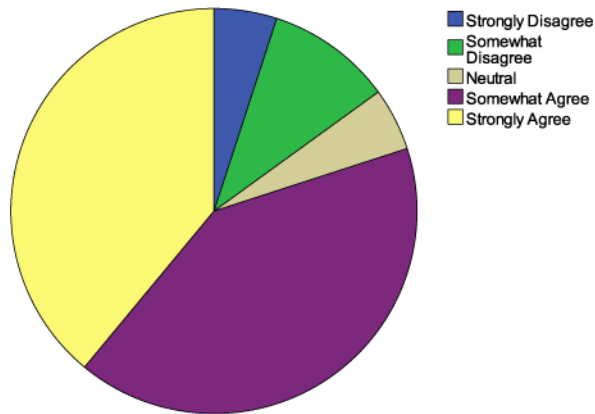
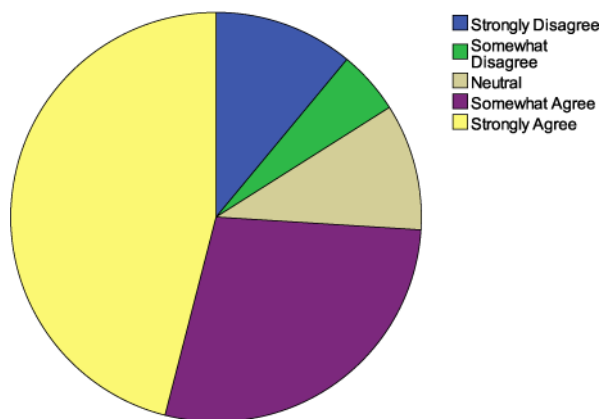


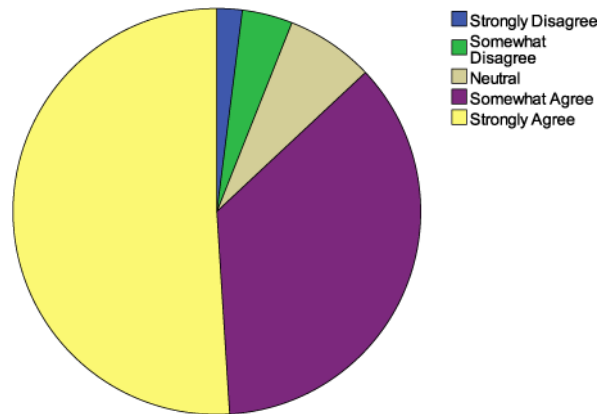
Figure 8.



When respondents were asked if almost every fairness TV commercials involve claim/promise of achieving idealized skin? 46% of respondents strongly agreed, 28% were somewhat agreeing, 11% strongly disagreed, 10% were neutral about it and only 5% of respondents somewhat disagreed.

When respondents were asked whether the product claims/promise demonstrated in fairness TV commercials sometime compels people to buy fairness products? 51% of respondents strongly agreed, 36% were somewhat agreeing, 7% were neutral about it, 4% somewhat disagreed and only 2% of respondents strongly disagreed.

Figure 9.



Frequency of Fairness TV Ads

When respondents were asked if repeated exposure of fairness TV ads is an important element to create demand within the market? 42% of respondents strongly agreed, 32% of respondents somewhat agreed, 12% of respondents were neutral about it, 11% of respondents were somewhat disagreeing and only 3% of respondents strongly disagrees about it.

Figure 10.

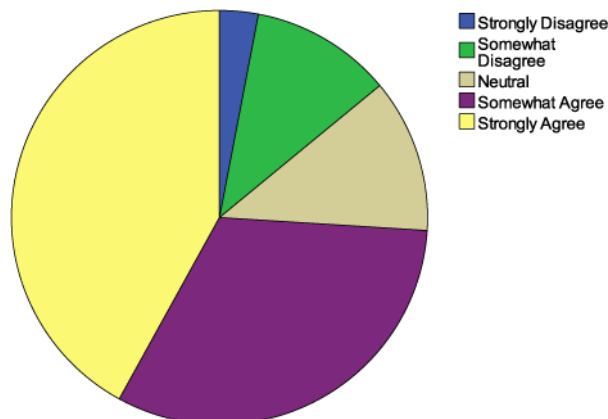
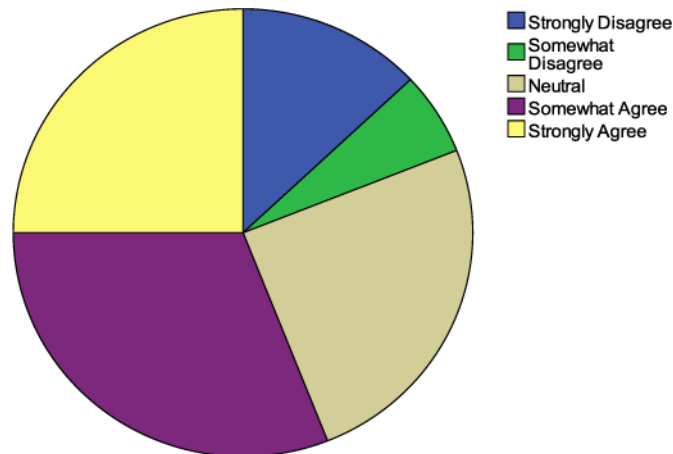
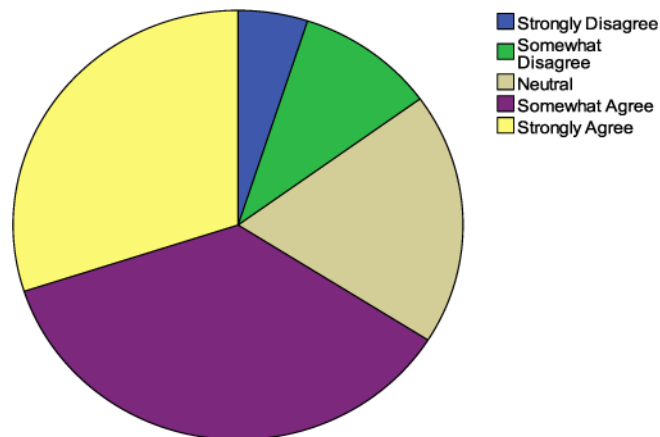


Figure 11.



When respondents were asked if repeated exposure of fairness TV ads diverts their attention? 31% of respondents somewhat agreed, 25% were strongly agreeing, 25% were neutral about it, 13% somewhat disagreed, and only 6% of respondents strongly disagreed.

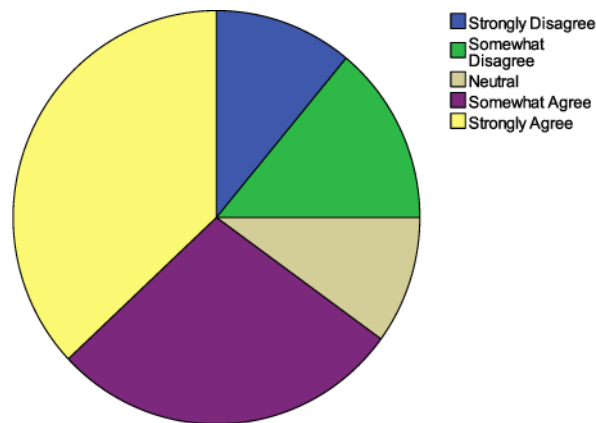
Figure 12.



When respondents were asked whether almost every TV channel relays fairness TV commercials many times a day? 36% of respondents somewhat agreed, 30% were strongly agreeing, 19% were neutral about it, 10% were somewhat disagreed and only 5% of respondents strongly disagreed.

When respondents were asked if the repeated exposure of fairness TV ads increases their curiosity towards a particular brand? 37% of respondents strongly agreed, 28% were somewhat agreeing, 14% somewhat disagreed, 11% of respondents strongly disagreed and only 10% were neutral.

Figure 13.



DISCUSSION

According to All-share and Salaimeh (2010), one of the most important functions of TV advertisements is to create demand for products. TV advertisements influence youth towards buying behavior (All-share & Salaimeh, 2010; Ashaduzzaman & Rahman, 2011). In this way, most of the youth population (nearly 73%) believed that they did find a demand for fairness products within their friends/peer group. Nearly 82% of the young population agreed that their friends/peer group often made use of fairness products. Simultaneously, the findings also revealed that the majority of university students (nearly 65%) believed that their friends/peer group gives priority to fairness products over other skin care products. Mostly respondents (approx. 76%) believed that fairness products are now in demand due to increasing desire to get fair skin complexion.

In this research, different aspects of fairness TV ads were analyzed in relation to the demand for fairness products which includes product claim and frequency. It can be analyzed that these aspects are meant to increase the demand for fairness products. Nearly 59% of the young population agreed that product claims/promise is an important element to create demand within the market. About 80% of respondents agreed that the product claims/promise in fairness TV ads diverts their attention. Nearly 74% of respondents agreed that almost every fairness TV commercial involves claims/promises of achieving an idealized skin. About 87% of university students agreed that the product claims/promise demonstrated in fairness TV commercials sometime compels people to buy fairness products.

The young population strongly believes that fairness claims made by advertisers about their products are true, so it is possible to achieve those ideal features (Javid, Namin, & Noorai, 2012; Saadeghvaziri & Hosseini, 2011). It has a strong impact on their buying behavior (Kamran, 2010) and thus leads to an increased demand for fairness products.

By the correlation analysis, we have come to know that a strong relationship exists between product claims in fairness TV ads and demand for fairness products with a significance level of .000. The value of R-square of 0.308, which indicates that 30% of the variation in demand for fairness products can be explained by variations in the product claims in fairness TV ads. The P-Value 0.000 is less than 0.05, therefore, the alternative hypothesis is accepted. The value of regression coefficients 0.529 and the constant 1.987, which is the expected value of the dependent variable (demand for fairness products) when the values of the independent variables (product claims in fairness TV ads) is equal to zero. The best-fitting regression equation for this data, as under;

Demand for fairness products = $1.987 + (0.529 \times \text{Product claims in fairness TV ads})$

The Alternate hypothesis is proved.

H1= There is a relationship between product claims in fairness TV ads and demand for fairness products in Pakistan.

The findings also specified that the more TV ad flashes on a TV screen, the deeper it will strike the mind of the audience (Ashaduzzaman & Rahman, 2011). In this way, most of the youth (nearly 74%) believed that the repeated exposure of fairness TV ads is an important element to create demand within the market. Nearly 56% of the young population agreed that the repeated exposure of fairness TV ads diverts their attention.

Simultaneously, the findings also revealed that majority university students (nearly 66%) believe that almost every TV channel relay fairness TV commercials many times a day. Mostly respondents (approx. 65%) believe that the repeated exposure of fairness TV ads increases their curiosity towards a particular brand.

By the correlation analysis, we have come to know that a strong relationship exists between the frequency of fairness TV ads and demand for fairness products with a significance level of 0.000. The value of R-square of 0.352, which indicates that 35% of the variation in demand for fairness products can be explained by the variability in the frequency of fairness TV ads. The P-Value 0.000 is less than 0.05, therefore, the alternative hypothesis is accepted. The value of regression coefficients is 0.652 and the constant is 1.621, which is the expected value of the dependent variable (demand for fairness products) when the values of the independent variables (frequency of fairness TV ads) is equal to zero. The best-fitting regression equation for this data:

Demand for fairness products = $1.621 + (0.652 \times \text{frequency of fairness TV ads})$

Alternate hypothesis is proved.

H2= There is a relationship between the frequency of fairness TV ads and demand for fairness products in Pakistan.

SOLUTIONS AND RECOMMENDATIONS

1. It is better not to exaggerate product claims in fairness TV ads. As, it often leads to create an inappropriate demand within the market. People are often compelled to buy products which they actually do not need.
2. Advertisers must keep in mind that too much repetition of TV ads leads to irritation within viewers, often resulted in clutter within their mind and instead of noticing TV ads they start ignoring them by switching channels.
3. The TV advertisements of fairness products need to improve its ad contents (concepts of storyline), as well as the way they execute its contents. Because, instead of creating prejudice regarding skin tone, they must convey a positive and constructive message to their consumers.
4. Fair skin models cast in fairness TV ads often leads to an objectionable comparison among skin tones, which results in the humiliation of dark skin people within society.
5. Pakistan Electronic Media Regulatory Authority (PEMRA) must regulate the objectionable content regarding fairness TV ads in order to induce improvement.
6. General public awareness programs should be initiated with regards to the health issues associated with skin whitening products in Pakistan.

7. During the process of legislation regarding cosmetics in Pakistan, expert opinion should be included, like dermatologists, psychologists, health and physical professionals, etc.
8. Pakistan should maintain proper data with regards to the cases associated with skin damage.
9. In Pakistan, victims of skin damage are large in number, there should be easy access for the victims where they can lodge their complaint.
10. Private companies should develop a strong liaison with the Government of Pakistan regarding their product development.
11. The Pakistani legal department should be equipped with the latest investigating technologies encompassing the damage from using inferior quality skin whitening products.
12. Pakistani scholars should discuss the issue of color on different forums, specially in print as well as electronic media.

FUTURE RESEARCH DIRECTIONS

Further researches can be conducted on the following encompassing themes:

1. The declining demand of local fairness brands in Pakistan.
2. To study the impact of skin tone partiality on self-esteem of consumers in Pakistan.
3. How can local fairness brands in Pakistan achieve competitive advantage over global brands.

CONCLUSION

Pakistani cosmetics industry is flourishing at a rapid pace. The demand for fairness creams exist and is rising in female as well as male consumers. The dilemma in Pakistan is standardization, individuals have a propensity to link beauty with a lighter skin tone. There are in addition social as well as monetary implications with respect to beauty. It takes a lot of endeavor to embellish as well as modify one's appearance in order to look stylish.

Society plays a significant function regarding the concept of attractiveness. Pakistani females crave to the Western idyllic of attractiveness, i.e. being fair, slim, and tall. A new type of social control exists in the form of beauty myth. It is an obsession with physical perfection that traps women in an endless spiral of self-consciousness, hope, and self-hatred as they try to accomplish society's impossible explanation of being a flawless beauty.

Different methods are employed to accomplish fairness in Pakistan. One of the most prominent is 'formula cream', and bleaching agents are its main ingredients. Fairness products mostly contain steroids according to dermatologists, and often lead to pigmentation, telangectasias, acne, scarring, early aging, as well as massive facial hair growth. In the process of lightening the skin tone, layers of melanin are depleted from skin. When the melanin layer is depleted for fairness, it also depletes healthy skin.

A number of TV advertisements in Pakistan portray that a dark complexioned girl is undesirable and utterly unhappy and after discovering and using a magical skin whitening cream all her dreams come true — not only does she get married, but also gains self-confidence. These advertisements project the notion that girls who are of a darker skin tone are worth nothing — they don't deserve success in any aspect of their lives, let alone marriage. In Pakistani society, while prioritizing people, after nepotism skin color surely takes the lead.

There is a strong impact of fairness products TV advertisements on demand among university students in Karachi, Pakistan. In this research, one of the factors, namely, product claim and another factor that is the frequency of fairness TV ads help to find the impact of fairness TV ads on demand for fairness products. These variables are correlated with each other that can be evidenced by the help of Pearson correlation. By the correlation analysis of these two variables we come to know that a strong relationship exists between product claims and frequency of fairness TV ads and demand for fairness products.

Finally, the findings also revealed that TV ads of fairness products holds a lasting impact on the minds of consumers and consequently leads to stimulate its demand due to its product claim. While, the frequency of fairness TV ads also leads to a positive relationship between these two factors.

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KEY TERMS AND DEFINITIONS

Advertisement: Paid, non-personal, public communication about causes, goods and services, ideas, organizations, people, and places, through means such as direct mail, telephone, print, radio, television, and internet.

Cosmetics: Products used to enhance the appearance of the face or texture of the body.

Demand: The quantity of a good that consumers are willing and able to purchase at various prices during a given period of time.

Fairness Products: Skin lightening products.

Government Universities: Public sector universities.

Repeated Exposure: People tend to develop a preference for things because they are familiar with them.

Target Market: A particular group of consumers at which a product or service is aimed.

Youth: The time between childhood and adulthood (maturity).

Examining the Value, Satisfaction, and Loyalty Relationship Under Online Framework Using PLS–ANN

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INTRODUCTION

The digital era has revolutionized the way of conducting businesses by converting brick-and-mortar firms into brick-and-click or pure-click firms. This has forced the firms to restructure their corporate strategies, which now consider customer-retailer interaction in online framework. With abundant options available for online shoppers in each domain, the e-tailers are facing a fierce market competition to gain a major market share in the economy. The dynamicity of markets resulting from these technological advancements poses a question on the loyalty of customers towards these e-commerce websites. Online retailers have shown interest in studying the variables influencing the e-loyalty among browsers. This has motivated extant researches to focus on exploring greater insights into the website loyalty frameworks. According to a report, customers who express continuance intention to shop from a website spend 67% more than new customers, and 60% will recommend the website to his family and friends in return of their loyalty (Statista, 2018). Thus, even though the topic of loyalty in online framework is less explored, recent researchers are finding this field of study attractive.

Loyalty may be defined as “the preferential, attitudinal and behavioral response toward one or more object category expressed over a period of time by a consumer” (Hirschman, 1970). Researchers have explained loyalty in both attitudinal and behavioral measures (Hill & Alexander, 2017). The attitudinal loyalty is represented by a preference desire towards an object, whereas the behavioral measures concentrate on the proportion of time the customer purchase same object in the presence of other objects in same category. The advent of internet technologies has shifted the loyalty concept towards online framework. Website loyalty may be defined as the attitude of a consumer towards a website and his willingness to make a revisit as well as recommend that website to his family and friends (Kabadayi & Gupta, 2005). The success of an e-business can be judged on the basis of its stable customer base, which in this digital world can be attained with the help of a user friendly and well-built website, that makes the shopping experience of customers smooth and enjoyable. The advancements in the information and communication technology (ICT) has showered the online customers with many blessings such as in-depth knowledge regarding the retailer and his offerings, information about the suppliers, comparing prices from various sites, availing discounts and various incentives available for membership holders, and many more ad-

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vantages. All these benefits inculcate uncertainty in shopper behavior and pose a challenge for marketers to create a loyal group of customers (Veloutsou & McAlonan, 2012).

Previous studies have evaluated loyalty in terms of the level of satisfaction achieved by the shopper while using the website (Anderson & Srinivasan, 2003; Anderson & Swaminathan, 2011). A desirable customer experience while using the website leads to its success, which eventually results in formation of a favorable attitude towards that platform in the presence of other alternatives (Ayo, Oni, Adewoye, & Eweoya, 2016). However, a delighted customer may show intent to make a revisit as well as suggest the site to his family or friends or peers, which leads to a loyalty intention. Moreover, a purchaser will stick to a site only if he perceives it to be beneficial in return of his investments, and is thought to create value for customers, which may be either monetary or non-monetary (Kumar Roy, M. Lassar, & T. Butaney, 2014). Thus, this study considers two antecedents of website loyalty namely customer satisfaction and customer value.

Customer value is defined as “the ratio of the customer’s outcome/input to that of the service provider’s outcome/input” (Patterson & Spreng, 1997). The concept is based on equity theory which considers that the customers should be offered fair and right product/service in return to his cost inputs. Customer value mainly focuses on the importance of an object (here website) and the extra benefits provided by it. The literature mentions two types of value i.e. transactional value and emotional value (Sweeney & Soutar, 2001). The transactional value concentrates on the price related issues. For example in the online framework, e-firms strategize many incentive appraisal programs so as to attract customers and generate traffic towards their site. On the other hand, emotional value takes care of the cognitive issues such as time or stress or feelings of the customers. Online firms achieve this task by practicing good business ethics and indulging corporate social responsibility (CSR) programs (Loureiro, Sardinha, & Reijnders, 2012).

Customer satisfaction is a vital concept in consumer related studies and has been vastly covered by previous researches (Quester et al., 2007; Söderlund, 1998). Satisfaction may be defined in two terms namely transaction related and overall satisfaction. The transaction related customer satisfaction is defined as “an emotional response by the customers to the most recent transactional experience with an organization” (Cardozo, 1965). On the other hand, overall satisfaction is defined as “a cumulative sum of the satisfaction associated with the specific products and various facets of the firm” (Cardozo, 1965). In online context, it may be defined as the optimistic feelings aroused in reaction to the aggregate experience during his browsing sessions. Many researchers have noticed that a satisfied customer embraces the success of an e-commerce website, which in turn leads to the popularity of the owner (Brown & Jayakody, 2008; Tandon, Sharma, & Aggarwal, 2019). Delighted customers convey positive messages regarding the website, however, negative messages by unhappy customers tend to diffuse faster and hamper the sales of the firm (Arbore & Busacca, 2009). Thus, it is important to incorporate customer satisfaction in the website loyalty framework.

Website service quality (WSQ) is asserted to be a combination of technical and customer-oriented dimensions of key features of an e-commerce website. The technical concept takes care of the system quality and content quality measures of the retailers, whereas customer-oriented concept involves the service quality measures (Wang & Tang, 2003). The web page of the company acts as the first contact point of the customers with the vendors. This page plays a key role in attracting the customers and its design motivates its usage by a large population. The concept of website quality is well known among researchers and included the variables such as trust, interactivity, ease of understanding, visual appeal, and consistency. The WSQ variable considered here makes use of the information system (IS) success factors which were defined to find the variables that improve the effectiveness of the systems (DeLone & McLean, 1992). Along with these factors, the construct also incorporates the items that customers look

out for while requesting a service using the website. Various measures have been introduced by previous studies in each category (Sá, Rocha, & Cota, 2016; Sharma & Lijuan, 2015; J. D. Xu, Benbasat, & Cenfetelli, 2013), but we consider the most comprehensive and distinct list of dimensions such as trust, tangibility, navigation, ease-of-use, ease-of-ordering, responsiveness, and customization. These dimensions help the customers to evaluate the utility of the website, an indicator of value generation for them.

With the emergence of digital mediums, people all over the world are knit closely in a social web. This has led to the introduction of various social media sites that allow its members to generate content and network with other users, over the internet (A. J. Kim & Ko, 2012). Social media reviews (SMR) is the phenomena of providing review related to a product/service over social media platforms, which can only be accessed by near and dear ones like family and friends (Y. Chen, Fay, & Wang, 2011). The role of these customer generated text is continuously trending upwards and is found to be highly influential for the purchasing decision making (Chu & Kim, 2011). This practice is being supported by the online retailers, as they have enabled the shoppers to post their comments related to the products/services in the form of text or ratings over their platforms, which helps in improving their services (Mishra, Maheswarappa, Maity, & Samu, 2018). Customers generally show a strong tie with the people in his list under a social media platform. Also, companies have starting developing their profile over these social platforms, where the customers can comment, complain, or request service, which is visible to mass population, other than his friends and family members. Therefore, SMR may be considered as an extension of electronic word-of-mouth (EWOM) concept over public network sites, with a rapid diffusion rate (Chu & Kim, 2011). Thus, is plays a non-monetary value generation approach for the customers.

In aggregation, this chapter focuses on the following research questions:

- a) Is there a significant relationship of WSQ and SMR over CV; CV over CS; and CV and CS over LOY?
- b) Does switching cost play a moderating role between CS and LOY relationship?
- c) Which is the most influential predictor in each causal relationship considered?

Partial least squares (PLS) is an extension of the covariance based SEM (CBSEM) approach, with few major improvements (Hulland, 1999). Structural equation modeling (SEM) is an improvement made by researchers over first generation techniques such as ANOVA and multiple regression, which can predict the causal relationship between the independent and dependent variables with hierarchical or non-hierarchical structural equations (Hox & Bechger, 1998). The covariance based SEM laid emphasis on the overall fit of the covariance matrix constructed under the hypothesized model. The tools usually preferred for it are LISREL, AMOS, EQS, and MPlus, whereas smartPLS is usually preferred for component based SEM (PLS-SEM). SEM performs estimation of the model parameters in such a way so as to minimize the error between the estimated and original sample covariance matrices (Ali, Rasoolimanesh, Sarstedt, Ringle, & Ryu, 2018). On the other hand, PLS emphasizes on utilizing the explained variance of the endogenous latent constructs by estimating the parameters of the model using ordinary least squares (OLS) method. Another advantage of PLS over its predecessor is that it is a soft modeling technique without any distributional assumption on the data. A major assumption in path modeling models using PLS is that the latent variables (LV) are made up of linear combinations of manifest variables (MV) and that the latent variables themselves are also associated linearly (Puig & Ming, 2017). This poses a relationship degree between these latent variables. This drawback can be rectified by using Artificial Neural Network (ANN). ANN has the ability to predict the non-linearity association among the variables and also evaluate the most important predictor in a causal model (Chong & Bai, 2014). But, ANN is

not capable of testing the hypotheses and measuring the path loadings. Therefore, this chapter uses PLS followed by ANN to measure the path loadings and to check the type of relation between the variables.

Previous studies considering website loyalty as endogenous variable have been performed (Bilgihan, 2016; X. Chen, Huang, & Davison, 2017; Hsieh & Tsao, 2014; O’Cass & Carlson, 2012). Most of these studies used path modeling such as SEM or PLS-SEM. Also, the independent variables considered in these studies are information quality, system quality, customer satisfaction, utilitarian and hedonic factors, and many more. To the best of our knowledge, this is the first chapter that utilizes the combination of PLS and ANN to determine key determinants of website loyalty. The PLS determine the path loadings for the conceptual framework while ANN helps in determining the most determining variable in each cause-effect relationship. Moreover, the distinguishing part of the chapter is validating the moderating role of switching cost between customer satisfaction and website loyalty. The rest of the paper is sequentially organized into sections that discuss the literature and formulate the hypotheses relevant to the study; describe the methodology employed to check the significance of the proposed model; then the results on the data analysis are provided in detail; afterwards, the discussions and implications for practitioners are provided; lastly, conclusion and limitation faced during the study are aggregated.

BACKGROUND

Website Service Quality (WSQ)

Last two decades have noticed a remarkable increase in the studies emphasizing success of online businesses, which rely mainly on their platforms. Literature supports the fact that online service is basically an interaction between the customers and information systems (DeLone & McLean, 1992, 2003; Molla & Licker, 2001). Therefore, today’s website service quality literature is a mix of service quality studies and information system or website design quality studies (Zhou, Lu, & Wang, 2009). The service quality measures mainly focus on the traditional SERVQUAL model whereas the website quality studies concentrates on computer and networking based impersonal interactions. The pioneer study in the area of service quality defined it to be “the degree of discrepancy between the customer’s normative expectations for the service and their perceptions of the service performance” (Parasuraman, Zeithaml, & Berry, 1988). They proposed five dimensions of SQ namely assurance, responsiveness, empathy, tangibility, and reliability, which were aggregated to be known as SERVQUAL. However, researchers observed that this traditional service quality was incapable of handling quality under online framework, as the former concentrated over customer-firm interaction. Later, this problem was rectified by the introduction of the concept of e-SERVQUAL (Zeithaml, Parasuraman, & Malhotra, 2002). On the other hand, the pioneer study under website design quality monitored the impact of system and content quality over the success of an information system (DeLone & McLean, 1992). This study has played a key reference point for many extensions based on customer’s perspective or industrial ones. The development of WebQual concept aligned system quality, content quality, and service quality in online framework under one roof, termed as website service quality (Loiacono, Watson, & Goodhue, 2002).

Social Media Reviews

Recently social media has emerged as a communication platform for consumers and firms. Social media is defined as “a group of internet-based applications that build on the ideological and technological

foundations of Web 2.0 and allow the creation and exchange of user-generated content (UGC)” (Abirami, Askarunisa, Gayathri, & Jeyalakshmi, 2015). Various types of social media applications have been observed such as internet forums, message boards, product review websites, weblogs, wikis, and picture/video-sharing websites. They provide an incomparable platform for past purchasers to post their product experiences and opinions through electronic word-of-mouth (EWOM) or customer reviews (Schultz & Peltier, 2013). In the presence of such platforms, these messages are generated in abundant volume, diffuse at an unmatched speed, and consequently creates a high impact on firm strategies and customer’s purchase behavior. Previous researchers have emphasized the importance of reviews and their impact on the purchase decision of the shoppers (Schindler & Bickart, 2012; Ye, Law, & Gu, 2009). It is believed that most of the potential purchasers make use of these online customer reviews (OCRs) or blogs or other UGC present on these social platforms in addition to the ones available on the e-commerce sites, before turning into actual purchasers. These reviews result in reducing the level of risk perceived by shoppers and participate in an enjoying shopping experience (Chu & Kim, 2011). Thus, with the unprecedented growth in internet technology and incorporation of socially connecting links, the role of social media reviews (SMR) is over-clouding the effect of online customer reviews considered under e-commerce systems.

Customer Value

The customer value is defined as “the proportion of the net output/input of the customer with respect to the net output/inputs of the service provider” (Woodruff, 1997). It was developed under the theoretical fundamentals of equity value, which emphasized that the equity of a customer can be evaluated on the basis of his expected returns in relation to the cost incurred by him (Carpenter & Fairhurst, 2005). This cost may be monetary or non-monetary such as time invested or energy and stress experienced. Thus, customer value may be measured as a trade-off between the reward-sacrifice relationships. An equitable situation is achieved when the desired outcome in relation to inputs invested is almost equivalent to the outcome/input ratio of the organization. Recent studies have shown interest in value related studies as it is considered to be a predictor of purchasing behaviour of the customers and also that it is a multidimensional construct which depends on the circumstances and other situations of the customer (C. M. Chiu, Wang, Fang, & Huang, 2014). The topic of customer value in the online context is less explored by the researchers. Availability of numerous website options and low browsing cost has transformed the purchasing behaviour of the customer to be more hedonic and unplanned. The emotional or attitudinal state of the customers has a major impact on their online pre-purchasing behaviour. Moreover, the product characteristics too influence the proactive buying behaviour. These characteristics may be external such as price, brand which are not part of the physical product or they may be internal such as size, design which are part of the physical product and can be manipulated (Eggert & Ulaga, 2002). Since in online shopping the customers cannot feel the product, the extrinsic attributes dominate the intrinsic ones. A detrimental factor for value is the amount of risk perceived by the consumers while shopping (Featherman & Pavlou, 2003). Customers assume themselves risk averse from lack of trust on website’s security facilities and prone to personal information breaching by hackers. Another factor that affects value inversely is the price of the product. Latest technological advancements allow online customers to compare products and their prices through multiple websites, and also provide a low transaction fee. Thus, above mentioned monetary and non-monetary aspects influence customer value.

Customer Satisfaction

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Customer satisfaction is the level of pleasure experienced by the customer during the purchasing process and its consequences on the future perceptions. It is the net evaluation of the products/services post purchase (Hallowell, 1996). Satisfaction in online context asserts the holistic, complex, and subjective shopping experience encountered by the customers between him and the online platforms such as shopping websites and social media (Bai, Law, & Wen, 2008). The behavioural consequences of a purchaser are highly influenced by the relative measure of satisfaction and dissatisfaction experienced on using the product/service provided by the e-firm. A satisfied shopper conveys positive words related to the product/service and is willing to recommend it to others. On the other hand, dissatisfied customers may prove to be a detrimental factor in terms of spreading bad word-of-mouth, switching to competitor website, and complaining to external and internal agencies (Caruana, 2003). It has been shown by researchers that the negative impact overtakes the positive one with respect to satisfaction (Ye et al., 2009). Thus, with the dynamicity in customer purchasing behaviour, generating satisfaction is a very tough task for these online vendors.

Website Loyalty

Loyalty may be defined as the consequence of a relationship between the customer and a brand or a product or a store or a website. Loyalty is a multidimensional construct with both behavioural and attitudinal constructs (Ariff, Yun, Zakuan, & Ismail, 2013). Website loyalty reflects the relative attitude of the customer towards a website in the presence of other competitor's websites. This preference should be maintained in the presence of decrease in price sensitivity, lower selling costs, increase in positive WOM, and competitive messages (Reichheld & Schefter, 2000). Loyalty leads to the phenomena of repeat purchase from the same online vendor, leading to customer retention, which in turn contributes to the profitability of the firm, apart from the increasing market share (Casaló, Flavián, & Guinalíu, 2008). A number of factors such as availability of alternative websites, low cost of surfing, facility of comparing prices from various sites, incentives to premium members, and low switching cost have resulted in fierce competition among these online platforms to retain their customer base, which is a determinant of online loyalty (Aydin, Özer, & Arasil, 2005). Moreover, loyalty measures are assumed to be market or situation specific, where for stable markets the marketers consider the behavioural measures for loyalty evaluation and make use of attitudinal measures in the presence of uncertainty in markets. In the online context, some retailers believe that the site image, price of product, quality of the product/service provided, and the payment options contribute to loyalty generation (Lin & Sun, 2009). Others highlight the importance of design and relevant content of the website, a healthy dialogue with the browser, and availability of rewards or incentives (for example loyalty points) lead to customer retention (Qian, Peiji, & Quanfu, 2011). Although it may be considered true that compared with the vast body of literature focusing on loyalty in general, website loyalty is a relatively under-investigated concept, with few studies investigating the concept and the antecedents of website loyalty. A comprehensive list of loyalty studies for online markets is provided in Table 1.

Table 1. Previous Research on Website Loyalty

Variables	Author(s)	Analysis Technique
trust, satisfaction, and flow	(Kabadayi & Gupta, 2005)	Second order confirmatory factor analysis (CFA)
perceived usability, satisfaction, and trust	(Flavián, Guinalfú, & Gurrea, 2006)	Structural equation modelling (SEM)
Perceived ease of use, perceived social presence, perceived usability, trust, and enjoyment	(Cyr, Hassanein, Head, & Ivanov, 2007)	Partial least square (PLS) - SEM
perceived usability, reputation, satisfaction, and consumer familiarity	(Casaló et al., 2008)	SEM
technology acceptance factor, website service quality, specific holdup cost, and satisfaction	(Lin & Sun, 2009)	SEM
perceived service quality, satisfaction, and trust	(Kassim & Asiah Abdullah, 2010)	SEM + Analysis of variance (ANOVA)
website quality and satisfaction	(Hur, Ko, & Valacich, 2011)	SEM
Website quality, trust, and word-of-mouth	(O'Cass & Carlson, 2012)	PLS-SEM
service quality and satisfaction	(Ariff et al., 2013)	Hierarchical regression analysis
System quality, information quality, e-service quality, and perceived risk	(Hsieh & Tsao, 2014)	SEM
information quality, system quality, service quality, trust, and customer satisfaction	(J. V. Chen, Yen, Pornpripheet, & Widjaja, 2015)	SEM
hedonic features, utilitarian features, brand equity, flow, and trust	(Bilgihan, 2016)	SEM
social capital and website quality	(X. Chen et al., 2017)	PLS-SEM
Website service quality, social media reviews, customer value, and customer satisfaction	Proposed model	PLS-SEM-ANN

HYPOTHESES DEVELOPMENT

Website Service Quality and Customer Value

A number of combinations of dimensions have been studied up by researchers focusing on the concept of WSQ. The aggregate list of these dimensions consist of usability, design, trust, empathy, information, security, privacy, functionality, responsiveness, reliability, enjoyment, usefulness, ease-of-use, and content (Ariff et al., 2013; J. D. Xu et al., 2013). This study provides a unique combination consisting of trust, tangibility, customization, responsiveness, ease of ordering, navigation, and ease of use. An amalgamation of these attributes puts a major impact on customer value. Since the online platforms enable the potential buyers to check prices of the products, make comparisons among alternative offerings, and find unusual products (Andam, 2003). Thus, quick access to low cost, relevant information has a beneficiary effect over the online purchasers. Moreover, website design that encourages more of cognitive efforts and is less user-friendly deems to assert a negative impact on value generation (Kumar & Desai, 2016). Thus, we posit that

H1: there is a significant positive association between WSQ and CV

Social Media Reviews and Customer Value

Social media reviews (SMR) enables a previous purchaser to express his attitude and experience regarding a website or a particular product/service of that website with their family members, peers, friends, or the people with whom he is connected online (Zhang, Li, & Chen, 2012). Online firms have started noticing the impact of SMR on their sales as well as on the buyers, in terms of impression management, emotion regulation, information acquisition, social bonding, and persuasion (Abirami et al., 2015). Purchasing decisions are highly influenced by the cognition cost involved during shopping (Andreou et al., 2005). It basically supports the cost-benefit tradeoff considered by online buyers before making a purchase. According to this theory, the customer keeps looking forward for additional information regarding a product/service until the benefits obtained from that information exceeds the cognitive cost incurred during the search process (Kwahk & Ge, 2012). The above discussions interpret the impact of social reviews over various aspects of customer value. Hence, we posit that

H2: there is a significant positive association between SMR and CV

Customer Value and Customer Satisfaction

Customer value is measured in terms of the net benefits obtained in return for the net cost invested i.e. it is an indicator of net utility generated by an online firm. Customer satisfaction is the amount of positive or negative feeling created in relation to the product/service provided by the e-tailors. Therefore, customer value evaluates the level of customer cognition whereas satisfaction mirrors the feeling portrayed by values (C. Xu, Peak, & Prybutok, 2015). In literature, value is considered to be a cognition dependent variable which reflects the benefit-discrepancy relationship, whereas satisfaction is basically affective and evaluative variable (Puig & Ming, 2017). It is believed that while shopping if the buyer asserts his benefits to outnumber his discrepancies, there is a relevant amount of satisfaction engendered (Gallarza, Arteaga-Moreno, Del Chiappa, & Gil-Saura, 2016). Keeping in mind the social theories which state that the cognitive process leads to affective responses, we posit the following.

H3: there is a significant positive association between CV and customer satisfaction

Customer Value and Website Loyalty

A customer is loyal to an object only if that object meets his expected value. The customer value may be defined as the ratio of the output generated by a firm in comparison to the level of inputs incurred by the customer. Because loyalty is a behavioral intention, it is considered to be a subordinate goal whereas customer value is deemed to be a super-ordinate goal (Gallarza et al., 2016). As per the goal-action relationship, it has been argued that super-ordinate goals are very likely to influence the subordinate goals (Abelson, 1983). In the online environment, value driven loyalty is generated if the website provides an attractive interface, low cost products, and risk free transactions so as to make online payments (C. M. Chiu et al., 2014). It is not just price that influence the value of a customer (Veloutsou & McAlonan, 2012). An e-tailer may charge a high price for an offering, but if they attach few additional fringe benefits to it, the customer may not feel hesitant in accepting that commodity. Thus, customer value acts as a determinant for website loyalty till the proportional measurements indicate utility for the customer (Puig & Ming, 2017), and this leads us to posit that.

H4: there is a significant positive relationship between CV and website loyalty

Customer Satisfaction and Website Loyalty

Previous studies indicate that customer satisfaction and loyalty assume to have some intuitive association as some marketing analysts believe that satisfaction precedes loyalty whereas some believe that satisfaction positively affects loyalty (Chadha & Kapoor, 2009). Satisfaction is believed to be the key determinant factor for customer loyalty (M.-J. Kim, Chung, & Lee, 2011). Satisfied customers are expected to have a healthy and longer bond with the product provider, be it in offline mode or online (Anderson & Srinivasan, 2003). This may be due to the fact that the customers perceive that since the organization fulfilled his expectation, they will continue to do so in the future too (Limbu, Wolf, & Lunsford, 2011). Thus, this self-actualization of the expectations will increase the buying intention from that website for the future needs, resulting in more frequent visits to the website, which eventually may result in more purchases more even at premium prices (T. S. H. Pham & Ahammad, 2017). Here, we posit as follows.

H5: there is a significant positive relationship between CS and website loyalty

Moderating Effect of Switching Cost

Switching cost consists of the economic, psychological, and emotional dimensions of the consumers. This cost may vary with the type of product, businesses, or customers (H.-C. Chiu, Hsieh, Li, & Lee, 2005). The technological incompatibility within brands for technology products increases the switching costs. In business sector, switching costs can be classified as hard and soft assets. The monetary, behavioral, search and learning related issues contribute to the switching cost with respect to customers. Few studies have considered the role of switching cost in the satisfaction-loyalty relationship (Huang & Hsieh, 2012; Minarti & Segoro, 2014). However, these studies emphasize on the fact that this role is dependent on situational variables such as businesses, products and consumers, and this relationship may not always be significant. However, the significance of the moderator is supported in the mobile phone sector (Aydin et al., 2005; Oyeniyi & Abiodun, 2010). In this digital era, the firms now own their websites and help shoppers reduce searching costs for price and quality information, as well as allow comparisons across e-stores by eliminating physical travel. Since the competitors are just a click away, the shoppers face minimum barriers for switching e-commerce platforms (Chuah, Marimuthu, Kandampully, & Bilgihan, 2017). Therefore, the role of switching cost as a moderator warrants further investigation. Thus, we posit that

H6: the relationship between CS and website loyalty is moderated by switching cost

METHODOLOGY

Data Collection

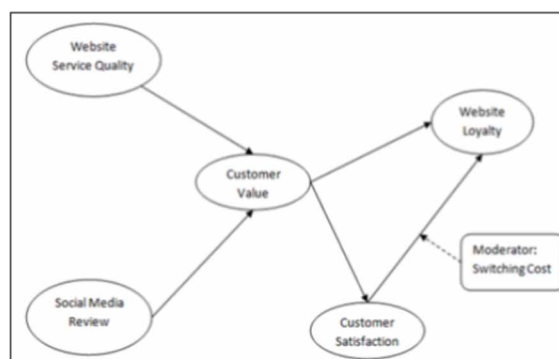
A questionnaire was prepared to perform a web based survey sent over some popular social media platforms. This type of survey is useful as the respondents come from a population which is socially connected over the internet and can make meaningful responses on statements related to impact of the social reviews, as well as those who do shopping online. 250 responses were registered, out of which 174 were considered for study, after removing the incomplete and wrongly filled up questionnaires. A simple random probability sampling technique was adopted as each respondent had an equal chance of being selected in the sample; however the overall population was limited to the number of connec-

tions over that platform. The survey was conducted from 1 May, 2018 to 31 July, 2018. To get accurate response and reduce ambiguity, pilot study was conducted on 30 respondents which mainly consisted of academicians and management experts dealing with e-commerce websites. The pilot group correctly filled the questionnaire and suggested few changes in the questionnaire language. The final questionnaire with closed ended questions on 5-point likert scale was prepared after incorporating the suggested corrections. Moreover, the sample seems apt as it consists of respondents that are active on social media, perform online shopping, and make frequent transactions online. The demographic profiles of the respondents are presented in Table 2.

Measures

This chapter aims to study the relationship between website service quality (WSQ), social media reviews (SMR), perceived value (PV), customer satisfaction (CS), and website loyalty (LOY); and also check the moderating effect of switching cost in the association between customer satisfaction and website loyalty. A conceptual model is constructed here on the basis of hypotheses developed in this study, as shown in Figure 1. A self-administered questionnaire with 19 constructs was used to check the support for the hypotheses. The respondents were asked about their shopping experience with respect to a particular website in the past three months. This provided us with meaningful responses rather than the ones which we would have received on asking about their most visited website. The respondents were questioned about website service quality measures (seven items, 5-point likert scale), the influence of reviews available on their social media accounts (three items, 5-point likert scale), the value generated by the website towards its customers (two items, 5-point likert scale), level of satisfaction achieved while using the e-commerce website (two items, 5-point likert scale), loyalty generated (three items, 5-point likert scale), their perspective on switching website (two items, 5-point likert scale), amount of time spent on online shopping, and general demographic characteristics. Scaling was done using agreement-type of 5-point likert scale, where 1 = strongly disagree and 5 = strongly agree. The statements of the constructs used in the questionnaire are provided in the appendix. All the variables considered here are multi-item measures. Though it has been proved by researchers that single-item measures best represent an overall evaluation, but when it is not possible to define a construct in terms of single item, researchers must make use of multi-item measures (Hoeppner, Kelly, Urbanoski, & Slaymaker, 2011).

Figure 1. Hypothesized Model



DATA ANALYSIS

Validity and Reliability of Measures

To rectify the scales of the considered measures, exploratory factor analysis (EFA) was performed. For EFA, principal component analysis with varimax rotation and eigenvalue greater than 1 was considered and attributes with factor loadings above .5 were retained for further analysis. Kaiser-Mayer-Olkin (KMO) value of .836 and valid Bartlett's Sphericity Test suggest the usefulness of factor analysis. All the constructs had Cronbach alpha value above .7 and composite reliability (CR) value above .7, which substantiated construct reliability. Confirmations of discriminant validity of the constructs were observed with AVE (average variance extracted) values above .5 and that the square roots of AVE for each latent variable more than absolute correlations between these variables. Above mentioned results are given in Table 3 and 4.

Table 2. Demographic Profile

Respondent's Demographic Profile	Variables	Usable responses	Percentage
Gender	Male	103	59.20
	Female	71	40.80
Age (in years)	Below 18	7	04.02
	18 – 30	114	65.52
	31 – 45	33	18.97
	Above 45	20	11.49
Education Qualification	Undergraduate	5	02.87
	Graduate	46	26.44
	Postgraduate	67	38.51
	Other	56	32.18
Occupation	Student	82	47.13
	Self employed	43	24.71
	Service	49	28.16
Annual Household Income (in lacs of Rupees)	Below 4 (Low)	45	25.86
	4 – 8 (Lower Middle)	60	34.48
	8 – 12 (Upper Middle)	32	18.39
	Above 12 (High)	37	21.27
Hours spent on online shopping (in a month)	Below 6	36	20.69
	6 – 12	48	27.59
	Above 12	90	51.72
Hours spent on social media (in a month)	Below 6	40	22.99
	6 – 12	55	31.61
	Above 12	79	45.40

Table 3. Dimensionality and Reliability Results

Variable	Items	Loadings	Cronbach Alpha	CR
Website Service Quality (WSQ)	WSQ1	.730	0.756	0.87
	WSQ2	.656	0.768	
	WSQ3	.592	0.764	
	WSQ4	.863	0.751	
	WSQ5	.746	0.759	
	WSQ6	.850	0.749	
	WSQ7	.900	0.753	
Social Media Reviews (SMR)	SMR1	.891	0.766	0.96
	SMR2	.631	0.768	
	SMR3	.873	0.768	
Customer Value (CV)	CV1	.671	0.762	0.82
	CV2	.611	0.756	
Customer Satisfaction (CS)	CS1	.887	0.774	0.93
	CS2	.620	0.772	
Website Loyalty (LOY)	L1	.681	0.768	0.92
	L2	.830	0.761	
	L3	.806	0.768	
Switching Cost (SC)	SC1	.878	0.778	0.94
	SC2	.859	0.792	

Table 4. Discriminant Validity Results

	AVE	WSQ	SMR	CV	CS	LOY	
WSQ	.67	0.82					
SMR	.79	0.64	0.89				
CV	.58	0.61	0.63	0.76			
CS	.74	0.62	0.70	0.67	0.86		
LOY	.72	0.76	0.74	0.77	0.72	0.85	
SC	.76	0.68	0.70	0.72	0.65	0.79	0.87

Common Method Bias (CMB)

A common instrument used for surveying both independent and dependent entities may result in the problem of CMB. The most efficient method to detect this issue, as suggested by many researchers is the Harman's Single Factor Analysis. From the results of the present study, we may infer that there is no CMB error as a single factor is able to explain less than 50% of total variance explained (Anderson & Swaminathan, 2011).

PLS-SEM Results

The hypothesised relationships among the considered latent variables were examined through PLS-SEM. For this, smartPLS (2.0) software was used to determine the path loadings between each pair of variables, coefficient of determination value for the endogenous latent variables, and lastly the t-value to test the significance of the assumptions. The coefficient of determination value for CV, CS, and LOY were found to be .602, .430, and .460, respectively, and bootstrapping technique was used to obtain the t-test values, which were greater than the threshold value of 1.96 for acceptance. The results of the hypothesis testing are shown in Table 5.

Table 5. Hypotheses Results

Path	Loading	T - value	Status
WSQ → CV (H1)	0.476	2.363	Accept
SMR → CV (H2)	0.358	2.610	Accept
CV → CS (H3)	0.641	4.685	Accept
CV → LOY (H4)	0.402	3.361	Accept
CS → LOY (H5)	0.354	2.996	Accept

Moderating Effect of Switching Cost

In addition to the above analysis, we wish to study the significance of switching cost as a moderator over the relationship between customer satisfaction and website loyalty. The moderation test was performed by generating the interaction effect between SC and CS, by setting the LOY as the endogenous variable. The PLS test was again run and the bootstrapping results were obtained. The path loading obtained after the analysis was .224 with t-value equal to 2.860. This supports the significance of hypothesis H6 at 5% level of significance. The results are provided in Table 6.

Table 6. Moderating Effect Results

Path	Loading	t-value	Status
CS → LOY	0.387	3.308	Accept
SC → LOY	0.204	2.335	
CS*SC → LOY	0.224	2.860	

After performing the hypotheses testing and obtaining the respective path loadings using PLS-SEM, we next proceed to find the best determinant variable in each causal relationship considered in the developed hypothesized model by making use of ANN.

Artificial Neural Network (ANN) Analysis

The literature supports various multivariate assumptions such as normality in data, linearity of relationships, absence of outliers and multi-collinearity, homoscedasticity, and sufficient data elements, which need to be fulfilled by the analytical techniques (Sarstedt, Ringle, Henseler, & Hair, 2014). For covariance based SEM, all these assumptions are vital for its application to exist. PLS takes care of outliers, small sample size, and non-normality, during its application, however it is unable to detect the linearity or non-linearity among the relationships. ANN is the most robust technique towards all these assumptions and is capable of handling both linear and non-linear associations (Hsu, Chen, & Hsieh, 2006). Based on the above discussion, we first check the feasibility of using ANN. The foremost objective is to examine the normality, which was tested using one sample Kolmogorov-Smirnov (KS) normality test.

Table 7. One Sample KS Test Results

Items	N	Normal Parameters		Most Extreme Differences			Kolmogorov-Smirnov Z	Asymp. Sig. (2-tailed)
		Mean	Std. Deviation	Absolute	Positive	Negative		
WSQ1	174	3.6552	1.11041	.214	.130	-.214	2.821	.000
WSQ2	174	2.7816	1.43793	.181	.172	-.181	2.386	.000
WSQ3	174	2.0172	1.26525	.301	.301	-.211	3.968	.000
WSQ4	174	2.9425	1.29344	.184	.163	-.184	2.427	.000
WSQ5	174	1.5747	.99283	.385	.385	-.281	5.083	.000
WSQ6	174	3.5805	1.19337	.183	.141	-.183	2.419	.000
WSQ7	174	3.4368	1.25575	.196	.113	-.196	2.587	.000
SMR1	174	2.4310	1.36147	.228	.228	-.147	3.003	.000
SMR2	174	3.1092	1.19953	.176	.157	-.176	2.327	.000
SMR3	174	2.0920	1.32676	.301	.301	-.205	3.964	.000
CV1	174	2.6494	1.26220	.197	.197	-.151	2.593	.000
CV2	174	2.8046	1.39644	.172	.172	-.155	2.266	.000
L1	174	3.1034	1.14331	.192	.132	-.192	2.527	.000
L2	174	1.9253	1.21653	.305	.305	-.223	4.027	.000
L3	174	2.9943	1.32777	.166	.135	-.166	2.195	.000
CS1	174	1.8678	1.18751	.325	.325	-.232	4.287	.000
CS2	174	3.2011	1.26756	.161	.161	-.138	2.120	.000

Table 8. ANOVA Result

Path	F - value	Sig
WSQ → CV	2.548	.012
SMR → CV	2.806	.000
CV → CS	5.944	.000
CV → LOY	5.605	.000
CS → LOY	5.763	.000

The results presented in Table 7 show that all the p-value are less than 5% level of significance, which cancels the normality in distribution. Moreover, we look for linearity assumption, which is taken care of by Analysis of Variance (ANOVA) approach. For all the causal relationships considered here, we noticed the p-value to be less than 5% level of significance, which confirms non-linearity among the latent variables, as provided in Table 8.

ANN is an interconnected network consisting of neurons connected through synaptic weights. The structure consists of three layers of neurons namely input, hidden, and output layer, known as multilayer perceptrons (Holcomb & Morari, 1992). During the training process, the neurons in the input layer are processed through the hidden layers to finally reach the output layer. This is generally termed as feed-forward back-propagation algorithm. In case of supervised learning, these hidden layers act as knowledge bank for predicting the future and the synaptic weights acts plays the role of catalyst during this process. The error terms are produced at the output layer, which are propagated back to the input with the help of hidden layer (Chong & Bai, 2014). This cycle is repeated till the error becomes minimal and prediction capacity becomes efficient. Though, ANN has few advantages over other similar techniques such as SEM, MRA, logistic or discriminant regression (Hsu et al., 2006). (1) The learning ability of the approach makes it superior than these traditional techniques. (2) It can identify both compensatory as well as non-compensatory associations, in comparison to conventional ones which could involve only compensatory ones. (3) It does not depend on p-value, the value which nullifies as the sample size increases, and is thus capable of identifying complicated linear and non-linear relationships. (4) Non-parametric ANN makes it possible to study the cause-effect relationships without testing the hypotheses.

This study applies ANN to determine the most influential predictor in each causal relationship. To minimize over-fitting of the model, we perform ten-fold cross validation. The data ratio in training to testing is set to 9:1. The numbers of hidden layers were automatically generated, whereas sigmoid activation function was used for hidden and output layer. To evaluate the prediction accuracy we make use of RMSE (root mean square error). Finally, sensitivity analysis was used to measure the normalized importance of each predictor on the basis of relative importance. In this analysis, we consider three models. Model 1 consists of WSQ and SMR as the input neurons and CV as the output layer. Model 2

Table 9. RMSE Results

Neural Networks	Model 1		Model 2		Model 3	
	Training	Testing	Training	Testing	Training	Testing
NN1	.0932	.0868	.1214	.0976	.1464	.1488
NN2	.0949	.0637	.1169	.1334	.1405	.1559
NN3	.0933	.0855	.1329	.1294	.1418	.1438
NN4	.0999	.0924	.1316	.1492	.1367	.1218
NN5	.0946	.0748	.1262	.1225	.1498	.1247
NN6	.0944	.0729	.1212	.1074	.1410	.1492
NN7	.0985	.1008	.1201	.1144	.1410	.1549
NN8	.0986	.1080	.1221	.0922	.1397	.1598
NN9	.0937	.0827	.1374	.0981	.1421	.1049
NN10	.0933	.0847	.1232	.0685	.1479	.1427
Mean	0.0954	0.0852	.1253	.1113	0.1427	0.1407
S.D.	0.0026	0.0131	.0066	.0235	0.0041	0.0178

Table 10. Sensitivity Analysis Results

Neural Networks	Model 1		Model 2	Model 3	
	WSQ	SMR	CV	CV	CS
NN1	.497	.503	.100	.195	.805
NN2	.504	.496	.100	.294	.706
NN3	.356	.644	.100	.196	.804
NN4	.427	.573	.100	.459	.541
NN5	.723	.277	.100	.546	.454
NN6	.306	.694	.100	.650	.350
NN7	.375	.625	.100	.697	.303
NN8	.445	.555	.100	.217	.783
NN9	.821	.179	.100	.397	.603
NN10	.620	.380	.100	.618	.382
Mean	0.5074	0.4926	.100	0.4269	0.5731
Normalized	100.00	97.08	100.00	74.49	100.00

considers CV as input whereas CS acts as output neuron. Model 3 takes CS and CV as inputs and LOY as output. The RMSE results are provided in Table 9. Moreover, the sensitivity analysis results are given in Table 10. The RMSE results for the ten-fold analysis shows that for all the three models there is less variation between the training and testing outcomes with the values .0105, .0169, and .0137, respectively. Moreover, the sensitivity results show the most important predictors in each model i.e. WSQ, CV, and CS, respectively.

DISCUSSIONS AND IMPLICATIONS

The acceptance of hypothesis H1 validates the direct association between website service quality and customer value. This is consistent with the results provided in previous studies (Ariff et al., 2013; Kumar & Desai, 2016; J. D. Xu et al., 2013). The first thing that the shopper comes in contact with is the firm's webpage. It is necessary for a company to own its website so as to reach wider audience not only within country but also across borders. Previous studies have laid emphasis on system quality, content quality, and service quality dimensions for the success of an e-commerce website. The chapter covers these dimensions under one umbrella, namely the website service quality. The online shoppers expect these items while purchasing through a website and so marketers must concentrate on these concepts so as to increase their website traffic. These dimensions are trust, tangibility, customization, responsiveness, ease of ordering, navigation, and ease of use. Moreover, equity theory embarks the importance of customer value during their purchasing process. The theory suggests that customers prefer those products/services that provide them with equal benefits in return for their inputs. These inputs may be in form of price (monetary) or in terms of time or sentiments (non-monetary). The acceptance of the hypothesis registers the relationship between WSQ and CV. Therefore, the online marketers must have a website which is compatible to the shopper's need and wants such as a safe and secure transaction medium, a platform which is easily accessible, makes it possible to order products/services with ease and at affordable prices, availability of customer support system which is very affordable. In addition to

these, customers also expect a platform that is available 24X7, displays correct and precise information regarding their offerings, and most importantly allowing shopper to compose his shopping cart as per his requirements. Moreover, the strategy of providing cash-backs, discounts, free shipping, and other incentives seems a beneficial decision for customers, and helps in generating value in them.

The direct association between social media reviews and customer value is validated by the support of hypothesis H2. This is similar to the analysis results obtained by the previous studies (Abirami et al., 2015; Andreou et al., 2005; Kwahk & Ge, 2012). As discussed earlier, customer value is an aggregation of price and cognitive activities. The SMR is the form of electronic word-of-mouth, where the messages related to an object are spread by near and dear ones as well as acquaintances over social platforms. Extant researchers have noticed the influence of these social stimuli in the purchase decision making of a customer. Therefore, these online customer reviews plays the emotional role in customer value generation. The online vendors must keep a track of the feedbacks provided by previous purchasers, and try to solve their issues related to its offering, if any. This will help in retaining present customer base and also adding potential purchase in their database. Thus, e-firms must be active on social platforms in order to maintain a continuous dialogue with their potential and actual customers, which in turn lead to enhancement in value generation.

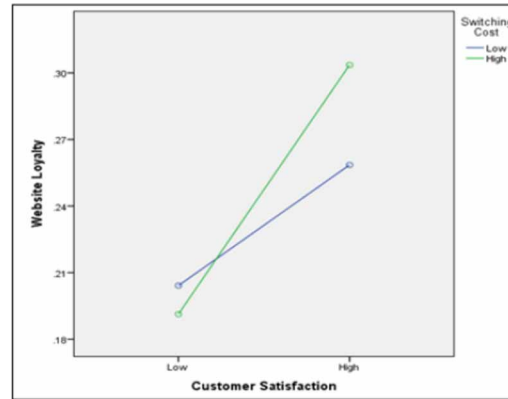
The support for hypothesis H3 verifies the positive direct association between customer value and customer satisfaction towards a website. Similar validation has been provided in previous studies (Gallarza et al., 2016; Puig & Ming, 2017; C. Xu et al., 2015). CV is the basically an evaluation of net benefit generation. If this net benefit valuation turns out be a positive number, and then it will lead to a feeling of satisfaction among the customers. They will be happy with their returns and a feeling of contentment will be showcased by them. Also, customer satisfaction towards an e-commerce system is judged to be an indicator of e-business success. Therefore, it validates the sociological theories of cognitive processes resulting into affective responses.

The direct relationship between customer value and website loyalty is validated by the acceptance of hypothesis H4. The theoretical implications can be verified through the past studies (Gallarza et al., 2016; Puig & Ming, 2017; Veloutsou & McAlonan, 2012). If a customer perceives that he is getting good return for his investments, which may be monetary or non-monetary, he will try to stick to that organization. But, this process is supported until his marginal utility is maximized. Therefore, marketers must track the shopping patterns of buyers so as to provide them enjoyable and hedonic shopping experience. This will increase the loyalty intent towards that website and resistant to switching barriers, however small they may be. Thus, if the shoppers find a website good worth for their inputs, they will be ready to recommend it to his family and peers.

The acceptance of hypothesis H5 signifies the positive direct relationship between customer satisfaction and website loyalty. This relationship has well been justified by previous studies, and suggests marketers to focus on their previous purchasers so that they are inclined to make a revisit to their website and make contribution towards market value generation for the firm (M.-J. Kim et al., 2011; Limbu et al., 2011; T. S. H. Pham & Ahammad, 2017). Therefore, only when the buyers are satisfied with their shopping experience as well as with the purchased product/service, they will consider that website superior to other similar alternatives and will be willing to suggest it to others.

Next, the question arises whether there is a catalyst that can intensify or de-intensify the direct relationship between customer satisfaction and website loyalty. Few researchers have considered the role of switching cost under this association but have stated its significance as per situation. This motivated us to take it as a moderator in this chapter. The hypothesis testing results provided in Table 6 gives a glimpse of a parallel relationship between the between the combined effect of CS and switching cost

Figure 2. Interaction Effect



over website loyalty. The significant positive path loading along with acceptable t-value validates our hypothesis H6 that customer satisfaction acts as a moderator in this relationship. Also, to gain deeper insight, we studied the interaction effects among these variables. The graphical representation is provided in Figure 2. The curves show that website loyalty increases with increase in customer satisfaction; however switching cost facilitates this impact.

Lastly, after hypotheses testing, artificial neural network was used to find the best predictor of the endogenous variable. For this, we divided our conceptual framework into three models. The first model considered SMR and WSQ as independent variables whereas the dependent variable was CV. The second model considered CV as independent and CS as dependent constructs. The third model considered CS and CV as explanatory variables whereas LOY played the role of explained variable. The RMSE results provided in Table 9 show that the variation between the training and testing results for each model considered is very less, which validated the three models. Moreover, sensitivity analysis was provided to investigate the best predictor of each causal relationship (Table 10). For Model 1, WSQ is more important predictor of CV in comparison to SMR. This may be due to the fact that many customers feel that the user generated contents are skeptical as they may be fake or posted by the firm itself. For Model 2, since the relationship involves only one predictor, CV is itself the best determinant of CS. For Model 3, CS is more important predictor of website loyalty in comparison to CV. This may be attributed to the fact that a customer who wins the price-return tradeoff may not be eventually happy with the quality of offering provided or that the customers do not feel content with the website.

CONCLUSION

Thus, this chapter attempts to examine the relationship between website service quality (WSQ), social media reviews (SMR), customer value (CV), customer satisfaction (CS), and website loyalty (LOY); with the moderating effect of switching cost between CS and LOY. Also, the most influential predictor in each cause-effect relationship is determined. The hypothesized conceptual framework is validated using a two-stage approach. In the first stage, the hypotheses are tested and path loadings are generated using PLS-SEM approach. Also, the moderating effect is studied. Second stage utilizes the advantages of artificial neural network (ANN) to obtain the best explanatory variable in each independent-dependent association. The two approaches were applied on 174 meaningful responses obtained through a web-

based questionnaire to get to the conclusion of the study. PLS-SEM results show that all the hypotheses considered in the study as well as the moderating effect of switching cost are significant. ANN results proved that WSQ, CV, and CS are the best predictors of CV, CS, and LOY, respectively.

FUTURE RESEARCH DIRECTIONS

Though the study has the limitation of geographic location, and so the results may not be generalized for sample in other developing or developed economies. Future studies may consider involving the moderating role of various demographic characteristics in the conceptual framework.

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KEY TERMS AND DEFINITIONS

Customer Satisfaction: The deviation between the expectation and actual outcome for a customer.

Customer Value: In context of online platform: a potential customer will make a purchase only if the item is consistent with his monetary and non-monetary requirements; and also provides some incentives.

Social Media Reviews: The reviews regarding a product/service provided by experienced customers over social media platforms.

Switching Cost: Monetary and non-monetary factors that compel a customer to shift his website preference.

Website Loyalty: It means a customer willing to make online purchase through same platform while buying.

Website Service Quality: The variable consisting of information and system quality related to a website.

APPENDIX

Website Service Quality

- WSQ1: E-commerce website makes me feel safe while making a transaction
- WSQ2: E-commerce website offers multiple ways of searching product/service online
- WSQ3: E-commerce website correctly answers my queries
- WSQ4: E-commerce website provides correct information about the product/service
- WSQ5: E-commerce website provides a smooth interface for requesting and obtaining information
- WSQ6: E-commerce website provides a smooth interface for ordering goods/services online
- WSQ7: E-commerce website provides a smooth interface to opt the product/service according to my preferences

Social Media Reviews

- SMR1: E-commerce website is introduced by peers/family
- SMR2: E-commerce website is introduced by media
- SMR3: E-commerce website is introduced by customer reviews

Customer Satisfaction

- CS1: I am overall satisfied with the website
- CS2: Website is ideal to my expectations

Customer Value

- CV1: Compared to alternative websites, the website charges me fairly for similar products
- CV2: Comparing what I pay to what I get, the company provided me with good value

Website Loyalty

- LOY1: I will recommend the website to my friends and relatives
- LOY2: I will again make a purchase from the e-commerce website
- LOY3: I will make a purchase from this website in the presence of other competitors

Switching Cost

- SC1: It takes me a great deal of time and effort to switch to another website
- SC2: It costs me too much to switch to another website

Emotional Intelligence and Customer Satisfaction of Online Health Information

13

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INTRODUCTION

The healthcare sector is probably one of the most dynamic sectors of the economy and society contiguously changing in response to a whole range of forces: patient expectations, changing social patterns, public policies and new technology (Agarwal & Labrique, 2014). As a consequence, the consumer of online health information is now viewed in a new perspective as a combination between the traditional patient and the contemporary consumer, having much more knowledge about the health system, open to innovations and with an active role in the process of diagnosis, treatment and maintaining health (Feng & Xie, 2015).

Romania has been and continues to undertake a variety of activities related to the implementation and adoption of technology in its health care system. These efforts have been particularly successful in the primary care sector in all regions of Romania but development of health IT projects must encourage successful adoption and implementation efforts. Withal, Romanian patients may also make use of health IT products, especially those designed to encourage healthier living habits and to enable patients to make appointments with providers.

The importance of various service qualities for customer satisfaction and subsequent adoption of online health services has been evidenced in numerous studies, but there is a paucity of research that explores the linkage between online health service quality satisfactions and customer adoption intentions in the context of Romania (Powell et al., 2011; Thackeray, Crookston & West, 2013; Grande & Taylor, 2010; Bansil et al., 2006).

Emotional intelligence directly influences the performance of an entity in both positive and negative ways because it determines the performance of the entity, the credibility of managers by promoting their values, beliefs, attitudes and behaviors (Ashkanasy & Humphrey, 2011). These approaches point to the fact that the core of emotional intelligence is the managers' value system, which influences their

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satisfactions, decisions and behaviors with a major impact on the entity's activities. Organizational effectiveness and efficiency, productivity, open, creative and stimulating work environment, entity role in the community, social responsibility are just some of the values shown by top managers (Gevers & Peeters, 2009). It is also why the employees agree to be evaluated and motivated, as do all the actors involved, in relation to established standards. Where the environment is a mobilizer, they can they work together to maximum effectiveness.

There is a direct link between the need for an entity of change, having as its rationale its evolution, development, the gaining of new markets, or sometimes the staying in the competitive market and the influence of a strong emotional intelligence (Petrides et al., 2016). The latter may be either the key element in the transfer of the entity to another economic level, or the element that salvages the entity from a situation that might have led to its exit from the market. Under the pressure of the external and internal influences, emotional intelligence comes with a substantial contribution that guides the processes of change of entities through decisions and actions of managers (Campo et al., 2016).

The present chapter intends to identify the construct a set of factors that influence customers' behavioral intentions towards using online health information in Romania. The research questions have been formulated as following: Are health care institutions today making efficient use of the online health information they have available? How to use emotional intelligence in health IT?

This chapter is structured in the following way: in the first section, the authors will introduce a radiography of current situation regarding assessment of the potential for online health service; in the second section, research methodology will be discussed; in the third section, the results of the study and statistics analysis will be discussed; finally, the authors will argue the conclusions and will presented this paper's limitation.

BACKGROUND

Controversies about health IT implementation have been, and are still, generated by the difficulty of accurately determining demand, unequal access to participants' information, regulated pricing and pricing mechanisms and intervention of the third paying party, as well as ethical and moral aspects related to the patient-doctor relationship, the limit between research and treatment, the perception of health and illness, etc. (Beig et al., 2007; Hallyburton & Evarts, 2014; Kontos et al., 2014).

On the one hand, online healthcare consumers differ from those of other goods and services, due to certain peculiarities that arise from the specifics of the market, the supplier-client relations, and the way of organizing the health system (Rezai-Rad, Vaezi & Nattagh, 2012). Unlike other areas where, as a rule, the number of consumers is limited in traditional health services, in online health anyone can become theoretically the consumer at some point, so the potential market is very high.

In response to the necessity of online health information, consumer behavior is structured on two basic components, with important implications for online health services, namely purchasing behavior and consumption behavior (Li et al., 2010; Kelly, Jenkinson & Ziebland, 2013). Therefore, studying the behavior of the online healthcare consumer should not be limited to the individual as the end user, but should also focus on studying the relationship between the provider and the consumer, and in particular on set of factors may influence this behavior. In online healthcare, purchasing decisions require the most presence of multiple participants, who fulfil different roles: the influence, the decision-maker, the buyer, or the user (Carpenter et al., 2011; Khoja et al., 2007; Galdas, Cheater & Marshall, 2005).

On the other hand, emotional intelligence equips individuals with the attitude needed for a customer service position. Consumer behavior is the object of the permanent concerns of modern firms (Sillence et al., 2007; Jaiswaland & Gupta, 2015; Grosso, Castaldo & Grewal, 2018). In the face of increasingly strong competition on the market, it is necessary to know the behavior of the consumer in order to preserve market position, but also to expand, to increase the market share (Kim et al., 2012; Mittal, 2017). Understanding consumer behavior and knowing customers is never a simple job because consumer behavior is dynamic, constantly changing and evolving (Campo et al., 2016). This means that many statements about consumer behavior will probably become inappropriate, similar to fashion, with the change in concepts and social conditions. It is necessary to know what consumers think (perception), what they feel (impressions) and what they do (conduct); which are the things and places that influence or are influenced by what they think, feel and do (the environment). Not only can thoughts and emotions give the value of behavior, but behavior itself leads to related behavior (Biswas et al., 2014). Indeed, emotional intelligence equips the employee with the attitude needed for a customer service position.

RESEARCH METHODOLOGY

The primary data of this research were gathered from a questionnaire distributed online for the multi-functional platform designed to optimize diagnostic and decision making methods in medical services in Romania. - PROMED. The questionnaire was pre-tested and revised to ensure reliability. Apart from respondents' personal information that are measured by a categorical scale, the main questionnaire contains 9 items that are measured by a 5-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree). It is by design to minimize the total number of items for encouraging the willingness of responses.

The experiment was conducted from April 2017 until December 2017. A total of 850 valid returns were obtained from the 1,000 distributions, representing 85% response rate. From 850 valid returns, Table 1 illustrates the sample's demographics. Majority of the respondents are female, at 68.47% ($n = 582$). By age, 52.35% ($n = 445$) of the respondents are between 31 and 40 years old. By marital status, 68.82% ($n = 585$) of the respondents are married. Females tend to be more willing to participate in the survey and mailing questionnaires back.

Then, collected data were analyzed using SPSS 20.0 statistical software for Windows. After performing factor analysis to identify the attitude of Romanian consumers towards online health service quality, demographic differences were examined through one-way analysis of variance (ANOVA). In the next stage, in order to confirm questionnaire reliability, its internal consistency was measured by Cronbach alpha. The alpha coefficient of each item indicates appropriate reliability of the instrument. Thus, it was revealed that the questions are internally homogenous, that is, they measure one common construct.

According to the results obtained Mean ratings of the 9-item scale are presented in Table 2. Among them, Q_6 : "Using online health service suits my living environment" received the highest mean, at $M = 5.66$ and Q_8 : "It is more beneficial for patients make use of online health information" ($M = 5.46$). On the other end of the spectrum, the lowest mean was found in Q_2 : "Help is available if I have problems in using online health service" ($M = 3.24$), followed by Q_1 : "I consciously try to choose online health service because they are easy to access" ($M = 3.31$), and Q_3 : "I believe online health service provides me complete health information" ($M = 3.70$). It is interesting to note that the standard deviation (SD) is higher among items with the lower mean (i.e. Q_1 : $M = 3.31$, $SD = 1.513$; Q_2 : $M = 3.24$, $SD = 1.616$; Q_3 : $M = 3.70$, $SD = 1.534$). Conversely, items receiving higher mean tend to have lower standard deviation

Table 1. Demographic characteristics of the respondents

Demographics	Number	Percentage
Gender		
Male	268	31.53
Female	582	68.47
Age		
18 to 30	92	10.82
31 to 40	445	52.35
41 to 50	297	34.94
Over 50	16	1.89
Marital status		
Single	233	27.41
Married	585	68.82
Divorced/Widowed	32	3.77
Education		
High school or less	32	3.76
Junior college	81	9.53
College	298	35.06
Post graduate	439	51.65

(i.e. Q_6 : $M = 5.66$, $SD = 1.233$). The phenomenon implies that the respondents tend to agree in unison on items that receive higher mean.

The nine attributes of “online health service” analysed are presented in Table 3. The first identified attribute can be attributed to “Social Influence”, which is explained by 20.317% of the total variance with an eigenvalue of 2.862. The second online health service attribute, “Behavioural Intention”, accounts 20.415% of the total variance with an eigenvalue of 2.814. The last attribute, “Facilitating Conditions”, explains 18.417% of the total variance with an eigenvalue of 2.578. The Cronbach’s alpha (α) across

Table 2. Measurement of online health service attributes

Items of measurement	Mean	SD
Q_1 . I consciously try to choose online health service because they are easy to access	3.31	1.513
Q_2 . Help is available if I have problems in using online health service	3.24	1.616
Q_3 . I believe online health service provides me complete health information	3.70	1.534
Q_4 . People who are important to me think that I should use online health service	5.19	1.479
Q_5 . I prefer use the Internet to look for health information	5.17	1.274
Q_6 . Using online health service suits my living environment	5.66	1.233
Q_7 . I believe it is worthwhile for me to solve my health problem using health IT	4.98	1.445
Q_8 . It is more beneficial for patients make use of online health information	5.46	1.357
Q_9 . I systematically choose the online health service to protect my privacy	5.12	1.393

Table 3. The key Statistics

Online health service attributes	Factor loadings		
	1	2	3
Factor 1: Social Influence ($M = 5.172$)			
Q ₄ . People who are important to me think that I should use online health service	.849		
Q ₅ . I prefer use the Internet to look for health information	.836		
Q ₈ . It is more beneficial for patients make use of online health information	.705		
Factor 2: Behavioural Intention ($M = 5.272$)			
Q ₇ . I believe it is worthwhile for me to solve my health problem using health IT		.808	
Q ₃ . I believe online health service provides me complete health information		.742	
Q ₉ . I systematically choose the online health service to protect my privacy		.740	
Factor 3: Facilitating Conditions ($M = 3.442$)			
Q ₆ . Using online health service suits my living environment			.851
Q ₁ . I consciously try to choose online health service because they are easy to access			.759
Q ₂ . Help is available if I have problems in using online health service			.741
Eigenvalues	2.862	2.814	2.578
Cronbach's alpha	.872	.881	.874
Variance (%)	20.317	20.145	18.417
Cumulative variance (%)	20.317	40.462	58.575

these three attributes ranged from .872 to .881, indicating adequate consistency. The factor loadings (λ) ranged from .705 to .851 across all items.

According to the findings of the present study, owners of online health information must understand the importance of designing a website which inspires pleasant emotions of online health service users, directs their occasional feelings, and satisfies them with interaction with the website.

DISCUSSION

In health services, due to their characteristics, demand has to be seen from two points of view, namely the consumer / patient and the provider. The client / patient's point of view regarding the demand for health services may differ from that of the physician because: a) the consumer / patient has a less "scientific" perception of the disease, its causality, its evolution and its treatment ; b) the consumer / patient only partially knows the characteristics of a particular disease because the diseases are scientifically defined; c) for the consumer / patient, the period is limited in time because it emphasizes the current manifestations of the disease rather than its subsequent consequences; d) the consumer / patient is more concerned about the impact of the illness in terms of discomfort and interference with the activities of a normal lifestyle as defined by its place in society. However, knowledge of consumers' needs and their image regarding health services are not sufficient unless accompanied by a number of specific strategies at the level of the organizations in the field.

For businesses, this study has implications that go beyond the simple fact of making consumers choose a health service. Once involved with emotional intelligence, managers can gamble from sensing customer preferences and motivations to engaging enough to communicate clients / patients to a posi-

tive state. As it can be seen from the results of this study, there is no miraculous recipe for the success of the interaction, but if certain empathy manifests, there will be an economic and emotional gain. And if emotions are so contagious, any organization that provides online health services needs to remember that it can improve its performance.

SOLUTIONS AND RECOMMENDATIONS

This study systematically examines whether the online health service quality of the health system can influence the behavioral intention of customers by providing them the satisfaction expected from such alternate reliably service. As such, the takeaway for the health care institutions will be to adopt or improve these qualities of their online health services in order to achieve customer satisfaction and thereby, result in an increased growth rate in the use of health IT services in Romania. Also, the health care institutions should actively inform their customers about the processes and time needed for certain services under the online health system in order to ensure quality information.

Furthermore, the results of this study claims that respondents who expect less effort input in the service consuming process are more likely to show positive attitude in embracing the concept of online health services. Along the same line, facilitating conditions is found to be yet another determinant that can influence respondents' behavioral intention and use of online health services. Facilitating conditions generally tend to be the wide availability of computers, strong mobile networks and fast internet services in the context of Romania. The findings from this research generally supports the results of various recent studies in the field of health IT service quality like Rains (2007) and Shahab et al. (2014).

Implementation of health IT system might be a long-term project, but the fairly positive perception and an equally positive attitude of customers towards such services clearly paves the way of a higher rate of adoption of online health services in Romania.

FUTURE RESEARCH DIRECTIONS

Through the goals set, this chapter has touched its target. The presented and analyzed issues are a synthesized part of the vast amount of information that has been developed by the authors to create the framework for understanding Romanian customers' satisfaction of online health information. Therefore, there are new directions of future research such as:

- § Use technology to generate statistics and management indicators to better measure and plan care;
- § Incorporating safety screening into patient portal-based surveys that are keyed to emergency department visits, hospital discharge, or office encounters;
- § Analyzing and interpreting the dilemma situations faced by online health services from the former socialist countries that have not been analyzed in this chapter.

CONCLUSION

In order to explain the behavior of the online health consumer, it is not enough just to study the behavior of the healthcare consumer, but also the relationship between medical staff - especially the doctor - and

the consumer as the main determinant of his behavior and consumption. The significance of this relationship is extremely important for online health services because the creation and delivery of services and their quality depend to a large extent on the relationship between the two. Medical staff can help improve this relationship by constantly informing the consumer through a realistic picture of the illness and the judicious use of the possibilities and resources available to the consumer.

The nature of the relationship between the doctor and the patient does not fall within certain limits, it is always problematic and can be affected by conflicting views and attitudes and a number of communication difficulties. Thus, in the physician-patient relationship, two types of behaviors appeared: the social or social behavior developed within the community and the personal behavior, which manifests according to the nature of each of the two participants in the process of performance. For all that, despite a significant number of initiatives in Romania related to online health information, lack of interoperability remains one of the major challenges in implementing successful health IT systems.

At the same time, the emotional intelligence exerts a major role in organizational culture when managers are willing to affect an appreciable share of their time for employee communication and training as regards managerial philosophy and the set of core values of the firm and consequently are aware of their role on which they have in their firm, not only at formal but also informal level.

In this regard, suppliers of online health information are making efforts to change the optics of approaching business, moving to consumer orientation. Beside on the results of this study we can say that the Romanian health IT is a growing business.

Like most empirical research, this study has several limitations. First, the conclusions drawn from this study are based solely on the users of the PROMED platform. Second, the study can be more constructs characterizing online health services or moderator effects like that of age, gender, recognition of benefits, engagement readiness of doctor, etc. that can be added in the research model to enhance the understanding of service qualities that customers expect from online health information.

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KEY TERMS AND DEFINITIONS

Benchmarking: A technique for determining competitive advantages and learning about products, services, own operations, by comparing with the best.

Emotional Intelligence: The ability to understand and manage emotions of the client and can make the difference in whether the customer decides to come back to the online health services.

Motivation: Is a problem of temperament: on one hand, we will always meet individuals that are more passionate than others, who are more dedicated to their work, and on the other hand, there are methods likely to contribute to changes in attitude towards work, decisive, both for the success of the individuals in organizations, and for the organization's success on the market..

Online Health Service: The utility obtained by the consumer as a result of interdependent activities based on the client-client relationship and which materialize in a physical, mental and social welfare.

Organization: A system, which includes employers and employees aiming at achieving common objectives.

Organizational Culture: Values and behaviors that contribute to creating a social and psychological environment of an organization.

Performance: The ability of an organization to exploit its environment to access scarce resources.

When Do Working Consumers Become Prosumers?

Exploring Prosumer Characteristics for Organizational Value Creation Strategies

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INTRODUCTION

Recent debates have outlined a substantial movement from an organizational dyad to a triad (Gabriel, Korczynski, & Rieder, 2015). The dominant organizational characters, namely the manager and the worker, behold a newcomer, the consumer. Thus, the sphere of consumption is modified and new terms emerge (Fontenelle, 2015). Concepts like the ‘working consumer’ (Cova, Dalli & Zwick, 2011), ‘consum-actor’, ‘post-consumer’ (Firat & Dholakia, 2006) or even ‘prosumer’ (Cova & Cova 2012; Ritzer & Jurgenson, 2010; Toffler 1980) are blurring the producer and consumer spheres (Cochoy, 2014), without significant delimitation between them.

Working consumers are consumers reconsidered as workers (Cova, Pace, & Skålén (2015), or even ‘partial employees’ (Mills & Morris, 1986), enrolled for their competencies, either intellectually or physically, with the final scope of consumer exploitation (Arvidsson, 2005). Even if Cochoy (2014) argues that the work of the consumer is not necessarily seen as a chore and depending on the context, it does not automatically transform him/her into a worker; the term ‘working consumers’ is often associated with self-service activities, where consumers work is needed at the end of the production chain.

Prosumers on the other hand, are seen not only as participants in the co-creation of value (providing work in the last stages of production) but active designers of product and service experiences (Chandler & Chen, 2015). Giannopoulou, Gryszkiewicz and Barlatier (2014) even argue that prosumer participation in the co-creation of value can change the structure and boundaries of service configuration and design. Pitt, Watson, Berthon, Wynn and Zinkhan (2006) and Xie, Bagozzi and Troye (2008) state the fact that prosumption is different than mere customer participation in firm service, delimiting working consumers from prosumers.

BACKGROUND

In the last decade there has been a growing academic interest in different forms of prosumer collaboration (Cova, Kozinets & Shankar, 2007). In practice, prosumers have been associated with value added activities in corporate environments or governmental spheres. Prosumers have the power to create value for themselves and for their peers, but especially for businesses in an open innovation approach

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(Chesbrough, 2003). Thus, they are becoming an extremely important external partner in delivering added value in a competitive environment. Kotler (1986) argues that managers together with marketing specialists should look for opportunities to facilitate prosumption activities. Companies are motivated to involve prosumers in product or service design at any stage due to several benefits: reduced risk and customer satisfaction (Cova et al., 2011), development of products that match and satisfy customers' needs (Enkel, Perez-Freije & Gassmann, 2005), the design, improvement and marketing promotion of new services (Sigala, 2012).

But we merely have some definitions and guidance for prosumer behavior. How can organizations increase their participation? Knowing prosumers' relevant characteristics will help managers engage them effectively in pursuit of the benefits listed above. In this line of reasoning, the present paper aims to provide a thorough conceptualization of prosumer characteristics in the co-creation context of organizational studies.

The present study seeks to understand how prosumers behave and what makes them co-create alongside companies. Denegri-Knott (2006) suggested that an increased control, information availability, aggregation and participation are triggering consumer power on the web. Gamble and Gilmore (2013) consider that co-creational marketing depends on the degree of consumer control and involvement. But studies of prosumer behaviour and triggering factors are scarce. Thus, our purpose is to uncover the characteristics which make consumers become prosumers and co-create valuable outcomes. With this purpose in mind we have developed the following research questions:

- What is the motivation for prosumption?
- What enables people to prosume?
- Which are the dominant prosumer characteristics companies must take into consideration when designing new co-creative strategies?

The research questions are designed to extend current theoretical frameworks using a theory building qualitative research approach with a high importance for management theory and practice. Because grounded theory (GT) is best used in the absence of hypotheses (Thornberg, 2012), the authors have chosen to use this approach to investigate the characteristics of prosumption.

The objective of this study is to advance the prosumer concept and the co-creational strategies as to enable managers to develop a prosumer-oriented relationship with their customers (Izvercian & Seran, 2013) in a natural pursuit of market position and marketing management advantages.

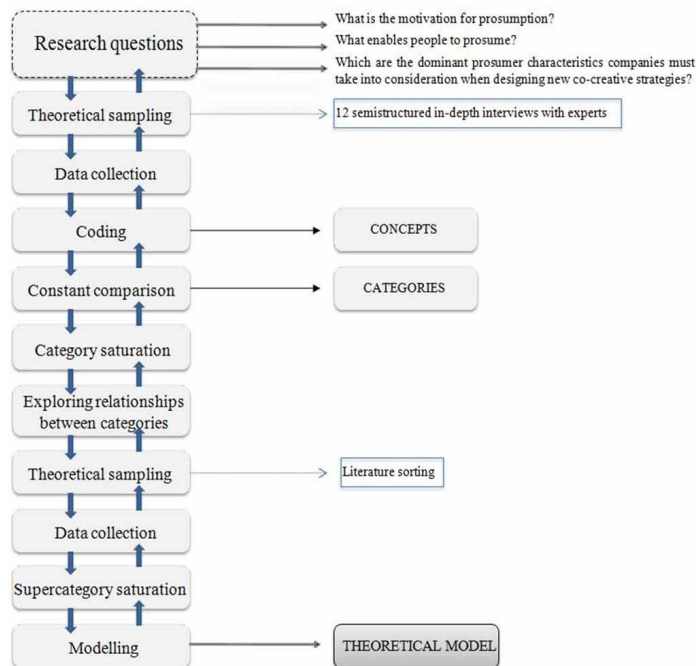
FOCUS OF THE ARTICLE

Grounded Theory Methodology – Prosumer Characteristics Analysis

Grounded theory (GT), originally developed by the sociologists Glaser and Strauss (1967) and defined as the discovery of theory from data, offers systematic and at the same time flexible guidelines for data collection and analysis to construct theories that consist of abstract conceptualizations of substantive problems that people experience. Accordingly, the present research proposes to identify and analyse prosumer abilities, scope and generic behaviour patterns to better understand the “why” and “how” prosumption takes place.

As the theory-building process occurs via recursive cycling among the case data, emerging theory, and later extant literature (Eisenhardt & Graebner, 2007), GT is built upon two key concepts (Suddaby, 2006): constant comparison (no separation between data collection and analysis) and theoretical sampling (envisages decisions about which data to collect by on-going interpretation of data and emerging conceptual categories). Bryman and Bell (2007) consider the constant comparison and theoretical sampling together with coding (whereby data is broken down into component parts which are given names) and theoretical saturation, the most important tools of GT. These stages of continuous data sampling and data analysis are detailed in Figure 1 which represents the theoretical process of grounded theory development regarding prosumer characteristics.

Figure 1.



Because theory-building research using cases typically answers research questions that address “how” and “why” in unexplored research areas particularly well (Edmondson & McManus, 2007), we have chosen multiple cases for the likelihood that they will offer theoretical insight and better ground the theory (Eisenhardt & Graebner, 2007).

Due to the fact that the prosumer concept is not yet debated by the public, remaining a topic in the research area of experts, we need to find highly knowledgeable informants who share critical similarities related to our research questions. Thus, for the first theoretical sampling step, a representative homogenous sample of experts from Delft University of Technology were chosen with ages ranging from 28 till 62, both male and female, with 3 to 20 years of experience in research, who view the focal phenomenon from diverse perspectives because they use the prosumer concept in different areas of research (energy, large scale distributed systems, educational games and simulation gaming, system engineering of infrastructures, crisis management, learning organizations, computer science). They research the subject and use the prosumer concept in their projects.

Saturation of the categories has been reached after 12 interviews with 20 hours of observation.

Research based on qualitative interviews contributes to conceptual and theoretical knowledge advancement. From Bryman and Bell (2007)'s major types of interviews, we have chosen the semi-structured interview because it offers the possibility of an a priori organization of the proposed subjects for discussion and the liberty to detect topics and in-depth details based on the respondent's ideas and observations.

The interview guide was built upon 14 open questions, starting with introductory questions about professional area of expertise, projects and interests (for contextualizing their next answers) followed by specific, direct and projective questions regarding the prosumer concept.

The interviews have been placed over a period of three months, in which the interviewees were contacted by e-mail and asked if they are interested to schedule a meeting inside their university, at their workplace (main office or discussion room). The specific location has been chosen because the experts needed to remain in the physical context of their organizational role and therefore focused on their research and professional opinion. The discussions have been tape recorded with the permission of each interviewee to assure a thorough examination of the data in the analysis phase. Each interview recording was fully transcribed for data analysis.

The data coding process for the in-depth interviews with experts was a constant comparison between the theory under construction and theoretically sampling cases. Data from interview notes and transcriptions has been conceptualized line by line, segment by segment, while the particular iterative phenomena in the text has been temporary labeled.

The process of coding has been accomplished by a sequence of coding steps (Strauss & Corbin, 1990): open coding (labels and categorizes phenomena, grouping concepts at an abstract level), axial coding (develops main categories and their sub-categories) and selective coding (integrates the categories to form the initial theoretical framework).

The analysis started with the chronologic order of the interview data and the retrieved codes have been numbered sequentially, adding new codes with each interview data analysis. Because the codes are always changing to fit the right data, the constant comparison of data has been used to find similarities and differences between them. Clusters of initial codes have been formed till basic categories emerged.

In this analysis stage for each case study (transcribed interview) a memo has been established. Memos are concisely written reports of the case study analysis. They work like a set of ideas written in a bank of concepts and relations between concepts, which will furthermore lead towards a written theory.

The open coding phase comprises a total number of 12 memos which contain 417 concepts. It continues with an axial coding stage where initial codes have been explored to reveal which of them best cover the ideas drawn from collected data. Therefore, the complex codes are raised at a conceptual preliminary category level. For the formation of categories two main criteria have been taken into consideration (Van Staaldin, 2012): clarity (the main theme of a category must be clearly stated even from the title and must emerge from its associated key-words) and distinction (categories must be different from one another to avoid confusion). Each category has specific notes for the ease in its further analysis.

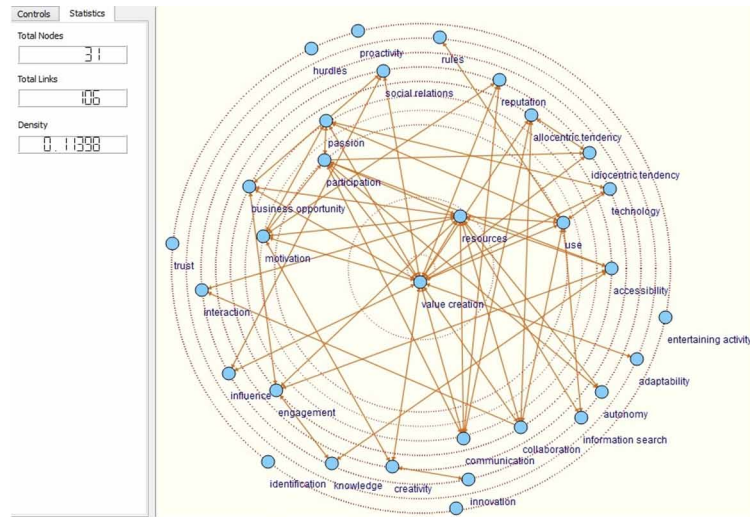
The constant comparison process continued until all possible categories have been concluded.

The category notes have been completed with properties and dimensions for each category. Properties have been established according to associated key-words, unlike dimensions in which attached concepts have been used to ascertain the qualitative extent of properties. In conclusion, the axial coding phase comprises 31 categories based on 401 of the concepts retrieved from the open coding phase, 16 concepts have been abandoned due to lack of relevance for the present study.

The selective coding represents the last step towards a first sketch of the theoretical model of prosumer characteristics. It explores the relations between categories in the search of the core category to which all

the codes will furthermore relate to. For this reason, the open access SocNetV tool (Kalamaras, 2010) has been used. It enables a visual understanding of the strong relations between the 31 already chosen categories (Figure 2).

Figure 2.



Findings

From Figure 2 we can easily see the core variable “value creation” which has the strongest links with the majority of other categories. The next strong category is represented by “resources”. Therefore, the main prosumer characteristics are envisaged by these two key-words which can be translated into production of value (value creation) through the consumption of resources. Based on the 31 categories, the relations between them and the analysis observations, a hierarchy of the most important categories has been realized together with their distribution in six specific groups called ‘super categories’ (Table 1).

Table 1. Super categories formed based on initial categories

Super categories Initial categories	Creative potential	Motivation	Social interaction	Engagement	Used resources	Objective
1	adaptability	entertaining activities	collaboration	accessibility	search for information	business opportunity
2	awareness	motivation	communication	autonomy	rules	allocentric tendency
3	value creation	passion	influence	trust	resources	idiocentric tendency
4	creativity	reputation	social relations	identification	technology	
5	knowledge		interaction	participation	use	
6	innovation			hurdles		
7				proactivity		

The value creation category represents the core category and it is included in the most representative super category of the research, which encapsulates the most relevant prosumer feature, his or her *creative potential*. Without this feature, prosumption would not be possible. This creative potential is typical for a flexible person, aware of his or her potential and creativity level, capable of using accumulated knowledge for value creation. Innovation is a final feature, the result of the creative potential, which offers the most important competitive advantage in the market. But without *motivation*, prosumers would not act. It comprises entertaining activities, passion and reputation.

Prosumers are compelled to interact in the majority of their activities, and *social interaction* is one of their distinctive traits. Proactive prosumers are living for the purpose of influencing others being also affected by the social relations they develop through collaboration and communication. Their *engagement* takes place only if the respective activity allows access, the desired autonomy and develops trust. The feature known as *proactive* facilitates engagement due to personal initiative. Prosumer participation can suffer from hurdles if there is a need for anonymity or a lack of some of the features listed before.

We cannot talk about engagement if there are no *resources* for the prosumer to use. If the creative potential means production, the use of resources designates consumption. These two concepts are complementing each other. Prosumers are engaged through their search for information and use of technology. Rules are also important, even if they refer to system rules of security or the rules which define responsibilities in consumption.

The objective through which the prosumer realizes different activities can be oriented towards the commercial sphere becoming a business opportunity, towards satisfying personal wishes and needs (idocentric tendency) or towards helping others (allocentric tendency).

Table 2. Literature findings regarding the prosumer concept

Authors	Findings
Toffler (1980)	- a prosumer is a person that <i>creates</i> goods, services or experiences for his <i>own use or satisfaction</i>, rather than for sale or exchange - the prosumer is a person who <i>produces</i> and <i>consumes</i> his own output
Kotler (1986)	- the prosumer is an individual that <i>produces</i> many of his <i>own</i> goods - prosumers are <i>another market segment</i> for which specialists will need to develop new opportunities and research tools
Tapscott and Williams (2008)	- true prosumption entails deeper and earlier <i>engagement</i> in design processes and products that facilitate customer hacking and remixing - prosumers are able to <i>create value for everyone</i>, not just for their <i>own use</i> and they are <i>sharing</i> it globally - prosumers <i>co-innovate</i> and co-produce the products they <i>consume</i>
Humphreys and Grayson (2008)	- prosumers appear when consumers are <i>producing exchange value</i> for companies, producing a fundamental change in economic organization
Ritzer (2010); Ritzer and Jurgenson (2010)	- prosumers are seen as individuals who <i>take on tasks</i> from corporations and <i>produce</i> value in the process
Hellman (2010)	- prosumption is when we <i>make a contribution</i> in the <i>usage value</i> of a product or service for <i>own use</i>, without which the product process remains incomplete, regardless if there is or not a <i>payment</i> for his activity - the prosumer is seen as a consumer that <i>makes a contribution</i> in the usefulness of a product or service that he furthermore <i>consumes</i> therefore <i>adding</i> both work and <i>value</i> for the market

Literature Sorting and Discussions

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The study of the grounded theory approach is continued with a second theoretical sampling stage named literature sorting. Thornberg (2012) defines bibliographic analysis as a constructive method of grounded theory, which gives liberty to the researcher without forcing data. Literature sorting is left until this moment for not jeopardizing data from the start with preconceived ideas (Glaser, 1998). By comparing the emergent theory of super categories to the existing literature, the internal validity of the theory is reached. The literature review has taken into consideration the most significant scientific contributions to the prosumer concept definition (Table2).

From this literature review it can be concluded, that prosumers start as consumers who act/contribute/create (value production) due to engagement (involvement in an activity), through usage (resource consumption) for a purpose/objective (own use, others' use).

Engagement is an essential feature for prosumption because it envisages a consumer role expansion that changes consumption behaviour. If usual consumers are defined by passivity, prosumers are known as active actors in co-production. But an active role (participation/engagement) in production activities does not automatically make someone a prosumer. Engagement alone does not transform a consumer into a prosumer. In this line of reasoning, Tapscott and Williams (2008) argue that prosumption is more than customization because customization entails mixing and matching pre specified components, which limits flexibility and innovation, considering that flexibility of thought is important for innovative results.

Ritzer and Jurgenson (2010), on the other hand, associate the prosumer concept with the self-service domain. They argue that prosumers are involved consumers 'put at work' by smart companies in the end phases of the production process through self-service technologies (SSTs) or Do It Yourself (DIY) techniques, like unpaid employees. These tasks do not comprise flexibility of thought, originality or a real added value (contribution). Therefore, customization and self-service/DIY techniques are not able to offer flexibility and autonomy for prosumption to occur.

Based on the present analysis and literature sorting, the main trait that differentiates prosumers from other market segments is represented by their latent qualities and abilities that may be developed and lead to creative contribution. Without a certain amount of creativity or originality, they do not have the power to make a contribution (to add value), and the provided work is solely self-service (they remain in the consumer segment). The creativity dimension refers to the productive thinking, which is necessary for today's urge for innovation (Seran, Kolfshoten & Izvercian, 2013).

If an engaged person cannot become a prosumer without creativity, both creativity and engagement are the consequences of adequate *motivation*.

Social interaction is also seen as an important prosumer characteristic because social environment is claimed to influence both the level and the frequency of creative behaviour (Amabile, Conti, Coon, Lazenby & Herron, 1996). Tapscott and Williams (2008) argue that even the participation in an online community makes a contribution to the new digital commons, due to the fact that community members engage and support each other in solving problems and generating ideas.

The use of resources, as seen from the interview analysis, is the second must connected feature, enabling a creative output. Without the consumption of resources we cannot produce value. Therefore, the fifth major prosumer characteristic is considered to be the *use of resources*.

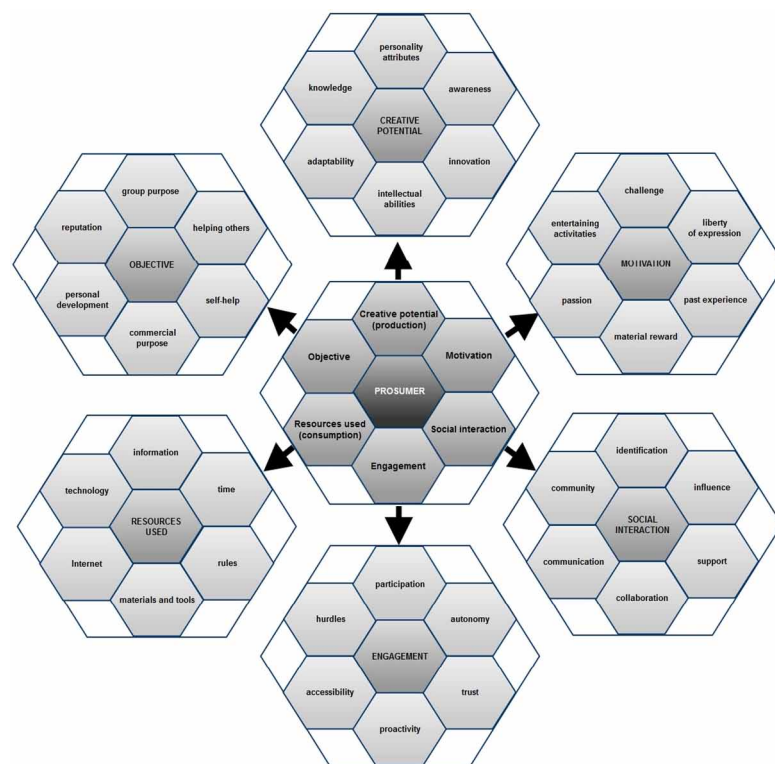
Prosumers engage due to an adequate motivational drive, create by using resources and collaborating with peers or being influenced by their social environment, but the ultimate *objective* of prosumption can differ. If the motivation for prosumption represents in the majority of cases an unconscious impulse

for engagement, a specific objective becomes a target wilful planned, an ambition toward which effort is directed.

The Prosumer Characteristics Theoretical Model

After the conceptualization of the super categories, the 31 categories have been merged and reinterpreted based on literature sorting, brainstorming and discussions. From the undertaken research, a honeycomb structure of prosumer characteristics (Figure 3) is built based on six main prosumer characteristics: creative potential, motivation, social interaction, engagement, resources used and objective, each with specific concepts.

Figure 3.



The prosumer is inserted in the middle as the starting point of the proposed model. For each main prosumer characteristic, specific honeycombs are formed. In each specific honeycomb the main prosumer characteristic is inserted in the middle to envisage that the elements it comprises organize around it. In the following, each main concept will be presented in a sub-heading with an adequate definition based on literature, a link to the prosumer concept and citations from the in-depth interviews undertaken in the qualitative research to give an example of how it was recognized as an aspect of prosumption.

The Creative Potential

Creative potential, according to Kristensson, Gustafsson and Archer (2004), is the ability to generate creative ideas defined as original (new), valuable (solve a perceived problem) and realizable (can be transformed into a commercial product). They also agree that customers should be thought of as a valuable source to initiate exploitable ideas. Izvercian and Seran (2013b) claim that if a customer is adequately empowered, he or she is likely to become a creator of value, namely to transform into a prosumer. Therefore, creative potential, as noted in the literature sorting and discussion section of the present article, represents a main prosumer characteristic. It was also recognized as such by the expert in education and technology who stated that “I consider creativity and involvement as the essential factors for prosumption.”

Creative potential is composed by: adaptability, intellectual abilities, knowledge, specific creative personal attributes, awareness of self-competence and value creation/innovation.

Adaptability to different situations determined by flexibility of mind is considered by Dundon (2002) as a trait of a creative thinker; flexibility of thought makes the difference between a personal touch and a standard setting, an adaptive characteristic of the prosumer. In this line of reasoning, the expert in crisis management defined prosumers as “creative in handling a situation and also in using technology completely different from what it was designed for.”

The *intellectual abilities* refer to the confluence of synthetic, analytic and practical contextual abilities (Sternberg, 1999). To make a creative contribution a person needs to see problems in new ways, surpassing conventional thinking.

Knowledge is necessary to make a contribution to a field (Sternberg, 1999). It requires preliminary understanding of the field for an entrenched perspective for the purpose of moving it forward. Too much knowledge can hinder creativity due to preconceptions but also a low amount of knowledge can limit creativity due to domain gaps. The lesson learned expert explained that “this is why programming communities stay relatively small, because if you want to prosume, you have to possess extensive knowledge of programming languages.”

Creativity is also characterized by specific *personality attributes* as perseverance, self-efficacy, and willingness to overcome obstacles, to take risks and tolerate ambiguity (Sternberg, 1999), together with openness to new experiences, stand up to conventions and act in creative ways. Individuals engage into an activity when they perceive themselves as capable of doing a specific task, becoming *aware* of their competences. Ryan and Deci (2000) argue that to adopt a goal, it requires that one feels efficacious with respect to it, supporting the importance of competence awareness. The interviewed experts also argued that: “when teenagers become prosumers, they are aware of their creativity”, “the prosumer seems the perfect entrepreneur, taking risks and creatively handling difficult situations.”

Innovation represents the successful implementation of creative ideas within an organization (Amabile et al., 1996). The crisis management expert claimed that “prosumers are very creative and innovative to me, designing and using technology different than the rest.”

Motivation

Motivation involves an individual’s reasons for engaging in a task (Amabile et al., 1996). Motivation concerns the “why” of actions (Ryan & Deci, 2000), becoming critical for prosumption. Regarding the incentives for prosumption, the opinions of the interviewed experts differ. Some claimed that “financial incentives are most important”, others considered “a fun activity triggers prosumption”, all concluding that “there is no motivation to match the needs of all prosumers”. Therefore, motivation can be repre-

sented by: passion, entertaining activities, challenging activities, liberty of expression, past experience and material rewards.

We can make a distinction between intrinsic and extrinsic motivation. Intrinsic motivation reflects the natural human propensity to learn and assimilate (Ryan & Deci, 2000) and also refers to doing an activity because it is inherently interesting or enjoyable.

Passion refers to an interest in some kind of work (Amabile et al., 1996). Ritzer and Jurgenson (2010) confirm the fact that prosumers enjoy, even love what they are doing and are willing to devote long hours to it for no pay. The expert in educational games argues that “there are a lot of people that find technology interesting and start to produce, you have a lot of people that find a game interesting and then learn themselves how to program in order to mod it. So I think it depends on where your interest lies, based on that you are eager to act.”

Entertaining activities (e.g. online games which trigger addiction) can mobilize masses of consumers to transform them into prosumers. Geo-cashing is an example of an entertaining activity provided by the expert in systems engineering of infrastructure due to the fact that “it is entertaining, like the joy to solve a puzzle.”

The *challenge* of a task has the potential to trigger creativity (Amabile et al., 1996). The crowdsourcing phenomenon materializes in all kind of contests, where companies promote a competition and launch a challenge for prosumers to improve something or to find a solution for a problem they are confronted with. The majority of the interview experts argued that “the main incentive for clients to become prosumers is the product or service which is not there”, namely the need for a new one. The challenge to create the product or service you need is extremely motivating.

Liberty of expression is also known as self-expression. Multiple experts agree that prosumers want to stand out of the crowd, to share information and experience, to express their thoughts, ultimately to “make their voice heard”. The expert in education and technology argued “As a prosumer, I want to influence people and express my opinion, therefore I blog.”

Past experience determines habits or product familiarity and prior knowledge. It also refers to others’ experiences or creative results that are setting goals or aspirations that direct action (Price, Arnould, & Zinkhan, 2004). Creativity in prosumption, as the education and technology expert opinions, has a lot to do with past experience. “Once I have taken part in an activity which I did not know and everything went bad. But the second time, I could be more creative because I had experience with the tools.”

Extrinsic motivation refers to doing something because it leads to a separable outcome, an instrumental value (Ryan & Deci, 2000). *Material rewards* (coupons, money, tickets, products or free services) used alone tend to have a negative influence on creativity, but used together with intrinsic motivation, they increase creativity. The game expert argues in this direction “if I get paid to play a game, then, depending on the amount of money, I will play it. But as soon as they stop paying me and the game has not an addictive quality that engages me to play, I would probably stop.”

Social Interaction

Sigala (2012) opinions that in order to fully exploit customer creative potential we must enable customers to perceive themselves as members of a group or community and create a platform and a community environment that will be mentally stimulating, enjoyable, entertaining and a source of fun for active customers. Therefore, social interaction is composed by the following sub-elements: community, communication, collaboration, support, influence and identification.

A prosumer is not able to create without the help of others. Csikszentmihalyi (1997) estimates that creativity results from the interaction of: a culture with symbolic rules, a person who brings novelty into the symbolic domain and a field of experts who recognize and validate the innovation. The experts (*communities*) are extremely important due to the fact that, by social interactions, the creative idea is presented and validated as valuable and worth pursuing. The expert in lessons learned argues that “I used discussion forums to give and receive feedback in problematic areas or programming, I helped my community and they helped me.”

In groups, prosumers are able to *communicate*. *Collaboration* refers to working together for a purpose (Seran & Izvercian, 2014). Prosumers form communities online, share information, collaborate and swap tips, tools and product hacks (Tapscott & Williams, 2008), therefore, working together for everyone’s gain. The educational games expert has noticed that recent games are designed as a social environment, “so you can both work with other people or you can share your own achievements and experience with others. If you share your experience apparently the enjoyment of the experience becomes slightly larger or more intense.”

Support through prosumption has been widely seen on forums and the health domain is researching this particular feature for peer support in psychological and physical recovery. The *influence* element of social interaction can be understood as prosumers influence others or are being influenced by the community they belong to. The expert in simulation gaming concluded that “people have different visions and they inspire one another by collaborating.” Also, the more consumers *identify* themselves with the group, the more involved they become in the co-creation process and put greater effort into the collaborative contribution.

Engagement

As discussed earlier, engagement is a very important prosumer characteristic, a differentiating factor for prosumption in general (Izvercian & Seran, 2013b). Engagement comprises: participation, autonomy, trust, proactive behaviour, accessibility and hurdles.

Tapscott and Williams (2008) envisage the new model of prosumption formed by customers who *participate* in the creation of products in an active and on-going way. Thus, prosumption starts with participation. We use the term engagement for both participation (observable behaviour) and involvement (psychological state). Involvement becomes activated when personal needs, values or self-concept are stimulated within a given situation (Price, Arnould and Zinkhan, 2004).

Engagement is maintained by a facilitating environment. *Autonomy* refers especially to having a choice in how to play, accomplish tasks, and contribute in some form. The expert in learning organizations shared a personal engagement model in education: “the elements important in this approach are trust and autonomy which belong to the idea of participation”. *Trust* in a brand for example can be understood as the consumer tendency to believe that the specific brand can keep its promises regarding performance (Chaudhuri & Holbrook, 2001).

Proactive behaviour determines the ease in future engagement. But trust, autonomy and a proactive behaviour appear when users are given *accessibility* to an activity, product, service, tool, community or experience. The large scales distribution systems expert estimated that “by providing information to people you allow them to take decisions.” Also another expert emphasized the fact that “prosumption appeared in some domains when the technology became accessible.” Therefore, the main *hurdle* for engagement can be understood by the absence of the elements which trigger and sustain it.

Resources Used

Resource allocation to projects is directly related to the projects' creativity levels. This prosumer characteristic is formed by the following elements: materials and tools, time, technology, Internet, rules and information.

The consumption of (material or immaterial) resources in prosumption is mandatory. In the physical world we use mainly *materials and tools* to engage in an activity.

Time is also a valuable resource. Time pressure is generally associated with high creativity when it regards challenging work and not workload pressure (Amabile et al., 1996). Like one of our experts emphasized, "social networking, blogs, user reviews, I just don't have time for them. I sometimes think what I would say but I don't ever come to write about it. Prosumption is a time issue."

Technology was an important element for the interviewed experts, because it enables prosumers to actively participate in the experience, to appropriate the goods to new uses, to combine and alter the goods to create entirely new experiences.

With the rise of the *Internet* and Web 2.0, considered means of presumption by Ritzer and Jurgenson (2010), consumers are now able to produce their own content and interact with one another. As the expert in educational gaming emphasized, "the Internet provides a platform for prosumption." Ultimately, the main resource we are handling and by which we are empowered is *information*.

Objective

We become prosumers due to adequate motivation, but we continue to prosume due to the objective we are trying to achieve. Price, Arnould and Zinkhan (2004) argue that by pursuing goals, motivated people may feel interest, excitement, anxiety, passion, engagement and flow. Prosumer objectives are consistent with their subjective culture. As Triandis (1995) identified, people have two opposed tendencies for different contexts: the idiocentric (when focusing on personal goals, needs and rights) and the allocentric tendency (when prioritizing communal goals). Thus, the six objectives we have proposed can be classified into allocentric tendencies (helping others, group purpose) and idiocentric tendencies (self-help, commercial purpose, personal development and reputation).

People can gain social value from joy of group activities with persons of similar interests. We call this objective *group purpose*. But in the same time people contribute also because they desire the experience of having social ties with others. This objective is oriented towards *helping others*, and it is mostly seen in discussion forums where as the lessons learned expert argues, "people discuss programming language and help one another." But, as the educational games expert emphasized, "it depends on the person, some people actually want to *help others* and others just want to gain social status." Therefore, prosumers can have different objectives, some want to share, to contribute for the sake of others; some are oriented towards their own goals.

Self-realization or personal development is the main reason people blog, act as DJs without being paid for that, take leadership roles in online communities and engage in practices of 'prosumerism' (Tapscott & Williams, 2008). This objective motivates prosumers on the long run to learn continuously from all experiences as considered by the interviewed experts and to engage in activities which enhance a positive sense of self (Csikszentmihalyi, 1997).

The *self-help* element has a distinct purpose. It refers mainly at engaging in an activity for the final purpose to achieve the desire consumption experience or a better quality for the product/service (Kot-

ler, 1986). As several experts argued, “when you modify a game in your own spare time, you do it for yourself” and “some people participate just because they like to create things.”

The concept of *reputation* appears for a validity assessment of self. The questioned experts concluded that “ultimately everyone wants to be recognized by their contribution to a certain community or society”, and “especially in the programming world, users create, modify and contribute open source for status.”

The last possible objective of a prosumer can be oriented towards the commercial aspect of his or her work. A *commercial purpose* is typical for a category of prosumers who create not entirely for self or others to share, but also for sale (Izvercian & Seran, 2013b), because, as the computer science expert claimed, “they are as capable or even more capable as companies to design and produce useful new products.”

SOLUTIONS AND RECOMMENDATIONS

The limitations of the study emerge from the principle of contextualization of Klein and Myers (1999) due to the fact that the separate messages of the experts interviewed may be dependent on the global context of the organization they belong to. Therefore, further extended research in other research institutions focused on the prosumer concept can provide a wider generalization and strengthening of prosumer characteristics. The conclusions of the study are also limited by external validity; we cannot generalize the prosumer characteristics model for all situations, people or stimuli. But the present research is a step closer to a more thorough understanding of the prosumer trend in today’s knowledge society. Other studies on this topic envisage the construction of practical strategic steps for prosumer inclusion in corporate product or service development based on the model of prosumer characteristics.

FUTURE RESEARCH DIRECTIONS

Scholars and practitioners alike feel the need to better understand the prosumer concept and its characteristics in the broad organizational culture for an adequate management of the new active consumer generation. Based on the findings of the present article, new business trends and strategies can emerge. By addressing prosumer characteristics, organizations can design engaging information technology architecture, build marketing 4.0 strategies and collective intelligence networks, improve customer relationship management, outsource intellectual capital and promote its offer in new ways. Governmental organizations may develop open innovation platforms and scholars can use prosumer characteristics for delineating prosumer-oriented management alternatives to current management practices.

CONCLUSION

Based on observations and literature considerations, three research questions have been proposed, which, adequately answered can advance theory and practice towards the development of specific targeted strategies for co-creation. With the help of the grounded theory methodology, the main motivational drives for prosumption have been analysed. The incentives for prosumption have been classified in intrinsic and extrinsic motivational elements, each examined and explored both by a literature review and expert data. Second, it has been revealed what enables prosumers to act and contribute.

The most important prosumer characteristics have been scrutinized for an accurate model construction, with the final purpose of answering the third research question for a further development of an effective design for new prosumer-oriented co-creative strategies. The advancement of the prosumer concept through theory will ultimately lead towards prosumer management for innovative organizational and social results. The findings can be applied to a wide sphere of domains. The gaming industry needs an engaging design and a continuous communication and collaboration with users for game improvement. In this situation, the prosumer characteristics may determine new strategies and partnership ideas. The tendency for open government also needs to address prosumer characteristics for innovative projects and engaging citizen contributions. Marketing specialists use crowd sourcing contests for loyalty building and customer attraction. Social media platforms are based on prosumer co-creation. In so many contexts and industries, prosumers are key for continuous and innovative development. Therefore, by taking into consideration prosumer features, specialists can better design platforms, projects or campaigns for prosumer engagement and creative outsourcing.

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KEY TERMS AND DEFINITIONS

Co-Creation: The result of a joint creative collaboration between an organization and its customer, with benefits for both parties.

Consumer Engagement: The participation and psychological involvement of the consumer in the creation of products, experiences, or services with an organization.

Creativity: The production of something novel which is perceived as original and valuable by significant others.

Grounded Theory: A qualitative research method that builds theories from various forms of data (case studies, interviews, observations) through theoretical sampling and constant data comparison.

In-Depth Interview: A semi-structured interview based on an adaptable interview guide for information exploration.

Prosumer: A consumer who exceeds his/her role by creatively engaging and co-producing value alongside an organization or platform.

Technology: The principles and processes needed for the development of useful tools.

Eye Tracker Technology in Sports Sponsorship Research

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INTRODUCTION

Sports sponsorship is a common marketing strategy for many commercial organisations. While the objective for sponsoring a sports event can vary across companies, many companies see sponsorship as a means to raise awareness and increase profit (Fullerton, 2010; Mullin, Hardy, & Sutton, 2007; Walliser, 2003). Coupled with the large financial cost in sponsoring sports events, there has been much interest in examining the effectiveness of sports sponsorship particularly in terms of the recall rate of sponsored brands (Walliser, 2003). While it has been established that sports sponsorship is generally effective, there are still many unanswered questions in this area.

In recent years, eye trackers have been employed to provide deeper insights in sports sponsorship research. While the use of eye trackers is established in other research areas, its use in sports sponsorship research is still relatively new. The aim of this paper is to provide an overview of the potential contributions and methodological challenges in the use of eye trackers in sports sponsorship research. The paper will conclude with a discussion on the future directions of sports sponsorship research using other technologies.

BACKGROUND

Many research studies in sports sponsorship have focused on whether spectators are able to recall the sponsors after watching an event (Chadwick & Thwaites, 2005; Cornwell & Humphreys, 2013; Meenaghan & O'Sullivan, 2013; Walliser, 2003). As spectators of sports events are exposed to sponsors at the sporting venues for a prolonged period of time, it is not unexpected that spectators will be able to recall sponsors (Bennett, 1999; Walliser, 2003). Research across many sports including American football (Moore, Pickett, & Grove, 1999; Newell, Henderson, & Wu, 2001), basketball (Maxwell & Lough, 2009; Turley & Shannon, 2000), car racing (Kinney, McDaniel, & DeGaris, 2008), cricket (Boshoff & Gerber, 2008), soccer (Bennett, 1999; Biscaia, Correia, Ross, & Rosado, 2014; Dekhil, 2010; J. H. Lee & Bang, 2005), swimming (Leng, 2017) and tennis (Herrmann, Corneille, Derbaix, Kacha, & Walliser, 2014) have largely established that sports sponsorship is effective. The proportion of respondents who correctly identifies at least one sponsor ranged from 60% of respondents (J. H. Lee & Bang, 2005; Stotlar & Johnson, 1989) to more than 85% of respondents (Biscaia et al., 2014; Moore et al., 1999; Turley & Shannon, 2000). Other studies using the mean number of correctly recalled sponsors as an alternative

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measure of sponsorship effectiveness have also found that sports sponsorship can be effective (Dekhil, 2010; Kinney et al., 2008).

Such measures of sponsor recall are based on explicit memory. Explicit memory refers to the intentional and conscious effort to recollect a specific past event (Balasubramanian, Karrh, & Patwardhan, 2006; Herrmann, Walliser, & Kacha, 2011; Holden & Vanhuele, 1999; Yang, Roskos-Ewoldsen, Dinu, & Arpan, 2006). As such, spectators will need to devote cognitive resources in order to recall a sponsor as a substantial degree of mental construction is required (Johar & Pham, 1999; Walliser, 2003). It is thus not surprising that some studies have found that spectators are unable to recall sponsors (Maxwell & Lough, 2009). Mere exposure within the sports venue does not necessarily lead spectators to process the message extensively and encode it for retrieval at a later stage (Lardinoit & Derbaix, 2001). According to the Limited Capacity Model of Mediated Message Processing, spectators have limited cognitive capacity for processing information and will need to allocate cognitive resources between watching a game and processing other peripheral information (Lang, 2000). When spectators are attracted to the game, they will be less likely to attend to peripheral messages from sponsors and as a result less likely to recall sponsors.

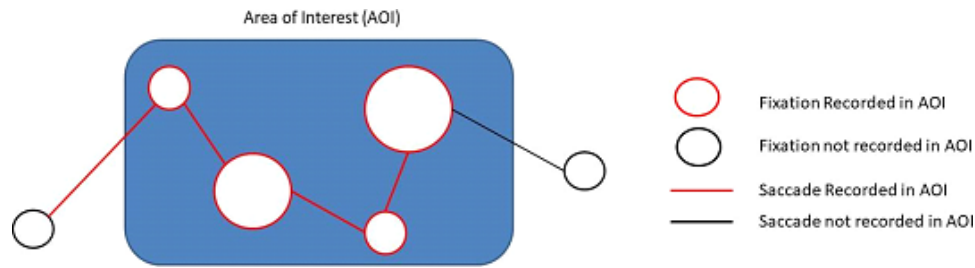
It becomes apparent that there is a need to examine the relationship between exposure and brand recall further. Eye trackers have been used in research studies in other fields including advertising and marketing communications. In such studies, the physiological responses of eye movements to advertising stimulus is examined to determine what the respondents is attracted to and how the visual stimuli becomes memory (J. Lee & Ahn, 2012; Taylor & Herbert, 2013). It is only recently that eye trackers are used in sports sponsorship studies (Breuer & Rumpf, 2012). Eye movements are typically characterised by 2 distinct components; fixations and saccades. Fixations are defined as a state where the eye is relatively still for a minimum amount of time typically for a duration of 200 to 500 milliseconds. Saccades, on the other hand, refer to quick and sharp movements, or 'jumps' of the eyes lasting around 20 to 40 milliseconds (Wedel & Pieters, 2008).

EYE TRACKER IN SPORTS SPONSORSHIP RESEARCH

The following describes a sports sponsorship study using an eye tracker to examine the relationship between glance duration and sponsor. This will serve to illustrate the potential contributions of the usage of eye trackers in this field of research.

60 respondents were recruited from a tertiary educational institution in an Asian country for the study. They were asked to watch a five-minute video clip of the FINA World Championship Shanghai 2011 50 meters men's Freestyle finals swimming event. The video clip was played on a computer desktop equipped with a 19-inch monitor, a headset and the SensoMotoric Instrument Remote Eye-tracking Device 250mobile (SMI RED250m). The SMI RED250m can track eye movement at a rate of 250 Hz with a gaze position accuracy of 0.4 degrees. By projecting an infrared light to the surface of the eye, the mini camera in the eye tracker detects the resulting corneal reflection to measure and record the position of the pupil as well as gaze direction. A nine-point calibration and four-point validation process for the participant's eye movements was carried out prior to watching the video clip. This was consistent with other studies using eye tracker (Breuer & Rumpf, 2012; Taylor & Herbert, 2013). The participants were not informed of the actual purpose of the study. This was essential so as to ensure that the participants were not primed to pay attention to the perimeter boards while watching the swimming event (Leng, 2011; Schneider & Cornwell, 2005). At the end of the video, respondents completed a survey instru-

Figure 1. Visual Depiction of Glance Duration. Adapted from *Eye Tracking Definitions: Basic Definition of Terms* by Fattahi, P (2011)



ment which collected data on the sponsor recall rate. Subsequently, participants were given a token of appreciation for their time and informed of the actual objective of the study.

The eye-movement data collected was analyzed using the BeGaze 3.5 program. To demarcate the areas for analysis, areas of interest (AOI) for each sponsor's banner were marked out using the computer software. For this study, the extent of attention of participants toward the event sponsors was measured by their glance duration toward the respective advertising boards. Glance duration is defined as the sum of all fixations and saccades between and within the AOI, including the duration of the initial saccade entering the AOI (Figure 1). This was then compared to the sponsor recall data from the questionnaire to determine the relationship between exposure and memory (Breuer & Rumpf, 2012).

The six official sponsors for the event were Nikon, Yakult, Myrtha Pools, Omega, Midea and Speedo. Each sponsor appeared on two equal sized perimeter banners along the competition pool. The mean recall rate was 2.53 (SD = .19) sponsors. Logistic regression was performed to assess the impact of glance duration on the likelihood that respondents are able to recall each sponsor. The full model was statistically significant for four of the brands: Midea (χ^2 (2, N = 60) = 6.37, $p < .05$); Omega (χ^2 (2, N = 60) = 7.23, $p < .05$); Speedo (χ^2 (2, N = 60) = 21.67, $p < .01$); Yakult (χ^2 (2, N = 60) = 26.32, $p < .01$). The models explained variance between 10.1% and 19.6% for Midea; 11.4% and 15.3% for Omega; 30.3% to 41.0% for Speedo; and 35.5% to 49.8% for Yakult. The odds ratio for glance duration across the four brands were 2.19 for Midea, 2.20 for Omega, 20.66 for Speedo and 7.76 for Yakult. This indicated that for every second increase in glance duration, the probability of sponsor recall increases between 2 to 21 times for these 4 brands.

This study shows that an eye tracker can provide additional data in understanding the effectiveness of sports sponsorship. The results show a clear relationship between exposure and memory. While this concurs with earlier research, the data from the eye tracker is able to quantify that for each second increase in glance duration, the probability of sponsor recall can increase between 2 to more than 20 times.

Table 1. Logistic regression of sport involvement and glance duration on recall of sponsor (n=60)

Brand	χ^2	p	Explained Variance	Odds Ratio
Midea	6.37	<.05	10.1-19.6%	2.19
Omega	7.23	<.05	11.4-15.3%	2.20
Speedo	21.67	<.01	30.3-41.0%	20.66
Yakult	26.32	<.01	35.5-49.8%	7.76

More importantly, the data also shows that exposure is not the only factor affecting recall. In this study, it was found that glance duration for two of the sponsors, Nikon and Myrtha Pools, did not significantly affect the likelihood that respondents are able to recall the sponsor. The variability in the explained variance and odds ratio across the four sponsors further suggests that the relationship between glance duration and sponsor recall is complex and requires further study. Rate of sponsor recall is likely to be affected by other variables besides glance duration. This was supported by earlier studies in the literature (Walliser, 2003).

METHODOLOGICAL CHALLENGES

Given that the use of an eye tracker can potentially provide more data for understanding sports sponsorship, it seems surprising that it was only recently that there is an interest in employing them for research in this area. There may be several reasons for this.

It is necessary to remember that the eye tracker can only track eye movement. As such, the researcher will need to understand if the data is relevant to the needs of the study and how to make sense of this data. In this light, it is a widely accepted belief that attention is only a precondition to other psychological and cognitive factors that take place in the brain (Wedel & Pieters, 2008). This, combined with the assumption that obtaining attention is a simple task for marketers, plays a large role in the lack of eye-tracking centered research thus far. It is possible that previous researchers in the field of sport marketing perceive a diminished role of visual attention, and thus opt to concentrate on other aspects of consumer behavior.

Another possible methodological challenge are cost-associated issues. For the study outlined in the previous section, the total cost of the equipment, which include the eye-tracking device and the associated software to run the analysis amounted to approximately \$50,000. The nature of stimuli being studied i.e. frame by frame video analysis, also requires powerful computer hardware, which makes such studies less economically viable. Without research grants or other forms of funding, it will be difficult to embark on such studies.

The third challenge is related to the time required to code and analyze eye tracking data. This issue is especially prevalent in the field of studying sports events as they are often of long duration and consist of dynamic images. As such, coding these videos, which involve the drawing of AOIs and shifting them across different frames, is extremely time consuming. For example, in the study outlined in the previous section, it took approximately one month to code a video clip of five minutes that featured six sponsors. Clearly, as the event gets longer and the number of sponsors increase, it will take more time and resources to code the AOIs.

Finally, such eye tracking studies are conducted in a laboratory setting, where there are specific conditions that participants have to adhere to when viewing the visual stimuli. This may prime the participant's attention towards certain aspects of the visual stimuli that he or she would otherwise not have paid attention to if viewing the same stimuli outside of the study. In addition, the eye tracking software used in the study described in the previous section requires participants to minimize head movement throughout the study. This may be unnatural to the participant and may cause the participant to exhibit different viewing behaviors when viewing the sport event, as compared to a more natural setting i.e. watching the event on the television at home.

SOLUTIONS AND RECOMMENDATIONS

Technological advancements in both eye tracking hardware and software have improved the practicality and ease of execution of studies in this field. Eye tracking studies in the past involved the researcher physically observing and recording an individual's eye tracking movement. This is very different from the equipment that researchers have at their disposal today. As eye-tracking technologies continue to improve, accessibility and cost will reach a point where it becomes more readily available to researchers.

Likewise, the current limitations with regard to participant constraints i.e. unnaturally still head positions and having the conduct of experiment only in a laboratory setting could also be resolved with improvements to technology. Already, there is some promising research using mobile eye trackers.

FUTURE RESEARCH DIRECTIONS

Recent studies have employed physiological instruments to measure arousal and attention as they allow for a more valid measure of the effectiveness of advertisements compared to cognitive and affective measures (Gangadharbatla, Bradley, & Wise, 2013). Future studies in sports sponsorship studies should also include physiological measures such as heart rate and skin conductance to provide additional information on the attention and arousal generated by the images of sponsors.

Eye movement data alone may only indicate exposure. The process of how exposure becomes memory suggests that more work needs to be done to examine factors such as brand familiarity, prominence of sponsors including size, colors and placement, etc and their effect on brand recall.

Sponsorship effectiveness is not only about recall. At the end of the day, sponsors require a return from their investment in sponsorship. As such, future work should also examine attitudes and purchase intention of sponsors' products and their relationship with exposure. According to Mere Exposure Theory, prolonged exposure leads to favorable attitudes towards a brand. It will be interesting to examine whether this can be generalized to the field of sports sponsorship.

CONCLUSION

The use of eye tracker can potentially shed new light in the field of sports sponsorship. Technological advancements have made eye trackers easier to use and more accessible. However, there are still several methodological challenges, mainly related to cost and time related factors. These can potentially inhibit the viability of such studies, especially in projects that involve a large number of respondents. As technologies continue to improve, it is expected that eye trackers will become less expensive and easier to use. This may allow more research studies using eye trackers to be conducted and improve the analysis of eye movement data in future.

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KEY TERMS AND DEFINITIONS

Area of Interest (AOI): The area marked out in eye tracking software that is of interest to researchers.

Eye Tracking: The measuring and recording of the eye movements of an individual.

Fixation: The state where an individual’s eye is not moving for a set amount of time.

Glance Duration: The sum of all fixations and saccades between and within the AOI, including the duration of the initial saccade entering the AOI.

Saccade: The fast and rapid movement of the eye.

Sports Event: An organized event of physical activity that is governed by rules and regulations.

Sports Sponsorship: A relationship where a sporting entity obtains financial or non-financial benefits from a commercial organization, in exchange for imaging rights to the sporting entity’s name, logo and other aspects of branding.

Section 14

Operations and Service Management

Business Process Management

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INTRODUCTION

The historical development of the business organization as well as the management theory took place in three fundamental phases. Until the 30s, the focus of the company organization was on technical problems in production and administration. At the beginning of the 80s, companies were structured into a hierarchies and processes. In this dualistic viewpoint, the focus of process was on the execution of tasks and the focus of organizational structure was on departments and positions (Krallmann et al., 2002). In the last and current phase, companies are increasingly focusing on value chains and workflows (vom Brocke & Schmiedel, 2015). Modern companies understand corporate structures as continuous procedures and value chains (Jeston & Nelis, 2010), which may also connect companies across organizational boundaries (Manuel, 2011). Instead of focusing on individual functions and optimizing individual business units, productivity and quality in seen in the overall business context and especially business processes influence the value of companies (Franz & Kirchmer, 2012).

Processes can be found in almost every company and every organization. They describe patterns (e.g., processing information) of how a company responds to events (e.g., a customer request). It has been confirmed in studies that with the optimization of processes the classical business goals like time, cost and quality can be improved (Weske, 2012).

There are many definitions of business processes. All have in common (Weske, 2012; Allweyer, 2014; Lehmann, 2012; Gadatsch, 2012) that a process consists of a sequence of activities (e.g., delivery of material, processing steps in the factory, outbound logistics). It typically has a defined start (input, trigger, e.g., a customer order) and completes with a defined end (output, e.g., automobile was provided to the customer). The result is of value to an internal or external customer (e.g., price of an automobile) and the procedure uses specific information (e.g., order data).

Some textbooks and standard works make a distinction between processes and **business processes**. The latter is characterized by two further properties (Weske 2012; Allweyer, 2014; Lehmann 2012; Gadatsch 2012). First, a business process is usually carried out with division of labor by several organizations or organizational units (for example, sales, production, logistics). Business processes are thus cross-functional. Second, the business process describes the creation of services according to the given objectives cascaded from an enterprise strategy (e.g., focus on quality leadership leads to more quality assurance steps in the process).

Business processes are understood as the set of goal-oriented operations that are carried out in several functional areas of a company and whose results are of value to a customer (Hammer & Champy, 2003). While processes generally transform a given input into an output (Schmelzer & Sesselmann, 2008), business processes always deliver a performance that is oriented towards the respective customer and generates significant added value for him/her (Allweyer, 2014).

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Business process management (BPM) is understood as an integrative concept of leadership, organization and controlling that enables control of these operations. It is also about meeting the needs of customers and other interest groups (Schmelzer & Sesselmann, 2008; vom Brocke & Schmiedel, 2015; Franz & Kirchmer, 2012).

In contrast to projects that take place only once, processes usually have multiple **instances**. This term is defined as a concrete execution of the business process. For example, the ordering from one customer of a specific car of a particular type carries individual information (e.g., color, equipment, etc.) as an instance, but follows the general model of manufacturing processes in production. The number of instances varies from process to process. Development processes can sometimes have only one process instance per year, while for example complaints or payroll processes may have thousands of instances per year (Weske, 2012).

It usually makes a difference in the definition whether a process is purely manual (e.g., hairdressing service) or at least partially automated (e.g., assignment of calls in a service center, robots in a manufacturing line). A **workflow** is defined as formally described business process that is fully or partially automated. Through a specified model, the workflow includes temporal, functional and resource-related specifications, so that an automatic control of the workflow at the operational level gets possible (Draheim, 2010).

PROCESS ORIENTATION

Process orientation describes the structuring of organizations/company design on the basis of coherent processes (Weske, 2012). This orientation in modern management can overcome challenges such as shorter product life cycles, increasing customer demands, globalization, increasing cost pressure, and information technology developments (Allweyer, 2005). It is thus becoming increasingly important in modern and digital companies.

The process orientation origins from **Business Process Reengineerings** as a findings from various consulting firms from the 90s. This concept by Hammer and Champy (2003) describes that companies need to radically rethink their procedures (processes) and should not remain thinking in the existing functions (Hammer & Champy, 2003).

Traditionally, companies differentiate between the organizational structure and the process organization. In internal and external communication, the focus is usually on so-called “work in the line”, that is the structure of departments and positions. However, since the daily work processes go beyond the functional and departmental boundaries, the orientation towards processes has central advantages (McCormack & Johnson, 2016; Becker, Kugeler & Rosemann, 2013; vom Brocke & Rosemann, 2010): The interfaces between teams and departments are well defined. Cross-functional work gets more effectively and efficiently. Through a holistic process responsibility, the roles do not only ensure the fulfillment of internal goals (e.g. the department strategy), but rather focus on the achievement of holistic specifications in the customer’s sense. Optimizing processes means focusing on value-adding activities rather than examining internal procedures of teams or departments. Through defined steps and ongoing optimization of processes, resources can be reduced and time can be saved.

Typically, there are three types of business processes (Lehmann, 2012; vom Brocke & Rosemann, 2010). **Management processes** include planning, control and controlling activities. All processes of this level serve the continuous improvement and strategic alignment. The **core processes** realize the essential business of a company. These should not be outsourced. For classic companies (e.g. from manufactur-

ing industry), these processes typically include Supply Chain Management (SCM), Product Lifecycle Management (PLM), and Customer Relationship Management (CRM). **Support processes** are often not directly visible to customers, but they make significant contributions to enable core processes (e.g., human resources, financial accounting).

In order to ensure a professional execution of processes on all levels in all domains, there are usually five roles of responsibility (Lederer, Butz & Bodendorf, 2015):

- The **Chief Process Officer** (CPO) is responsible for the entirety of all business processes of a company and establishes the holistic process orientation in the company.
- The same applies to the **process owner** who is in contrast responsible for one or more concrete processes.
- **Process managers** are usually located at a lower organizational level. They are responsible for the performance of all instances of a specific process.
- The **process team** executes the process (e.g., clerks).
- Depending on the process, **supportive roles** (e.g., modelers and auditors) can be provided.

Process Lifecycle

The different tasks of BPM can be described along the typical process lifecycle (see Figure 1) (vom Brocke & Rosemann, 2010; Weske 2012; von Rosing, van Scheel & Scheer, 2014):

- **Strategy:** A process should achieve goals that are cascaded from corporate strategy. Key figures are defined to measure process performance.
- **Modeling:** To understand how the process works, an actual and a target model are usually created. This can be based on employee statements, observations, document analyzes or digital traces (such as timestamps and actions within an IT system). Steps, tasks, documents, responsibilities and interfaces are typical entities of process models.
- **Optimization:** There are many different methods to identify optimization potentials. To increase internal efficiency, for example, it is questioned which process steps are particularly disruptive and which interfaces are not defined. To increase efficiency, tools, control flows and documents can be changed.
- **Implementation:** Good ideas for process optimization are implemented. This implementation may involve tools (e.g., other attributes, data or interfaces), teams (e.g., new departments, roles or forms of collaboration) and artefacts/documents (e.g., templates).
- **Execution:** If optimizations are implemented, the process instances can follow the new process.
- **Monitoring:** Have the goals of optimization been achieved? This is checked in the context of monitoring in various dimensions.

Strategy

Numerous indications and evidences show that business processes and also IT support (for example Enterprise Resource Planning Systems [ERP]) are only efficiently applied, when a corporate strategy was determined before (Schmelzer & Sesselmann, 2008; Allweyer, 2005) Explicitly stated strategic objectives should serve as the basis for selection of required resources, such as personnel and information systems in BPM.

Figure 1. BPM lifecycle (vom Brocke & Rosemann, 2010; von Rosing, van Scheel & Scheer, 2014)

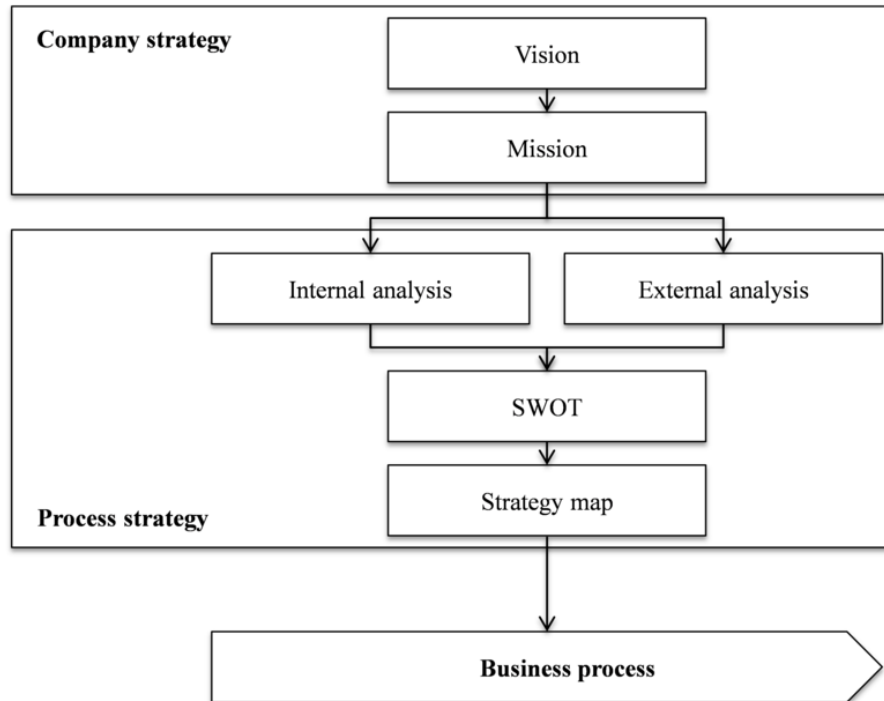
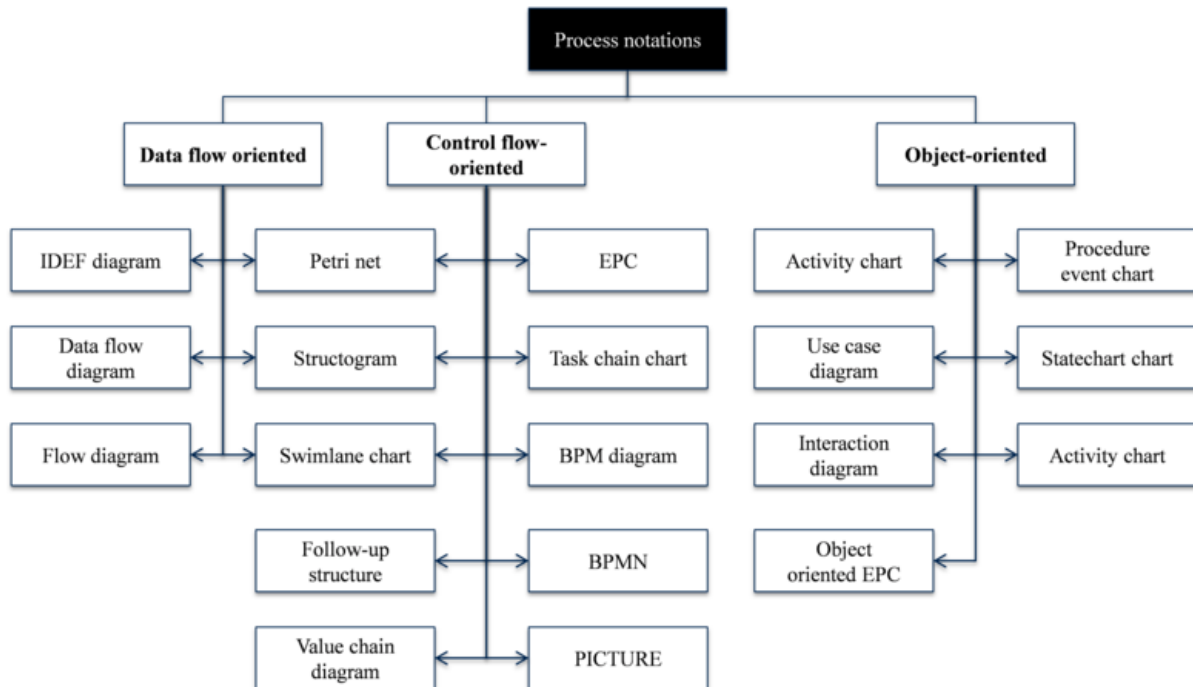


Figure 2. BPM strategy (Lederer, 2016)

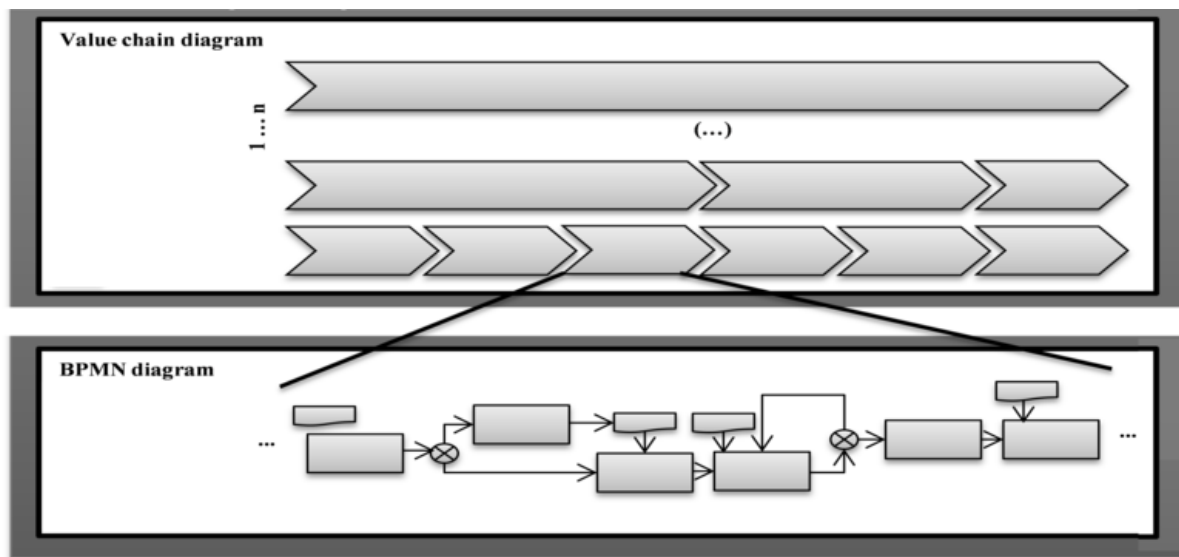


There is a variety of different methods and tools available for defining a strategy in the company. As Figure 2 shows as a general summary of many existing approaches, it is relevant for process management that individual strategic or tactical objectives are named (e.g., “High quality of service”, “Efficient handling of customer inquiries” or “High repurchase rate ” for a CRM process). This process strategy is described, for example, as a strategy map or balanced scorecard. It results from the cascaded business strategy and can be generated by combining an internal (e.g., resource analysis) and external analysis (e.g., PEST analysis) (Lederer, 2016).

Modeling

Modeling generally refers to the representation of perceptions that an individual makes of procedures in the environment (Wittges, 2005; Schmelzer & Sesselmann, 2008). Models consist of individual building blocks interacting with each other, with syntax rules and model types ensuring that the formal or semi-formal models can be used by IT systems in subsequent lifecycle phases (Wittges, 2005; vom Brocke & Schmiedel, 2015). In terms of companies and IT-based modeling of business processes, this means that the process components, such as activities, organizational units, data and events, are usually linked as symbols in terms of time and collaboration (Hansmann, 2006; Franz & Kirchmer, 2012). Depending on the desired focus (for example, detail specification for automation of a workflow vs. rough schemata of a top management discussion), different notations are used for the modeling. Gadatsch (2012) classifies available process notations according to their focus on data, control flow (i.e., activities), and objects (e.g., object-oriented programming) as a recognized division. His well-known and accepted classification is shown in Figure 3.

Figure 3. BPM modeling notations (Gadatsch 2012)

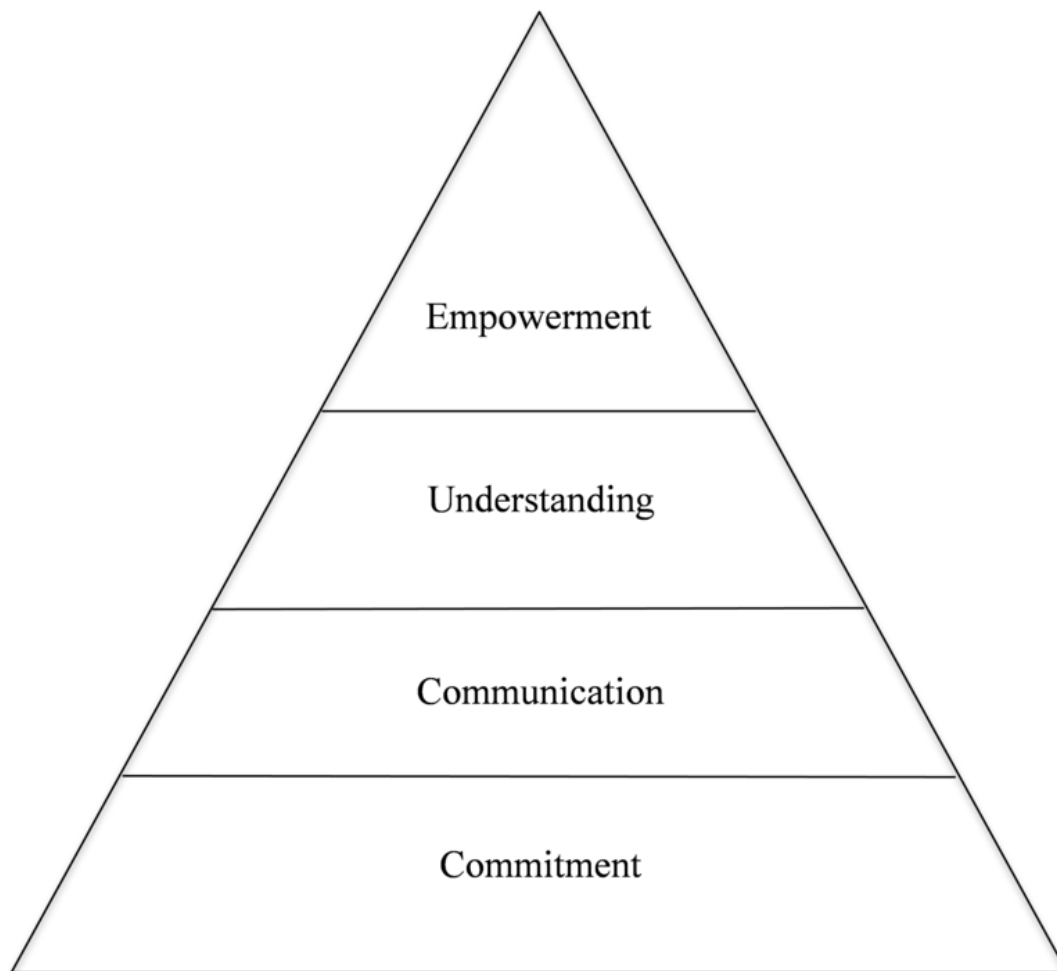


Since there are probably several hundred different notations (Lederer, Avci & Schmidt, 2017), studies come to different estimates of which notation has the widest distribution. However, it is generally accepted that in research and practice two notations are quite common.

Value chains are an extension of Porter's classic process chains. Functions (i.e., process steps) are described at a very high level of abstraction and in a purely sequential order. This representation is very intuitive and dispenses with the description of details (e.g., roles, IT systems, documents). This notation is used in particular for process maps, which serve as entry points for discussion or detailing.

Business Process Modeling and Notation (BPMN) is a graphical notation with a variety of symbols. The current standard BPMN 2.0 defines four basic types of elements: *Flow objects* are the nodes (Activity, Gateway and Event) in the diagrams and represent the actual contents like handling or checking steps. *Connecting objects* are edges in the form of sequence flows) as well as message flows. *Pools and Swimlanes* represent areas of responsibility of the roles and systems involved. *Artifacts* summarize all explanatory and supplementary elements such as groups and annotations. The main advantages of this notation are its power to visualize different procedure and flexibility as well as the possibility of digital translation. For example, diagrams can be automatically converted into machine-readable form (e.g. for workflow management systems, see later).

Figure 4. BPMN as detailed process modelling of value chain steps
(Lederer, Schott & Keppler, 2015)



The two notations described model processes at different levels of detail. Figure 4 shows in this context the possibility of detailing a PLM process chain in sub-processes with more details in BPMN.

Optimization

As part of the process analysis, business processes are assessed from the inside view of a company in order to identify room for improvement (Schmelzer & Sesselmann 2008). This is to be done before the process is implemented in the structure, teams and IT systems of a company. For example, a validation answers the question whether the established process model actually reflects reality (Richter von Hagen & Stucky 2004).

In general, processes can be analyzed to optimize according to the following criteria (Lederer et al., 2012):

- **Process costs (C1):** Process analysis methods of this category make processes more transparent in terms of their cost structure. The methods establish possible cost saving potentials in processes and identify cost drivers.
- **Process time (C2):** Methods of this category analyze processes with respect to the time dimensions in the process execution. They outline processing time, deadlines, critical paths/points and show their impact on value-adding processes and interfaces.
- **Process quality (C3):** This category describes the focus on quality of the process output, of process throughput and of the process structure.
- **Process outcomes (C4):** As one main goal a business process creates benefits to meet customer needs. Benefit represents the achievement of customer satisfaction and is analyzed in this category.
- **Process structure (C5):** This focus evaluates the process landscape of a company from an organizational and operational point of view. Analysis methods of this category show interdependencies, redundancies, and networks of processes. Moreover, these methods describe the general process orientation of the corporate structure.
- **Process information (C6):** Methods in this category analyze the supply of information, the availability of information and information transparency in the process. Moreover, the quality of information within processes can be analyzed.
- **Process communication (C7):** This focus category summarizes analysis methods outlining the efficiency and effectiveness of information exchange. Furthermore, the transmission of information within a process and across processes is examined. However, not the information itself, but the quality of the information transport is the main objective of analysis.
- **Process risks (C8):** This focus category groups risk analysis methods to identify possible process-relevant events which can have negative impacts. The most relevant aspects are the probability of these events as well as the level of impact of their consequences.
- **Process resources (C9):** Methods of this focus category look at process resources, meaning the supply and demand situation of all goods and resources necessary to execute a certain process.
- **Process flexibility (C10):** The flexibility of processes includes their temporal, spatial and functional adaptability to changing conditions.

The process analysis includes methods of performance evaluation (Richter von Hagen & Stucky, 2004). For this purpose, modern tools generally offer the possibility to compare alternative process models. At the end of the performance assessment, statements are drawn up about process models that show to

what extent a model fulfills the qualitative and quantitative process objectives compared to alternative processes or workflows (Gadatsch, 2012).

Simple and general hints for an intuitive optimization of processes are (Bleicher, 1991; Gadatsch, 2012):

- **Leaving out:** If activities are not necessary or are not rewarded by customers, they can be removed. The process becomes less prone to errors and faster.
- **Eliminating media breaks:** Media breaks (such as printing and rescanning) slow processes and unnecessarily bind resources.
- **Outsourcing:** Activities that are not core processes can be meaningfully outsourced.
- **Summarizing:** Pooling activities can create synergies and accelerate processes.
- **Parallelization:** If activities are performed in parallel rather than sequentially, the division of labor increases.
- **Relocating:** Occasionally, it makes sense to provide activities further up the workflow or even later in the process.
- **Accelerating:** By providing more resources, task completion can be optimized and waiting times can be avoided.
- **Avoiding loops:** If, for example, data is checked directly for plausibility when typing in, queries can be avoided.
- **Adding:** Adding process steps, sub-processes, e.g. for quality and result assurance, may lead to optimizations as well.

Lederer et al. (2012) show in their compilation a comprehensive picture of which concrete methods can be used to achieve which specific goals (marked with “X” in Table 1). Depending on the company’s strategy, specific methods may be applicable.

Implementation

To implement a business process and also to introduce the underlying IT tools, a roll-out strategies should be chosen, which plans the timing of new processes or process changes (Hansmann et al., 2008). The opposing implementation approaches are the “Big Bang Approach”, in which new processes or IT systems are introduced at a specific point in time throughout the entire company, and the “step-by-step approach”, in which the implementation in successive steps (Upton & Staats 2008).

In general, the implementation can relate to adjustments to teams/roles (humans) or to IT systems. Basic information on both approaches will be presented briefly (see the following sections).

Humans

Employee coordination focuses on new or changed process steps that are not automated but executed by a process team. In many cases, employees are involved in process activities and operationalize process objectives in their daily work. Employee coordination describes that process teams accept and follow the processes. Whether concepts such as open communication and individual incentives are possible and meaningful depends on many internal factors of a company (Lederer, Raake & Kurz 2014).

Figure 5 shows a maturity approach to how new processes should be introduced to process teams, as described as result of a meta-study by Lederer, Raake, & Kurz (2014).

Table 1. BPM analysis methods classified according to analysis focus categories

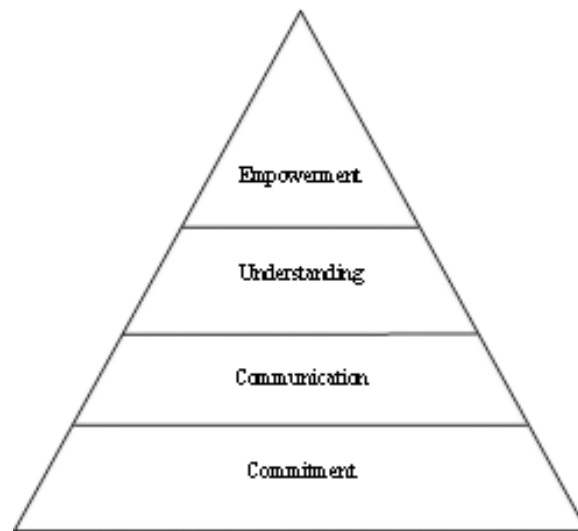
Analysis method \ Analysis focus	C ₁	C ₂	C ₃	C ₄	C ₅	C ₆	C ₇	C ₈	C ₉	C ₁₀
Critical path analysis	X	X								
Core process / core competence analysis					X					X
ABC analysis					X					
Information requirements analysis			X			X				
Communication Analysis		X				X	X			
Networking analysis					X		X			
Vulnerability analysis	X		X					X		
Cause and effect analysis			X					X		
FMEA		X	X					X		
Value analysis		X		X						
Force field analysis			X							X
Fragmentation / concentration analysis		X							X	
Runtime analysis		X								
Dependency Analysis		X	X							
Fault analysis			X					X		
Process cost analysis	X		X							
“Moments of truth” analysis				X						
“Voice of the customer” analysis				X	X					
Interface analysis		X	X							X
IT resource analysis						X	X		X	
Analysis the operational structure					X					X
Organizational structure analysis			X						X	X
Knowledge-centered process analysis			X			X	X			
Quality cost analysis	X		X							
Portfolio analysis				X	X					
Process potential analysis			X	X	X				X	
Process environment analysis					X			X		
Process-oriented SWOT Analysis				X				X		
Cost Benchmarking	X									

(Lederer et al., 2012)

Commitment means that the process manager is committed to the goals and new processes. This self-commitment is important at an early stage and an essential foundation for further steps in employee motivation (Harber, 1998). Lacking this foundation often results in disrespect or misunderstanding of the strategic objectives (Kaplan and Norton 2001, Blackall 2007).

In recent years, **communication** and knowledge has become a core resource of organizations and can have a significant impact on the overall success of process management. Process teams, for example, need knowledge about new process flows, documents, interfaces, functions, and roles after optimizing processes. The transfer of knowledge by the process manager thus follows the commitment. Functional knowledge describes specific knowledge that employees have to handle a function (such as activity in

Figure 5. Human-centric implementation steps of BPM



BPMN diagrams). They are aware of these abilities (e.g., knowledge of masks to be filled in) or implicitly carry them (e.g., presentation skills). Knowledge that is relevant for working in processes from an individual's point of view is called knowledge in processes. They include both internally described information (e.g., manuals, checklists for testing activities, etc.) and external knowledge (e.g., methodology, best practices, etc.). Knowledge about processes describes knowledge about the organization of a process (e.g., process steps and resources).

Building **understanding** of new processes in the process team follows the commitment and communication of concrete content. Understanding means that the process team is motivated for processes, has relevant information, and now gathers experience in dealing with it. The understanding of the objectives and the processes are important for the overall success.

Empowerment stands for the highest level of motivation and support of process teams. It describes the ability and will of process teams, objectives, and theirs

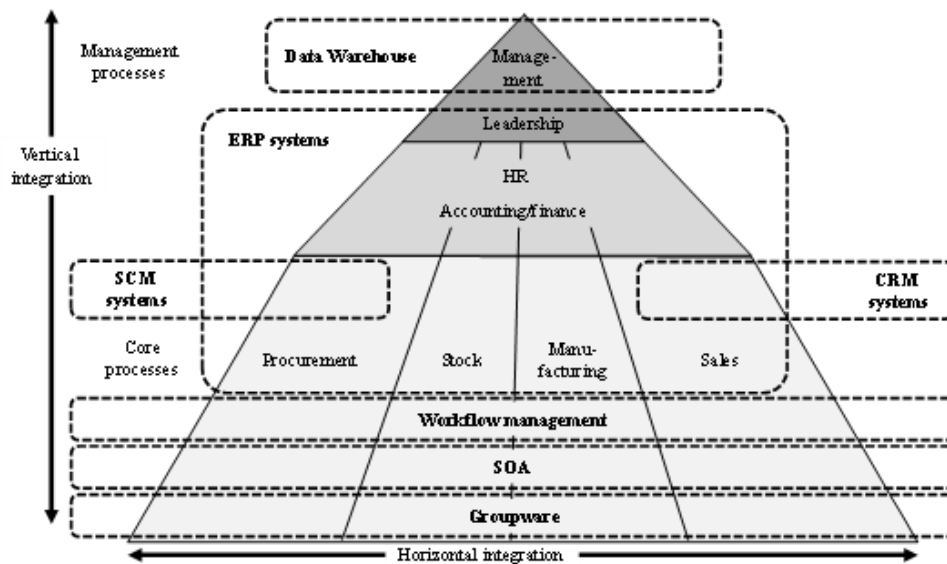
Operationalization. Empowerment characterizes a shift in power away from the managers to the employees (Hammer, Champy & Künzel, 1994), because without an overview of the entire process and its environment, employees entrusted with executive activities cannot shape their business processes (Kurz & Hartmann, 2011). This aspect is reiterated in the last section of the post with Social BPM.

IT-Systems

This article is not intended to depict specific manufacturers or tools. Rather, different classes of IT systems will be explained using the integration pyramid (see Figure 6). All of these typically support automated or semi-automated process management. In the modern IT landscape, data, functions and methods are integrated along the value chain (horizontally) and across the various management levels (vertical). Depending on whether operational or strategic views on processes are necessary, different IT system classes are used.

In addition to many modeling and visualization tools (from simple as Powerpoint to complex CASE tools), there are six key IT classes, shown in Figure 6. Depending on the hierarchical level and degree of vertical or horizontal integration the following classes can be distinguished:

Figure 6. IT tools supporting BPM classified in the integration pyramid of an organization



- **Data warehouse:** Systems of this class manage data and allow rough as well as detailed data analysis. For example, a dashboard is used to interactively show a divisional manager whether the process meets key performance indicators. Various visualizations (for example as diagrams or cubes) are available, depending on the intended use.
- **ERP systems:** These systems provide the highest level of integration because they consistently manage all corporate data and operations of all processes. These powerful systems claim to define all the process-relevant information and steps in one central database. Even though many success stories of ERP systems are well known, they sometimes overwhelm companies with their holistic approach.
- **SCM/CRM systems:** These specific systems support e.g. sales, marketing, logistics or customer management. Much of these solutions are now offered as cloud software. For example, depending on the focus, these systems offer predefined sales funnel (steps from an interested party to the loyal customer) and provide very specific support for managing each step (for example, campaign monitoring, cross-channel action planning, etc.).
- **Workflow management:** If all process model contents can be modeled in standard procedures (for example, payroll processes), they can be automated in this system class. A rule engine manages the norms of the process (e.g., when to send a request to whom) and ensures all the constraints from the process model. Unlike the previous class, these IT systems can be customized to the specific enterprise, regardless of a specific domain.
- **Service-oriented architectures:** The idea of this system class is to encapsulate all the steps (services) of a process. The overall process flow can thus be flexibly realized from a compilation of services available.
- **Groupware:** In addition to standard processes, there are also weak or unstructured processes (for example, creative phases in product development). This class of systems supports knowledge work (e.g., through authoring systems or coordination mechanisms), which follows a process model but has high degrees of freedom.

Execution

The business process execution includes all the activities of starting and controlling instances, which contains concrete data of a specific application case (Scheer 1999). In principle, the instantiation of a process model can be done either manually (e.g. by the action of a person) or automatically (e.g. within the framework of a formulated rule) (Dustdar et al., 2003).

After a business process is instantiated, it can in principle be executed manually or with IT support. In the execution, the work steps and activities of persons or IT systems designed in the process model are processed (Fischer et al., 2006). Coordination is done by the responsible manager and/or an IT system. In corporate practice, in particular process exceptions, that is, events not provided for in the process model, lead to intensive coordination.

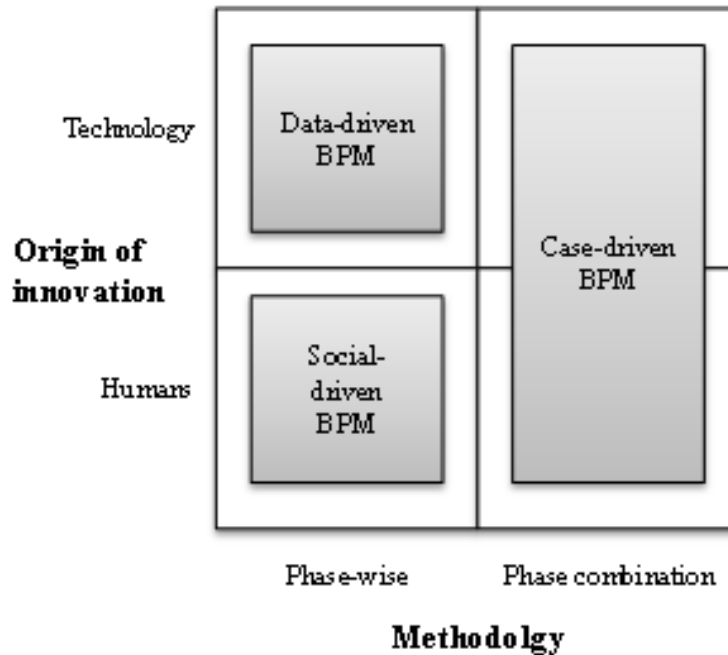
Monitoring

In addition to the operational monitoring of concrete process instances, this phase also includes strategic controlling. It includes the activities of the process documentation, the determination of key performance indicators (KPI) and their collection, as well as the implementation and control of improvement plans in response to the actual measured values. The main objective of this lifecycle phase is to increase the efficiency and effectiveness of the processes and thus of the company (Schmelzer & Sesselmann, 2008).

Starting point of almost all known monitoring approaches of BPM, such as process benchmarking, the Balanced Scorecard or cause-and-effect, is the collection of performance and key figures from processes. In contrast to the pure recording of process performance, process indicators represent the repeated and recurring measurement of certain points of interest (Köster, 2008). Geich (2001) summarizes in his review general tasks of process monitoring:

- Modern performance measures include both financial and non-financial metrics (Geich, 2001) as it often turns out in practice that not only the costs of a business process should be the focus of attention (Fischer et al., 2006).
- Since monitoring strives for well-balanced KPIs as well as a perfect match between defined operational and strategic plans, a monitoring tool must offer comparative and analyzing controlling possibilities. In this context, four essential analyzes are used in practice: (i) target/actual comparisons (e.g. information from the execution), (ii) actual comparisons (e.g. time comparisons), (iii) Analysis of deviations (e.g. weak point analysis) and (iv) procedural/ behavioral control (e.g. reconciliation of decisions).
- Although many companies currently design only a small degree of detail of their processes (Fink, 2003), the importance of increasingly stronger power level differentiation and target reconciliation at all levels of performance measurement performance will increase. As a logical consequence, the monitoring on an aggregated level (e.g. for overall processes) is needed as well as detailed evaluations (e.g. of a single activity or groups of activities within the process).
- Due to increasing stakeholder influence the preparation and presentation of key performance indicators and performance parameters is getting more important. This is due to the fact that stakeholders often have different specialist know-how and thus also often place very different interests in terms of process indicators.

Figure 7. Upcoming BPM trends (Lederer, Schott & Knapp, 2017)



Trends

The experiences with the phases of the classical lifecycle as well as the availability of new technologies result in new approaches for BPM. A compilation of modern trends should serve as closing of this contribution (Lederer, Schott & Knapp, 2017).

Based on a study by (Lederer, Schott & Knapp, 2017), it was shown that three major trends continue to enrich the BPM in the future.

Trends of the first trend (subsumed under *Social-driven BPM*) use the ideas, initiatives and experiences of the process team in procedures to gain important impulses for the BPM life cycle. Employees or customers who are active or even involved in the process execution get the power to independently identify improvement potentials. Proposals are prepared and made available by teams. Depending on the actual approach, employees/customers can only report improvements or make them directly in the process model. IT supports this further development (e.g. by virtual post-its in process models) that humans play a more important role for BPM. An explicit approach of this trend is known under the term BPM 2.0, which introduces specific approaches (e.g. tool support, role models) how unstructured or semi-structures ideas from front-line workers can be translated into process optimizations. This trend explicitly addresses the fact that process teams know best about customer needs and expectations. Their valuable input in the BPM lifecycle is used to enable process innovations. Frameworks and especially modeling notations from the trend of Subject-oriented BPM (S-BPM) have been developed to support this general development. S-BPM is no longer driven from a top-down view on processes, but to offer solutions for modeling and optimizing processes from the point of view of individual employees.

Due to the increasing automation of business processes, the presence of intelligent algorithms as well as many available sensors, data can also be used for the optimization of the processes (subsumed under *Data-driven BPM*). In this category, data consist for example of events, functions, resources and time,

relevant to analyze a process. Processes are for example increasingly supported and controlled by information systems that store events such as messages and transactions. Information systems in companies generate and collect data, which can be used, for example, by using process mining to identify, monitor and improve processes. Aspects of prediction based on data lead to the idea of Intelligent BPM. It leverages the connection of digital processes with physical objects in order to optimize business processes on a data-driven basis.

In principle, the individual approaches subsumed under the trend *Case-driven BPM* use the same sources for optimization. However, they deviate from the classic BPM lifecycle by operating business following cases instead of routine process instances. Methods of this trend use the inputs of people involved in processes as well as available data. However, in order to enable a general flexibility of procedures, certain processes instances are performed in the way of cases (Case-driven BPM). Case management is about supporting knowledge workers who require a higher degree of flexibility than it can be provided by the traditional process management. The processing of cases is originally from the medical field where procedures include both highly structured (e.g., performing an x-ray) but also very poorly structured (e.g., finding a complicated diagnosis).

CONCLUSION

Business process management already has a long tradition in organizations, because it focuses in the core on the continuous management of workflows across functional boundaries. The increasing digitalization results in numerous new starting points for optimization along the BPM life cycle, for example through simulation and automation.

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KEY TERMS AND DEFINITIONS

Business Process: Set of several activities that transform a given input in several stages into a valuable output.

Enterprise Resource Planning: IT system aiming to integrate all processes and data of a company.

Process Modelling: The mapping of procedure in a diagram.

Process Re-Engineering: Complete redesign of procedures without considering existing structures/workflows.

Social BPM: Approach to use the ideas, initiatives, and experiences of the process team in procedures to gain important impulses for the process life cycle.

Workflow: A business process that is completely or partially automated.

Artificial Neural Network in Operation Management Regarding Communication Issue

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INTRODUCTION

Communication through a proper and optimal network by meeting demand in satisfactory level is an important part of decision-making in operation management. Proper and optimal network can be defined in a significant way. The term ‘optimal’ refers to optimization of cost, use of resources, like fuel, manpower etc. ‘Proper’ signifies congestion handling. More specifically, the term ‘proper’ follows the research question “How is congestion reduced in a specific network?” Considering these facts with different motivations and contexts, various decision-making models were developed in this area. Among all these models, ANN based models play a significant role for decision-making. In this chapter, a set of ANN based models are taken into account for analysing the efficacy of ANN as a tool. All the developed ANN based models are not taken as consideration. The specific models are selected based on three following criterion:

- Revolutionary change in goal over earlier models
- Revolutionary change in technical outcome
- Introducing a real scenario in modelling

Before going to the detail of the modelling analysis, a small outline of three major wings- Travelling Sales Problem (TSP), Vehicle Routing Problem (VRP) and Transportation Problem (TP) is given in the following:

Travelling Salesman Problem (TSP)

Travelling Salesman Problem is a combinatorial optimization problem as well as it is NP hard in nature. It is equally important in the area of operation research and operation management. The basic objective

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of this problem is to identify an optimal path for a traveller among a set of cities/nodes. Optimality of network can be described in terms of cost, time, distance etc. But in generally, optimization of cost is taken into account. The crucial assumption of this problem is that each city should be covered once only. Mathematical structure of TSP model is,

$$\text{Minimize } Z = \sum_i \sum_j c_{ij} X_{ij} \quad (1)$$

Subject to

$$\sum_i X_{ij} = 1 \forall j \quad (2)$$

$$\sum_j X_{ij} = 1 \forall i \quad (3)$$

$$X_{ij} \in \{0,1\} \quad (4)$$

The list notations and corresponding significance is given below:

c_{ij} : Cost of travelling through the edge (i, j)

$$X_{ij} = \begin{cases} 1, & \text{if the edge}(i, j) \text{ is considered in optimal network} \\ 0, & \text{Otherwise} \end{cases}$$

Equation (1) denotes the objective function of TSP and that is minimization of total cost. Equations (2) and (3) ensure that each city is visited exactly once. Equation (4) represents that the only decision variable X_{ij} is binary in nature.

Transportation Problem (TP)

Transportation Problem (TP) is an optimization based problem. It is very much useful to connect the phases of supply chain. Also, it is useful to each phase of supply chain, i.e. in the cases of multiple production units, multiple retailing units, multiple warehouses etc. It is equally important to the critical issues of operation research. The objective of the problem is to minimize the transportation costs to ship goods from 'm' number of origins to 'n' number of destinations. Here, the transportation costs of goods from origins to destinations are given through a cost matrix. But there should be a balance between demand and supply of products. The LP structure of Transportation Problem is,

$$\text{Minimize } Z = \sum_i \sum_j d_{ij} X_{ij} \quad (5)$$

Subject to

$$\sum_j X_{ij} \leq S_i \quad \forall i \quad (6)$$

$$\sum_i X_{ij} = d_j \quad \forall j \quad (7)$$

$$X_{ij} \geq 0 \quad (8)$$

Here, d_{ij} represents cost of transportation of goods from i -th origin to j -th destination. Only decision variable X_{ij} is amount of goods to be transferred from i -th source to j -th destination. Objective (5) represents the minimization of cost. Constraints (6) and (7) represent the fulfillment of supply and demand of products respectively. Constraint (8) maintains feasibility condition of decision variable(s).

Vehicle Routing Problem (VRP)

Vehicle routing is also combinatorial optimization problem. It is very much realistic as well as it has wide range applications in present decade with different conditions and criterions. The objective of this problem is finding optimal set of ways for a finite set of vehicles to deliver a set of products to the customers properly. This is basically an extension of TSP. More particularly, objective function and constraints of TSP are same in VRP. Other assumptions of VRP are (i) balance between number of incoming and outgoing vehicles and (ii) capacities of vehicles must be greater than demand on each route. The particular NP hard problem is critical to handle in reality. The LP formulation of VRP is,

$$\text{Minimize } Z = \sum_i \sum_j d_{ij} X_{ij} \quad (9)$$

Subject to

$$\sum_i X_{ij} = 1 \quad \forall j \quad (10)$$

$$\sum_j X_{ij} = 1 \quad \forall i \quad (11)$$

$$\sum_i X_{i0} = K \quad (12)$$

$$\sum_j X_{0j} = K \quad (13)$$

$$\sum_i \sum_j X_{ij} \geq r(P) \quad (14)$$

$$X_{ij} \in \{0,1\} \quad (15)$$

Here, d_{ij} is cost of travelling by a single vehicle from i -th node to j -th node and the decision variable. X_{ij} determines that a particular edge is selected or not. Objective (9) represents minimization of vehicle traveling cost. Constraints (10) and (11) maintain the condition that each node is visited exactly once. Constraints (12) and (13) ensure that number of incoming and outgoing vehicles is same. Constraint (14) handles the condition that vehicle capacity on a particular path must be greater or equal to the demand of that route.

Artificial Neural Network (ANN) is a popular optimization tool in now a day. Actually different structures of Neural Network enhance the convergence of optimality in different ways. Also, in the area of operation management, decision makers can use the ANN based models for configuring the communication network corresponding to a particular firm. Among the techniques of ANN; Hopfield Network, co-adaptive network, Kohonen's network and Boltzman machines are popular most. The objective of the chapter is to develop a comprehensive analysis about the utilities of these specific neural network approaches with respect to the mentioned three fields.

Remaining parts of the chapter are maintained as follows: In the next section, a literature survey is developed on previous review articles of this field. After that different models are described with proper classification and analysis. At the end of the chapter, a conclusion is drawn with future direction of research in the field of communication management.

BACKGROUND

In the review article of artificial neural network based TSP models (Potvin, 1993), a comparative study is developed depending on three major architectures of neural network. These are elastic net, Hopfield Tank network and self-organizing map. TSP models are divided into two categories according to their implementation and performance. These are exact algorithms and heuristic algorithms. The major concern of this paper is to analyse the application of ANN in heuristic based themes. A thorough analysis of this paper says that Hopfield Tank network is not very much suitable to develop TSP models. But elastic net and self-organizing maps are better than that to find shortest way for a large number of cities.

Another important review (Daniel Graupe, 2001) is developed on TSP models using continuous Hopfield network. The objective of this paper is to develop a comparative study between Hopfield network and Kohonen self-organizing map in view of TSP models. In this development, it is shown that Hopfield network is better than Kohonen self-organizing map. This conclusion is drawn based on number of iterations to solve TSP models.

But these two previously mentioned reviews were developed in 1993 and 2001 respectively. After that some highly efficient TSP models are built up using ANN till today. In the proposed chapter, all such type of models are considered to analyse efficacy of ANN in TSP. But previously reviewed models are not excluded.

Another important field of communication management is Vehicle Routing Problem (VRP). A taxonomic review (Burak Eksioglu, 2009) was developed in the field of vehicle routing irrespective of tools and solution approaches. The main concern of this paper is how different solution approaches improve VRP. According to different application areas of VRP, the models are classified into some categories. The main attraction of the specific contribution is the synthesis of gradually improvement of VRP models using several approaches. But efficacy of neural network in this particular field was not analysed properly in this specific review article.

An excellent survey (M. Monica Subashini, 2014) was developed in the field neural network structure. In this particular contribution, different models of ANN are considered in comparative nature. These techniques are tested in the field Image processing. This particular paper is taken into account for choosing the required ANN models.

In the next section, the proposed discussion on communication management models is developed with suitable categorization.

Decision Making Models

In this section, different ANN based TSP, VRP and TP models are discussed with their corresponding unique efficiencies. For this purpose, 45 decision making models are collected from 29 different journals including conference proceedings. These models are selected based on technical efficiencies and consideration of significant realistic conditions. Among these, 8 are TSP models, 32 are VRP models, 1 is TP model and 4 are hybrid models. This categorization of models is listed in Table 1.

TSP Models Using Artificial Neural Network

An important approach (Beasley, 2003) of TSP was developed considering the Euclidean distance among the pair of nodes. This particular model takes Co-Adaptive Net architecture of ANN. The speciality of this dignified approach is less time complexity with a huge number of nodes considerations. Actually, to find the shortest path by maintain all the principles of TSP with a huge number of cities, this particular model is developed. Experimentally, it is observed that this specific model is well suited up to consideration of 85,900 cities with less time and space requirement. Ultimately, this efficacy is much better in view of large data set handling in computation.

Another technique (Hassan Ghaziri, 2003) of TSP was developed by considering a backhaul condition. More specifically, all the visited customers are partitioned into two categories using Kohonen mapping network. Beginning side of the neurons represents line haul customers and the end side of neuron represents back haul customers. Uniqueness of this approach is development of two separate chains of neurons based new network architecture. In this particular case, four type interactions are considered. These are interaction of line haul customers in the first chain, interaction of backhaul customers in the second chain, interaction of the two chains together at the tails and interaction with the depot with the heads of two chains. As a result, it can be easily decided that the number of revisited customers in the next iteration. This chaining system enhances the procedure of finding two clusters easily iteration wise. Experimental analysis shows that it provides very good result up to 1000 customers' problem. This

Table 1. Categorization of the communication management models wings wise

Models	TSP	VRP	TP
(Beasley, 2003)	✓		
(Hassan Ghaziri, 2003)	✓		
(Hui-Dong Jin, 2004)	✓		
(Junying Zhang, 2012)	✓		
(F. Jolai, 2010)	✓		
(Bert F. J. La Maire, 2012)	✓		
(Emile H.L. AARTS, 1989)	✓		
(Ricardo Insa Franco, 2016)		✓	
(Pedro M. Talavan, 2002)	✓		
(JEAN-YVES POTVIN, 1992)		✓	
(Jean-Yves Potvin, 1995)		✓	
(Linsen Chong, 2013)		✓	
(Xiaolei Ma, 2015)		✓	
(Weiliang Zeng, 2016)			✓
(Sina Dabiri, 2018)		✓	
(Jian Zheng, 2014)		✓	
(Peng, 2015)		✓	
(Abdolhamid Torki, 1997)		✓	
(Fabio Rafael Segundo, 2016)		✓	
(Koichi Maekawa, 2018)		✓	
(Georgios P. Mazarakis, 2007)		✓	
(Jae-Gon Kim, 2018)		✓	
(Nur E. Ozdemirel, 2000)		✓	
(Ke Song, 2018)		✓	
(Subramanya P. Nagesh Rao, 2017)		✓	
(Zhang Yi, 2016)	✓	✓	
(Jiaqiu Wang, 2016)	✓	✓	✓
(Irena Istoka Otkovic, 2013)		✓	
(Aleksandar D. Jovanovic, 2014)		✓	
(Dragan Pamucar, 2014)		✓	
(Juan de Oña, 2014)		✓	
(Yajie Zou, 2018)		✓	
(Jian Zhang, 2018)		✓	
(Nuno Coutinho, 2015)		✓	
(Zhang Lei, 2014)		✓	
(Douglas K. Swift, 2018)		✓	
(Hong Qu, 2012)		✓	✓
(LORENZO Mussone, 2013)		✓	✓
(Xiaogang Ruan, 2012)		✓	
(Zhongyi Zuo, 2014)		✓	
(Jittima Varagul, 2016)		✓	
(José S. C. Martini, 2017)		✓	
(Van-Suong Nguyen, 2018)		✓	
(Yang Zhao, 2016)		✓	
(Carl Goves, 2015)		✓	

particular approach is developed based on SOFM (Self Organizing Feature Maps) 2 opt strategy. The limitation of this particular approach is failure of addressing non-Euclidean instances.

To reduce this problem, a TSP technique (Hui-Dong Jin, 2004) is developed using extended SOFM. This extension is dependent on two important properties of Operation Research (OR): neighbourhood preserving and the convex-hull properties. Specification of this approach is the closing property of excited neurons to input city and pushing these towards cooperative convex hull of the cities iteration wise. Efficiency of the scheme is analysed through both of theoretical and experimental ways. Experimentation is developed using standard data sets with various number of cities, ranging from 50 to 2400. This typical approach ensures that it is more efficient than some popular approaches, like- Budinich approach, KNIES algorithms and convex elastic net techniques. The complexity of this approach is very much less as well as it is sophisticated heuristic approach to handle a large amount of data set easily. Actually implicit property of convex hull with ESOM is implemented here to acquire topological neighbourhood among the preserved and inspected nodes of cities. As a result, it is tried to assure the necessary and sufficient conditions of optimal routes. So, it is observed that the particular approach is efficient logically; but it is not compared with some popular complicated heuristics approaches.

A particular methodology (Junying Zhang, 2012) of solving TSP is developed for symmetric Euclidean matrices. This novel approach is designed by combining two selective rules- overall and regional competition. These two competition methods are used to separate less competitive and more competitive neurons. More specifically, overall competition method is used to locate less competitive neurons and regional method is implemented to find more competitive neurons. After preparing the neurons priority wise, three important properties of operation research- preservation, convex hull and infiltration are used to find the optimal tour. The utility of infiltration is easily handling of complex TSP (both of symmetric and asymmetric cost matrices). Computational complexity of this approach is $O(N^3)$; N is the number of cities in a particular network.

Another efficient TSP technique (F. Jolai, 2010) is developed merging Hopfield network and data transformation. More specifically, logarithmic and z-score approaches are used as data transformations to enhance the efficacy of TSP over only using the Hopfield Network. Actually in Hopfield Network, only local optimum value is obtained. But inclusion of data transformation enhances the result to global optimum. This particular technique is tested with 10 cities and comparative analysis with other approaches shows the effectiveness of this particular scheme.

An innovative concept (Emile H.L. AARTS, 1989) is developed in the field of TSP with Boltzman machines. The idea of binary variable is introduced here to develop the decision making model. This is very much suitable to select a particular edge easily. The speciality of Boltzman structure is handling of the discrete models easily. Also, in the case of continuous problems, both of linear and quadratic forms are handled easily. The particular TSP model is developed on the basis of two consecutive approaches- (1) A Boltzman structure is selected in such a way that a particular TSP instance is directly mapped to the combinatorial structure and (2) the strength of connections are chosen in a specific manner such that cost function is represented with consensus function.

An important TSP model (Pedro M. Talavan, 2002) is developed by new types of parameter settings in Hopfield continuous network. Normally the drawback of Hopfield continuous network is occurrence of non-feasible solutions. More specifically, the trial-and-error approach brings a lot of non-feasible solutions in the optimal scenario. Here, some new parameters are introduced to ensure that an equilibrium point distinguishes an optimal feasible path. The particular enhancement is analysed through a set of 'n' cities, in both of using only CHN (Continuous Hopfield Network) and this extended model.

An important analytical review (Bert F. J. La Maire, 2012) is developed regarding Neural Network based TSP models. This particular analysis develops a comparative analysis of efficacy among Genetic Algorithm (GA), Hopfield Network and Kohonen Self Organizing Map. These three are basically taken into account due to soft computing efficiencies. Also, TSP is considered as NP complete in now a day. So, it is a good problem for analysing the efficacy of these three approaches. Ultimately, through various experiments it is observed that Self Organizing Map is efficient more among these three approaches.

VRP Models Using Artificial Neural Network

The vehicle routing problem (or demand responsive dial-a-ride problem) is concerned with the allocation of vehicles to service the customers properly. Decision making regarding dispatching of vehicles and corresponding crews is still dependent on manually expertise. From experience, it seems very difficult to develop model explicitly that expertise via a symbolic approach.

An alternative neural network model (JEAN-YVES POTVIN, 1992) is proposed as a sub-symbolic and empirical alternative for modelling the decision process of expert dispatchers. Preliminary results about the ability of the network to reproduce various decision rules are reported. This paper focuses on the problem: the dynamic dispatching of vehicles and crews. Utility of the neural network approach in this particular case is solved of dial-a-ride problems dynamically and feasibility of the dispatcher system. The flexibility of the neural network approach is very attractive in this context, because it can be trained in several dispatching platforms, and adapts them dynamically at the time of training phase.

A competitive neural network model (Jean-Yves Potvin, 1995) is developed to enhance the VRP with time windows. Basically, seed customers are identified over the whole distributed network properly. Here, ANN converges towards the centroid of clusters if such clusters are present. Here, the use of a competitive neural network during the initialization phase of an insertion heuristic for the Vehicle Routing Problem with Time Windows (VRPTW) is described. First, the neural network initialization is based on spatial considerations only. Better results are achieved by considering both spatial and temporal issues during the initialization phase. In this case, a third input unit relating to the time window at each customer would be added to the neural network. This specific approach of neural network is considered as ART network. Solomon's standard set is used for testing purpose.

A rule-based neural network model (Linsen Chong, 2013) is proposed to simulate driver behaviour in terms of lateral and longitudinal actions in two situations, car-following and safety critical events. The main attraction of this contribution is consideration of fuzzy for developing the rule based network. An approach of machine learning is introduced to mimic behaviour of individual driver. This particular method is equally applicable in both of homogeneous and heterogeneous data sets. Here, the importance of fuzzy logic is to divide reinforcement learning method and traffic state variables. The major extensions in this approach are inclusion of driver merging and lane changing behaviour.

Another model (Xiaolei Ma, 2015) on speed prediction is developed using a special type of neural network. This particular long short-term network is used to confine traffic dynamically in non-linear structure. The novelty of this model is automatic determination of optimal time lags with removing the error of back propagation.

In now a day, green vehicle routing is one of the most important research topics worldwide. A model (Sina Dabiri, 2018) is developed regarding this using convolution neural network. Here, this particular architecture is prepared with GPS trajectories. A channel is developed with four attributes (speed, acceleration, bearing and jerk). Then the large population segment is divided into small terms and it is prepared according to the model requirement of CNN. These small segments are handled individually

and merging these solutions, ultimate path is obtained. The speciality of this methodology is obtaining more optimal result due to use of multiple layers iteration wise. The result is near about 84.8% accurate to the actual position. Another specification of this approach is removing the exposure to traffic and consideration of environmental conditions.

A great contribution (Jian Zheng, 2014) is developed for prediction of track changing decision of drivers using neural network architecture. The importance of this development are behavioural analysis of changing left and right track of the path. Also, path changing decision is considered in quantitative nature. This particular model is developed as multinomial model and the utility of this are estimation of model and validation checking. This is an initial enhancement in this particular field. So, the outcome of the model is not very well. Different experiments show that only 13.25% left track and 3.33% right track can be extracted correctly using this model.

To improve the accuracy of the particular model, another model (Peng, 2015) is developed with various criterions and different parameters. One of the most important parameter in this particular is time window and that is introduced here. Other considered parameters are visual search nature of drivers, vehicle operation, speed and condition of driving. The concept of back propagation together with neural network is used for predicting track changing behavior.

A self-organization Neural Network based VRP model (Abdolhamid Torki, 1997) is introduced in this paper for handling a group of Vehicle Routing Problems. Motivated by the outstanding performance of adaptive Neural Network approach in the Traveling Salesman Problem, an algorithm is devised to extend the domain of applicability of this approach to more complex problems. In this research, a new algorithm is designed based on SOFM for solving a class of routing problems. The simulation results demonstrate the capability of the algorithm to yield favourable solutions. Speciality of this particular model is that it is equally applicable to other type routing problems by a self-effacing modification.

A multi-copy routing strategy (Fabio Rafael Segundo, 2016) for a DTN built on the top of an Urban Bus Transportation System (UBTS) is presented with high efficiency. Using the buses as nodes, the contact history of nodes is used to improve the DTN communication. Depending on a journey predictor, a multi graph is built up in this formulation. The uniqueness of this approach is introducing minimal delay factor. Implementation of copy control algorithm enhances the concert of the system. In the UBTS context, the proposed multi-copy routing strategy outperforms the Max Prop strategy in terms of delivered messages, delivery rate, delivery delay, network load and cost of network messages per delivered message. The results indicate potential advantages of the ANN strategy over other ones in a real scenario.

A multi-scale simulation model with the pseudo-cracking method (Koichi Maekawa, 2018) is developed to estimate fatigue life of real RC bridge decks with a wide variety. An artificial neural network model is used for quick diagnosis for the remaining fatigue life at the site. The particular ANN model aims at quick but sound judgment equivalent to the pseudo-cracking method at the site.

In the model (Georgios P. Mazarakis, 2007) of signal processing work, the use of a time-domain encoding and feature extraction method is investigated to produce simple, fixed size matrices from complex acoustic and seismic signatures of vehicles for classification purposes. Classification is accomplished using an artificial Neural Network and a basic, L1 distance, archetype classifier and 8 bit microcontroller based sensor node. The TESPAN/FANN method provided high recognition rates between two types of vehicles using their acoustic and seismic signature. Different encoding alphabets have been tested and the effect on performance has been discussed. Classification performance is comparable with existing methods while computational cost is greatly reduced. A hardware implementation on a prototype wireless sensor node showed the effectiveness of that method to the vehicle classification task.

Another study (Jae-Gon Kim, 2018) proposes a neural network based predictive control (NNPC) approach that finds suitable weights for multiple factors dynamically so that the best performance of the intelligent parking guidance system can be achieved. This model enhances the efficiency of parking guidance system through dynamic control by selecting the parking lot in the best manner. Considering the fact that finding the best performance under public policy requires extensive processing time, the relatively low processing burden makes the proposed NNPC more applicable to real-time environments. Moreover, NNPC can adjust weight configurations in response to diverse parking environments.

A unique model (Nur E. Ozdemirel, 2000) of Automated Guided Vehicle routing is developed using the concept of artificial neural network. The main objective of this development is to find the shortest path for a single and free-ranging AGV that carry out more than one pick and deliver requests. This is NP hard in nature. Kohonen's self-organizing feature maps is developed to solve the problem. The developed algorithm outperforms the nearest neighbour rule for all request patterns and problem sizes in terms of the solution quality. But the nearest neighbour rule is always superior in computation time. A general result of these comparisons is that the algorithm provides good solutions within reasonable computation time for certain request patterns. The solution qualities for other patterns are acceptable but not as good. The main reason for this, is the unstable behaviour and that is considered as a major drawback also.

A learning vector quantization (LVQ) based neural network model (Ke Song, 2018) is developed for designing the driving patterns depending on the driving information of a vehicle. This multi-mode strategy shows the efficacy and it can automatically switch to the genetic algorithm under particular driving conditions depending on recognition results. The results show that the multi-mode energy management strategy can satisfy the needs of vehicle dynamic performance. And the energy management strategy can transform into a more suitable one based on driving conditions and produce a more economic performance than the thermostat strategy under the same dynamic conditions. In addition, a complex driving cycle is designed to verify the actual effect of this strategy MM_LVQ under complex driving conditions. The results show the efficacy under specific driving conditions. At the same time, the condition recognition effect helped the multi-mode strategy to adapt to real driving conditions.

An offline optimal charging strategic model (M. Gholami, 2013) is developed by taking the objective with minimizing the energy cost. This is done by exploiting the periodicity and predictable operation of the city buses. In this particular case, the actual demand of the energy of electric bus should be known and it has an important priority. A predictor is designed for addressing and the neural network model is capable to indicate the estimation of the energy demand of the next day. Three different optimal charging strategies are implemented using this. This shows considerable cost minimization i.e., capacity of charging the full battery at each available opportunity. A cost optimization between 32%– 54% is obtained at the time of comparing with the non-optimal strategy.

Another ANN based architecture (Douglas K. Swift, 2018) is developed to model and predict the traffic network. Application on the Connexion by Boeings (CBB) global broadband network was evaluated to establish feasibility. Exact classification and prediction regarding traffic network is very much essential for sizing network resource and for real-time network management. The purpose of this study was to examine whether or not network traffic on a large-scale broadband network could be modelled by adaptive, artificial intelligence, and computing techniques. The experimental results demonstrated that ANNs could indeed be used for network traffic modelling and have the potential for significant increases in accuracy and increased capability for adaptation.

A micro simulation based traffic model (Irena Ištoka Otkovic, 2013) represents the results of research on the applicability of neural networks in the process of computer calibration. VISSIM micro simulation model is used for calibration done at roundabouts in an urban area. It is developed on prediction

of neural network for the traveling time between measuring points. Besides this, the process involves a comparison between the modelled and measured queue parameters at the initial level. The process of validation includes an analysis of traveling time and queue parameters on new sets of data gathered both at the modelled and at a new round about.

A neuro fuzzy approach (Aleksandar D. Jovanovic, 2014) is developed for authorities of local city with a serious effort to expand the number of low-greenhouse gas vehicles (green vehicles) at home. A system has been developed to optimize the green capacity in urban green vehicle routing. The objective of this paper is to propose a green vehicle distribution model in a public transportation network. The problem has been defined as a problem of non-linear optimization with dispersed input parameters, requiring neuro-fuzzy logic. An adaptive neural network was developed, taking into account the costs to be borne by operators and users, and the environmental parameters along the observed vehicle route. One of the advantages of this model is consideration of uncertainties in predicting the operator/passenger costs and environmental parameters. Besides, the model allows for planning the vehicle routes with the maximum of positive environmental effects, including reduced greenhouse gas emissions, and a better air quality in most densely populated areas.

Another model (Dragan Pamucar, 2014) of neuro fuzzy is built up for the routing of light delivery vehicles by logistics operators. The model takes into account the fact that logistics operators have a limited number of environmental friendly vehicles (EFV) available to them. At the time of defining a route, EFV vehicles and environmental unfriendly vehicles (EUV) are considered separately. For routing the particular model, an adaptive neural network is used to train by a simulated annealing algorithm. In this model, the input parameters are logistics operating costs, exhaust emissions and noise for the given vehicle route. This model has been developed to minimize air pollution, noise level and logistics operating costs. Although the benefits of using EFV are well-known, their introduction is gradual, and their optimal allocation on routes is very important, which gives the model presented here great practical significance. The practical value of this algorithm lies in the fact that the collected experience of a number of experts is incorporated into the model, thus avoiding a situation in which the routing of EFV is limited to the knowledge of individuals who find themselves in a position where they have to solve these problems alone.

A model (Juan de Oña, 2014) on service quality of public transportation is carried out using ANN. Here the service quality perceived by the passengers is analysed. The ANN is proposed in this research because of its numerous advantages over more traditional parametric models (such as regression models, structural equation models or logit/probit models), and other non-parametric models, such as decision trees. ANN allows to mitigate the inherent instability of ANN models, which is an important improvement in the field of “black-boxes” techniques, to which ANN belong, since until now there is no consensus about what method of relative importance must be used for determining the variables relative importance.

A lane changing predictor based on Adaptive Fuzzy Neural Network (AFNN) model (Yajie Zou, 2018) is proposed to predict steering angles. The prediction model includes two parts: fuzzy neural network based on Takagi–Sugeno fuzzy inference, in which an improved Least Squares Estimator (LSE) is adopted to optimize parameters; and adaptive learning algorithm to update membership functions and rule base. The prediction results indicate effectiveness and stability of this model.

A neural network model (Jian Zhang, 2018) is employed with carefully selected traffic trajectory data. The virtual vehicle production is organized by a unique structure. The mobility model comes from the observed real-world traffic data, and is learnt by using a neural network. Differs from prediction in macro-level, detailed behaviours of vehicles is considered. Since the traffic flow is complicated and sensible may be faced in some unknown traffic situations, the mobility model is more reliable and pro-

duces more realistic traffic data than using a conventional car-following mode. A way is proposed on managing and organizing the vehicles that makes the proposed model to be executed efficiently. Finally, the presentation is implemented by employing the SUMO simulator.

An autonomous Quality of Experience management approach (Nuno Coutinho, 2015) is proposed for multiservice wireless mesh networks, where individual mesh nodes apply reinforcement learning methods to dynamically adjust their routing strategies. Within the forwarding nodes, a novel packet dropping strategy is developed that takes into account the impact on QoE. A novel source rate adaptation mechanism is considered here with the available network capacity. The introduction of source rate control improves further the QoE of each service types and for different WMN topologies. In addition, this approach exhibits a significantly smaller control traffic overhead.

A residual capacity estimation model (Zhang Lei, 2014) is built up based on an ANN. Both of charging and discharging current together with temperature are taken into account. This model comprises of three inputs (temperature, current and voltage) and one output (residual charge). The result shows that the proposed model can provide an accurate prediction of residual charge while maintaining good generalization capability. The established model can be used to precisely monitor the state of charge of the ultra-capacitors in ESS, and lays a reliable foundation for control strategy implementation and operation safety.

A method (Xiaogang Ruan, 2012) of realizing vehicle's photo taxis and negative photo taxis through a neural network is developed. A randomly generated network is used for computation purpose. During training only weights of the output units are changed during training.

An approach (Zhongyi Zuo, 2014) combining historical data and real-time situation information is developed to forecast the bus arrival time. This includes two phases: Radial Basis Function Neural Networks (RBFNN) model and an online oriented method. RBFNN is used to learn and to approximate the nonlinear relationship in historical data and online oriented method is introduced to adjust the actual situation. Ultimately, the system designing outline is given to summarize the structure and components of the system.

An algorithm (Jittima Varagul, 2016) is simulated for detecting object for Automated Guide Vehicle (AGV) guidance problem to avoid obstacle. This system is designed in security of internal transportation system to prevent collision. Depending on classification of obstacles, the system is designed. The obstacles recognition system using ANN with back-propagation learning algorithm by learning HOG features, 100% accuracy is achieved.

An adaptive biologically-inspired neural network model (José S. C. Martini, 2017) is made to receive the system state and is able to change the behaviour of the control scheme and order of semaphore phases. This particular adaptive control is evaluated on a single intersection scenario. The performance evaluation ensures that the model has higher adaptability and capacity than the previous traffic responsive control method, which is mainly attributed to its flexible and constant system monitoring and acting possibility.

A novel ANN controller (Van-Suong Nguyen, 2018) by using the head-up coordinate system is proposed to control automatically the ship into the berth in different ports without retraining the ANN structure. Numerical simulations are performed for two ports which verified the effectiveness of the proposed model.

A novel descriptor (Yang Zhao, 2016) is developed with road occupancy rate, for measuring campus traffic congestion level and it is statistically proved to be the most effective descriptor among other descriptors. Markov model and back propagation neural network (BPNN), are combined with the proposed descriptors. Experimental results show that the proposed methods can achieve desirable performance for detecting traffic congestion in campus, while the BPNN based method obtains more stable performance.

The results also point towards the importance of the proposed method for traffic congestion detection in campus.

By using Artificial Neural Networks (ANN), an excellent model (Carl Goves, 2015) is developed that 90% of the time predicts future traffic density 15 minutes into the future within 2.6 veh/km/lane of accuracy.

An energy consumption based ANN model (Ricardo Insa Franco, 2016) is developed to calculate the energy consumption of electric trains. It shows a good agreement with the target data. Output is compared with another subset of measured data and it provided a good estimation of the energy consumption with slight underestimation of negative energy peaks.

Transportation Model Using Artificial Neural Network

An ANN based transportation model (Weiliang Zeng, 2016) depending on theory of vehicle dynamics is developed to predict the vehicle CO₂ emission per kilometer and determine an eco-friendly path that results in minimum CO₂ emissions while satisfying travel time budget. The importance of this approach are-

- (1) The relative importance analysis indicates that the average speed and average acceleration occupy 85.6% relative importance to the CO₂ emission model.
- (2) Eco-friendly path offers significantly reduced CO₂ emissions at little cost in terms of increased travel time and the tours. On average, an eco-friendly path can reduce CO₂ emissions by 6.98%, 5.15%, and 10.17% relative to the observed path, the shortest distance path, and the least travel time path respectively.
- (3) Compared to the observed path as selected empirically by the driver, the eco - friendly path offers significant advantage in terms of travel time (reduced by 16.95%) and CO₂ emissions (reduced by 6.98%) though the travel distance is slightly longer (by 0.3 km).
- (4) In an eco-routing experiment using all the observed OD pairs, it is found that the percentage of trips in which CO₂ emissions are reduced increases as the travel time buffer increases. Interestingly, when the travel time buffer reaches 10%, a certain degree of CO₂ emissions reduction is achieved for almost all trips.
- (5) The average reduction in CO₂ emissions achieved by the eco-friendly path reaches a maximum of around 11% for trip OD distances between 6 km and 9 km and when the travel time buffer is around 10%. This indicates that setting a travel time buffer of 10% is appropriate for this eco-routing model, because this results in the greatest reduction in CO₂ emissions for the least cost in terms of travel time.

Hybrid Models Using Artificial Neural Network

A pulse coupled neural network model (Zhang Yi, 2016) is developed to find a single pair shortest path. A unique structure (on-forward/off-backward) is introduced to reduce the search space. In this mechanism, neighbourhood forward region is excited and backward region is inhibited at the time of firing a neuron. As a result, shortest path can be obtained quickly with less time complexity. Also, shortest path is involved in both of TSP and VRP. Therefore, it is considered in both these fields.

A space time delay network model (Jiaqiu Wang, 2016) is developed for merging temporal and spatial auto correlation of a network through both of local and dynamic approach. The concept of dynamic approach enhances the prediction of travel time efficiently.

Another modified continued pulse coupled network model (Hong Qu, 2012) was developed for large scale nonlinear shortest path computation. The idea of tree structure is used to handle the nonlinear structure. The specialty of the model is lateral connection among neurons through wave propagation. An approach (LORENZO Mussone, 2013) of multilayer forward network is developed to estimate Origin Destination (O-D) matrix of traffic. Here, the speciality is dynamic computation and due to that reason efficiency of the scheme is enhanced. Ultimately, missing data can be taken into account in this model for decision making.

CONCLUSION

In this critical review and discussion, three important categories (TSP, VRP and TP) of communication management are described shortly. Trends of research of these three particulars in last few years are realized properly. Moreover new policy enhancement, like- environment issue, zero carbon emission issue etc. are taken into consideration. From another view, the utility of artificial neural network can be comprehended properly in this particular research and development area. In the analysis of Potvin (Potvin, 1993), it was shown that ANN is not a sufficient approach in the area of communication management. But huge improvement ANN methodologies in last few years improve the decision making models with new policies efficiently.

FUTURE DIRECTION

Artificial Neural Network (ANN) is an important tool in the area of pattern recognition. In now a day, quantitative management research is using machine learning as a tool in different interdisciplinary fields, like- marketing, finance, human resource etc. Artificial Neural Network is also a part of machine learning. So, future researchers will be benefited by knowing about the different approaches of artificial neural network from this chapter. In view of optimization, researchers will be benefited from two sides- methods and applications. First, different methods of ANN that are discussed in this paper will give an overview about ANN regarding optimization. Second, the different application areas of optimization, like- VRP, TP and TSP can be enhanced in future by considering a lot of other real factors with other optimization models. That will also help to the researchers in the area of operation research and operation management.

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KEY TERMS AND DEFINITIONS

Artificial Neural Network: A framework for handling machine learning procedures critically. More specifically, it is one of the best ways to realize a certain pattern automatically.

Communication Management: Organization of communication through vehicles properly with meeting the demand in an optimal way.

Transportation Problem: TP is management of production unit to retailing market in an optimal way such that cost is minimized and maximum amount of resources can be utilized.

Travelling Salesman Problem: TSP is a NP hard problem to find the shortest path in a particular network with covering all the nodes.

Vehicle Routing Problem: VRP is an extension of TSP. It is basically routing/scheduling of a set of different type vehicles in a specific network.

Enablers of Servitization Roles and Action Mechanism

14

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INTRODUCTION

To build a long-term competitive advantage, the manufacturing industry has begun a movement to transform itself from simply offering products to offering customer-based services and solutions in addition to their products. This new business model is known as “servitization.” There are several business service models that manufacturers can use according to their level of service integration.

In order to transform into a service-driven organization effectively, various types of servitization enablers have been presented and examined in this study. This paper is organized to investigate servitization enablers thoroughly and to analyze their interrelations. Perona et al. (2017) pointed out that enablers have not been discussed comprehensively by servitization literature. Moreover, the enablers for servitization have been, in general, investigated individually without analyzing their interactions, which are important to facilitate the desired transition.

The first section of this paper addresses the most influential enablers by focusing on:

1. Type of organizational cultural in servitized manufacturing.
2. Leadership behavior and personnel management during the process of servitization.
3. The role of digital technologies in supporting servitization.
4. Organizational structure and operations that facilitate servitization.

The second section emphasizes the interrelations between servitization enablers. In order to make appropriate decisions, it is essential to understand how enablers can be redesigned to achieve servitization as a new business strategy, and to analyze the nature of interactions between enablers, as lacking a holistic view of their collaboration may lead to servitization failure.

BACKGROUND

The term “servitization” was firstly introduced by researchers Vandermerwe and Rada (1988). Since then, researchers have studied it from different perspectives. Baines et al. (2009) defined servitization as “The innovation of an organizations’ capabilities and processes to create mutual value by shifting from selling products to selling integrated solutions.” The early literature introduces servitization as adding services to supplement the existing product (Vandermerwe & Rada, 1988). The more recent literature introduces service offering and customization as a dynamic and central activity (Ng et al., 2011). Servitization enablers have gained the attention of researchers, and they have classified them into multiple categories. Matthysens and Vandenbempt (1998) identified organizational culture, organizational structure, and human resources as the key enablers, whereas Mathieu (2001) and Galbraith (2002) believed that

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strategy, people, structure, rewards, and processes were the key enablers. Gebauer and Fleisch (2007) also presented the latter key enablers and extended them to include market-oriented service processes, relationship marketing, customer-oriented services, and creating a separate service organization.

The impact of servitization enablers is important to organizational stakeholders, and therefore this paper offers a great opportunity to add new knowledge regarding the understanding of servitization.

FOCUS OF THE ARTICLE

Organizational Culture (OC)

Management literature defines OC in different ways based on their related variables. Ravasi and Schultz (2006) gave a simple definition of OC as “A set of shared assumptions that guide what happens in organizations by defining appropriate behavior for various situations,” and “it forms the basis to solve company’s problems” (Dubruc et al., 2014).

Servitization is all about innovation of business offers, which consequently demands a service orientation OC (Dubruc et al., 2014). Zeithaml and Bitner (2003) defined service culture as “Culture where an appreciation for good service exists, and where giving good service to internal as well as ultimate, external customers is considered a natural way of life and one of the most important norms by everyone.” Shifting from product-oriented OC to service-oriented OC means shifting the focus from achieving efficiency, economics of scales (Bowen et al., 1989) to innovation, flexibility, variety, and customization.

Schein (2004) determined three levels of culture:

1. The artifacts such as physical infrastructure, processes, structures, technology, and published values that can be seen and felt.
2. Espoused values such as norms, values, and beliefs that employees use to represent themselves within the OC.
3. Basic assumptions that are unconscious and taken for granted by employees.

Kinnunen (2011) suggested that changing OC would be in artifacts and espoused values only, because since the last level is not easy to recognize. Kinnunen (2011) argued that within the service transition, the artifacts will be concentrated on the role of the customer, type of customer relationship, and tools to measure performance, while espoused values will relate to the observation of the organization’s basic mission, its philosophy, and its competitiveness. Nuutinen and Lappalainen (2012) revealed that in a product-oriented organization, the product history was positioned in the firms’ mentality, existed in the structure and in management practices, therefore, the existing OC obscured new ways of thinking and the ability to develop a real service business.

Gebauer et al. (2012) emphasized modifying the company’s values and employee behaviors in order to have a service organization and people-oriented OC. However, service OC is not rooted at the early stage of a transition, but is promoted when the service offering becomes recognizable and profitable (Gebauer et al., 2010).

In terms of OC change during the servitization process, there are several issues to examine:

1. The change of managers and employees’ roles, and their service awareness are necessary (Nuutinen & Lappalainen, 2012). Service awareness at the managers’ level means changing their thinking

from services as “add-on” to services as “value added” activities (Gebauer et al., 2012), and doing business in new ways (Gebauer & Fleisch, 2007). At the employee level, it means changing employee roles from selling products to providing services (Gebauer et al., 2012).

2. Servitization requires OC characterized by flexibility, personality of services, and co-development with customers (Kinnunen, 2011).
3. Organizations are obligated to specify the amount and the type of required change of OC (Cameron, 2008).
4. It is not easy to change core beliefs about work and its purposes. When a more radical change is required, then changing deep-rooted beliefs regarding an organization’s purposes and its key success factors is needed (Nuutinen & Lappalainen, 2012).
5. It is essential that a service orientation be accepted in all business units (Gebauer & Fleisch, 2007), which depends on the required service awareness level (Gebauer et al., 2012).
6. The essential characteristics of service OCs are emphasizing service as a core task, developing integrative and cross-functional work practices, managing practices on the bases of flexibility and end results, and shifting customer relationships from short-term, transaction-based relations to long-term, development-based relations (Nuutinen & Lappalainen, 2012; Oliva & Kallenberg, 2003).

Cameron (2008) explored the steps necessary to establish a service OC by defining a type of OC to integrate and communicate values about the future OC, determining activities (to start with, to enhance, or to stop performing), beginning with easy tasks or concerns to change, setting milestones to measure and monitor change, enhancing communication channels, and training leaders for the job.

Leadership Behavior and Personnel Management

Within servitization, employees are encouraged to allow more interaction with customers, since customers are recognized as partners in creating value. From that perspective, practicing leadership in service-oriented organizations will not be the same as in product-oriented organizations. Consequently, leaders are expected to change their leadership style to direct and motivate their workforce effectively through the service transition process.

Leaders of service-driven organizations face challenges to direct employees due to the intangibility of their duties as they are related to communicating with customers. Therefore, the improvement of employees’ self-motivation and the encouragement of more creative behavioral attitudes are essential (Yong et al., 2013).

Nie et al. (2013) stated that in servitized businesses, the areas of leadership that need change are:

1. **Fellowship:** Changing the focus from discipline and obedience to the effectiveness of followers.
2. **Value Source:** Deriving value from employees’ thoughts rather than from blind procedures.
3. **Communication:** Solving problems through conversations with staff members regardless of their positions.
4. **Goal Setting:** Shifting from path goal leader to a leader who directs by setting an inspirational goal for the employees and letting them proceed, especially in a process to create a new brand, e.g. innovative services.
5. **Influential Power:** Using personality power instead of position power.
6. **Corporate Climate:** Replacing a hierarchy climate with a cooperative climate.

7. **Decision-Making Tools:** Shifting from a dependence on rigid databases or software to a societal-oriented software to share knowledge through joint communications and dialogs.

In the context of servitization, there are two comprehensive and well-adopted leadership styles that have been recognized: the transactional style and the transformational style. The transformational leadership style is centered on motivating staff to achieve superior results. It is about enhancing trust and confidence in the organizational environment and encouraging personal excellence. This is achieved by creating vision (Popli & Rizvi, 2015), enhancing communication, inspiring employees, and fulfilling employees' intrinsic needs (Yong & Kosak, 2014). Conversely, the transactional leadership style focuses on using authority, power, position, and policy to maintain control, and gets the job done through adopting transactions of reward and punishment (Popli & Rizvi, 2015).

Popli and Rizvi's (2015) work showed that the transformational leadership style is suitable for integrating service orientation into an organization, because it has direct and strong capabilities to create an environment for higher employee engagement.

Management studies have addressed human capital challenges with servitization, such as developing the abilities to build long-term relationships with customers and identifying employees' tasks to design and to deliver services (Rese & Maiwald, 2013). In that context, Gebauer et al. (2010) described a leader as a mentor, problem solver, and customer performance developer, and believed that employees should be hired for their behavioral capabilities and technical skills. According to Rese and Maiwald (2013), the number of employees who have direct contact with customers should be increased.

Gotsch (2014) identified the following individual capabilities required for service transition:

1. **Professional Expertise:** Refers to the technical competence and knowledge of conditions and corporate, which are essential for task-oriented services.
2. **Social Skills:** Refer to employees' behaviors and interactions with others, especially customers, which are essential for relationship-oriented tasks.
3. **Personal Skills:** Skills such as openness, resilience, self-confidence, good judgment, and readiness to learn.

However, Gebauer et al. (2010) also suggested that at the introduction level of services to an organization, technical competencies are required, and when service offerings become complex and dominant, then technical, social, and personal competencies become essential for job purposes. Gotsch (2014) suggested that employees who are involved in core service tasks would need new capabilities more than other employees in order to meet servitization challenges. Baines and Lightfoot (2013) agreed with Gotsch (2014), and suggested that enhanced capabilities were required for front office employees for service-related duties. They suggested five sets of skills that front office members were expected to hold, namely: 1). Flexibility to respond to customer needs; 2). Relation development, primarily with customers; 3). A service-centricity attitude; 4). Authenticity and; 5). Technical expertise in using systems and subsystems. Effective leaders have an obligation to build a cooperative OC amongst the employees, especially among the front office staff and, at the same time, maintain a comparable power balance between the front and back offices (Baines & Lightfoot, 2013).

Rese and Maiwald (2013) stated that managers might face two possible behavioral responses during a transition process, as employees could be either promoters or opponents to change. They viewed management's duty as being to reward the promoters, in order to gain more support from them, affect the

behavior of others, and overcome opponents' resistance. Furthermore, they believed that management could also consider the opponents' arguments as valuable feedback.

Rese & Maiwald (2013) explained that resistance to change evolves as employees' attitudes and beliefs are influenced by the transition process. Gabouer et al. (2010) emphasized that convincing employees about change must be related to their appreciation of the added services based on their recognition of the opportunities accompanying change. However, this could lead to creating multiple values and beliefs within the organization, which could result in internal organizational conflict (Rese & Maiwald, 2013). Rese & Maiwald (2013) also argued that communication is effective to managing employees' resistance. They stated that at the early stage of applying the change, a downward communication channel is essential to inform employees about the upcoming change. During the actual change phase, the communication channel delivers how tasks are altered; face-to-face communication is a recommended at this phase. At later stages, communication content focuses on publicizing the success of the change process (Rese & Maiwald, 2013).

Digital Technologies

It has been stated that the service revolution and the information revolution are two sides of the same coin (Ardolino et al., 2016). Moving an organization towards a service-oriented business model demands an adoption of digital technologies (Oliva & Kallenberg, 2003). Ardolino et al. (2016) assured that making an investment in information and communication technologies (ICT), such as customer-relationship management (CRM) and enterprise resource planning (ERP) will contribute to applying services successfully and automating key internal processes related to manufacturing, accounting, and customer engagement (Bevan, 2015).

The works of Ardolino et al. (2016) presented the following key digital capabilities as being possible through the use of high-level technologies:

1. User Identification, such as a customer's personal ID to access to the service.
2. Product identification, such as product serial numbers and database to identify service.
3. Geo Localization, such as using GPS for allocating customer location.
4. Timing assessment, such as determining the time for billing services for customers.
5. The amount of product usage, such as connecting printers to a remote data platform in order to determine the paying invoice per user.
6. Condition monitoring, such as monitoring of equipment for incident faults by connecting it to a remote database.
7. Usage monitoring, such as sending notifications to customers whenever they use the remotely monitored machine inappropriately.
8. Prediction, such as using predictive models to estimate the reliability of critical components of a product.
9. Remote control to solve product parameters, such as sending a notification to a car driver to stop a car for safety issues.
10. Maintenance Optimization, such as making adjustments on a product from a remote surveillance center to increase efficiency.
11. Autonomy, by allowing a product to make certain actions by using data and system connections, such as allowing an air conditioner to automatically adjust the temperature as the weather changes.

The concepts of smart manufacturing and digitalization have been used intensively to illustrate technology as a servitization enabler to create smart products, services, equipment, and processes (Kang et al, 2016). The following are classifications of the most accepted, well-known technologies that enable servitization in product-oriented organizations:

1. Predictive analytics to forecast product failure (Paschou et al., 2017, Danges et al., 2015; Cimini, 2018).
2. Remote communications to fix or bend products remotely (Danges et al., 2015).
3. Observation of customer-related aspects by using advanced customer relationship management tools in coordination with consumption monitoring (Danges et al., 2015; Cimini, 2018).
4. Publication of information to employees or customers (Danges et al., 2015).
5. Mobile platforms to communicate with customers and to obtain data access for enterprise resources planning purposes (Danges et al., 2015).
6. Internet of things (IoT) for purposes of data exchanging and interaction (Paschou et al., 2017; Cimini, 2018).
7. Cloud computing that opens access to a shared pool of resources by different stakeholders (Paschou et al., 2017; Cimini, 2018).
8. Additive manufacturing (technologies that build 3-D objects) to produce customized goods with minimum waste of resources (Paschou et al., 2017; Cimini, 2018).
9. Big data, to gather and store a large amount of data for further analysis (Paschou et al., 2017).
10. Cyber security to develop protection of Internet-connected systems, including hardware, software, and data, against cyber attack (Paschou et al., 2017).

Cimini et al. (2018) stated that at the early introduction of service orientation to the organization, cyber-physical systems (CPS) are utilized to make products smarter, traceable, identifiable, and to give updated information on the system's status. As business progresses in the journey of servitization, digitalization becomes more critical and complex in supporting service offerings and enhancing supplier-customer relations (Cimini et al., 2018). Baines et al. (2009) stated that the main aim of technologies utilized in service driven organizations was to deliver value through facilitation and mediation, and that this was achieved by using intensive mediating technology.

Organizational Structure (OS) and Operations

The literature on servitized organizations neither presents empirical evidence about successful or unsuccessful organizational design (Kreye & Jensen, 2014), nor identifies the relationship between servitization strategy and the OS (Lobert, 2016). Servitized organizations face the challenges of integrating different levels of customer services into their operations, as well as adapting to market changes and customer requirements (Kreye & Jensen, 2014).

OS shows how activities, coordination, and supervision are managed in order to achieve organizational goals, and where the decision-making power and authority is located within an organization (Galbraith, 2002). According to Galbraith (2002), OS is identified by four areas: specialization, shape, distribution of power, and departmentalization. Generally, developing the appropriate OS by an organization depends on how the OS will fit and serve the organization's status (Mintzberg, 1979).

There are key differences between the OS of product-oriented businesses and service-oriented businesses. Product-oriented organizations are structured according to their product business. The involved

functions of an organization are defined by the product kind and category, with hierarchical control (Galbraith, 2002; Shah et al., 2006). In general, sales are performed through intermediaries (Baines & Lightfoot, 2013), and the responsibility of service sales falls under the product sales units (Gebauer & Kowalkowski, 2012). Conversely, the service-oriented organization is described as an organization focusing on analyzing customer needs and creating values by obtaining the necessary knowledge of its clients (Lobert, 2016). Moreover, products and services are recognized as tools to solve customer problems. Customer or market segments are created to replace products, with several business units to offer products and services (Gebauer & Kowalkowski, 2012). In such organizations, front office functions and customer teams that supervise customer relationships are established (Galbraith, 2002).

A well-known service-oriented OS model is the front-back hybrid organizational model, or “interdependent system of profit centers” (Galbraith, 2002). It consists of two types of functions; front-end functions related to customer or market segments responsible for developing and delivering solutions, and back-end functions related to technologies and product lines responsible for developing and manufacturing products and services (Galbraith, 2002). These offices do not work separately, as the linkage between product, service, and customer-focused units is necessary (Galbraith, 2002), and is utilized through liaison devices to coordinate activities across the organizational units, e.g. informal processes, e-coordination, integrators, and formal groups (Galbraith, 2002). Kobashi and Konomi (2015) explained that front offices focus on a region or a country, and back offices focus on products. Thus, all or parts of products are developed in back offices in a standardized way, and then each product is customized in the front offices to meet the needs of the customers or the market (Kobashi & Konomi, 2015).

There are contrasting views about how service functions are designed and coordinated, and whether these functions should be integrated into the existing OS or separated (Lobert, 2016). Many scholars set different service typologies in order to design the proper service-oriented OS. Baines and Lightfoot (2013) focused on three broad service levels based on the customer integration into the organization's operations: 1). Base level (product, equipment, and spare part provision); 2). Intermediate level (training, maintenance, repair, overhaul and; 3). Help desk and advanced level (customer support agreement, outcome-oriented contracts, e.g. advanced rental and leasing solutions).

Gebauer et al. (2010) suggested the following classifications for service transition:

1. Customer service provider (supplementary services such as delivery, information, and billing services)
2. After-sales provider (spare parts, maintenance, inspection, and basic training)
3. Customer support provider (preventive maintenance, consulting, and advanced operating training)
4. Development partner and outsourcing partner (providing of customer solutions)

Schmenner (1986) built a service matrix of four types following the degree of labor intensity and the degree of customization. They are: 1). Mass service (high labor intensity and low customization); 2). Service factories (low labor intensity and low customization); 3). Service shops (low labor intensity and high customization) and; 4). Professional services (high labor intensity and high customization).

Examining the literature related to product service systems (PSS), another significant platform of service appears (Tukker, 2004) as:

1. Product-oriented services (selling products with some extra services)
2. User-oriented services (selling functions of the product as leasing).
3. Result-oriented services (selling results or utility as an outcome)

Auguste et al. (2006), Gebauer and Kowalkowski (2012), and Raddats and Burton (2011) discussed types of OS related to service-oriented organizations, which are combined product and service business units, separate service business units, and customer focused business units.

The decision regarding the appropriate OS to adopt is made according to an organization's service-led growth strategies. As organizations find profitable opportunities from offering service, the transition begins in stages, starting with a few product-related services and ending up with a broad set of services or solutions offered. During the early phase, base level (Baines & Lightfoot, 2013) or customer service provider (Gebauer et al., 2010), the organization decides to offer services to support a product. The combined product and service business units will be a proper OS for this level (Gebauer et al., 2010; Oliva & Kallenberg, 2003; Raddats & Burton, 2011). This OS will include product-related units and service management functions (Lobert, 2016).

As organizations increase their service offerings, they will enter the next stage, the intermediate level (Baines and Lightfoot, 2013) or after-sales service provider and customer support provider (Gebauer et al., 2010). In this stage, the expansion of services is recognizable and profitable. Service offerings are created to support product differentiation (Raddats & Burton, 2011). At this stage, the use of separated product and service business units is appropriate (Bustinza et al., 2015; Oliva Kallenberg, 2003; Raddats & Burton, 2011). Gebauer et al. (2008) suggested that at the after-sales stage, offers should include only basic services and could be integrated into the existing OS, whereas, at the customer support provider stage, separate service units would be more suitable. Oliva & Kallenberg (2003) pointed out that if offers are related to building a relationship or process-oriented services, creating independent business units for services is essential. At this level, the growth of service offers leads to increasing service orientation in OC (Raddats & Burton, 2011).

The last stage is the advanced level (Baines & Lightfoot, 2013), or development partner and outsourcing partner level (Gebauer et al., 2010). During this stage, designing customer solutions is targeted, which means shifting from selling products to many customers to selling a broader set (products and services) to a limited number of customers (Raddats & Burton, 2011). At this phase, organizations started to relocate their OS around customer groups (Gebauer et al., 2005; Raddats & Burton, 2011) and, therefore, the separation of product and business units is no longer a suitable OS, as the organization is expected to satisfy customers by integrating the efforts of all functions. Core teams in sales units, or designing customer-focused business units, are appropriate for this stage (Gebauer et al., 2008; Raddats & Burton, 2011). Consequently, a hybrid OS or matrix OS are formulated with two dimensions, customer units at the front end, and product and service units at the back end, and decision-making then shifts from product units to customer units (Galbraith, 2002). Gebauer et al. (2010) pointed out that R&D teams were necessary to work with customers and find solutions to their needs, and outsourcing partners are developed to overcome operational risks and to focus on customer operating requirements (Gebauer et al., 2010).

In summary, combined product and service units are appropriate for companies that sell products as a core business (Auguste et al., 2006). Independent service units are suitable for organizations that invest in service-driven growth (Raddats & Burton, 2011). Finally, customer focused units are appropriate if service is dominant, sales growth is decreasing, and separate product and service units are inappropriate (Raddats & Burton, 2011).

From an operations perspective, managing a service operation depends on the changes in OS, operation processes, and the identified type and number of tasks and people in the organization (Buzacott, 2000). Smith and Maull (2014) suggested that the challenges of servitization were not only associated with developing effective services, but also the actual integration between service (front offices) and production operation (back offices). Furthermore, they stated that the degree of customer orientation was

the critical element for operational change. Thus, the concept of “lean service” has been used recently in the service operation literature as a proposition to concentrate on the value creation, and to eliminate non-value activities from processes (Resta et al., 2015).

In summary, Table 1 illustrates the differences between production and service operations.

Table 1. Differences between production and service operations

Items	Production Operation	Service Operation
Role of Goods	Goods are end products	Goods are either intermediate product or offer package of products and services with service dominance
Value Characteristics	Creating value through a transformation of raw materials, (transactional activities).	Creating value through activities focused on building a customer relationship along with transactional activities related to product sales
Design of Work	Work is divided into units; people are assigned to execute their specified duties.	Preferable to work as staff teams from different departments and from outside the organization.
Main Concern	Product innovation	Quality of services and solving customer problems in addition to offering products
Processes and Technologies	1-Physical transformation of materials into tangible goods 2- Automation of processes in order to achieve quality conformity and decrease employees' involvement.	1. Delivering value through facilitation and mediation 2. The use of intensive, mediating technologies. 3. Processes and technologies must facilitate service delivery.
Capacity	Meeting market demand aiming to maximize the uses of resources.	1. Lower capacity is accepted in order to respond to customer needs 2. Increasing capacity is allowed without changes in the service process 3. Capacity can be measured through a number of customers served by the service unit per day
Facilities (Baines, 2009)	1. Large factories; assemble closer to production location. 2. Vertical integration is preferable to minimize costs, to control over quality and supply chain.	Smaller, multiple friendly facilities close to the market, or centralized manufacturing area, and service points located close to customer operations.
Customer Data and Knowledge	Used for Controlling	Used as a Valuable Asset
Quality Control	Techniques focus on achieving product conformity and utilization of resources.	Delivering service is measured through the subjective judgment of individuals and customer surveys.
Product and Service Range	Producing a higher volume of limited product range	Producing a limited product range with bundles of supporting services.
Introduction of New Products and Services	New product is designed and tested before releasing into the market.	New service is designed in cooperation with the customer.
Work Structure	Hierarchal, vertical structure is preferable	Network flatter structure is preferable
Performance Measurements	1. Parameters: cost, specification, and delivery time. 2. Measurements: profitability, market share, productivity, low operation cost	1. Parameters: customer expectation of service, co-location, and response speed 2. Measurements: customer satisfaction, customer lifetime value, collaboration between employees and management. 3. Difficult to measure satisfaction as every customer has his/her own mindset to recognize the acceptable service.

Source: Baines, 2009; Buzacott, 2000; Martin & Horne, 1992; Neil et al., 2013; Nuutinen & Lappalainen, 2010; Shah et al., 2006

DISCUSSION

This paper investigates the enablers of servitization and four elements are examined, reviewed, and the interaction between the enablers is analyzed. Generally speaking, it is not easy to study servitization enablers and their interrelations due to their complexity and the abundance of their aspects.

The Interrelation Between OC and Leadership Behavior

OC is among the major concerns in research work and business practices, which represents a crucial dimension to all aspects of organizational behavior. Developing service OC on the basis of customization and close relations with customers is vital. Based on Scien's OC model (2004), changing OC requires changes to the espoused values (social context) and the artifacts (operating systems). Transformational leadership has been suggested to drive organizational change (Popli & Rizvi, 2015). Leaders can utilize their knowledge of OC to change an organization's climate towards innovation and customization (Brooks, 1996).

However, Pawar and Eastman (1997) pointed out that organizational context will impact transformational leadership functions. Porras and Hoffer (1986) stated that cultural context shapes leadership style. Furthermore, the extent of leadership impact on organizational performance is mediated by OC (Ogbonna & Harris, 2000). However, servitization is perceived as business model innovation, and transformational leadership style is essential in shaping and monitoring a desired OC (Sharma & Sharma, 2010). Dubruc et al. (2014) clarified that changing OC within service-centric businesses depends on managerial behavior and structure transformation.

Recently, many scholars have concentrated on the proposition of the bilateral relationship between leadership and OC (Kargas & Varoutas, 2015). Through servitization, the transformation leader will act as a visionary, a strategic change authorizer, and a facilitator of organizational context change.

However, personal resistance may appear against a leader's actions within the service transition process, and this can disturb the leader's attention. Therefore, a comprehensive assessment of existing cultural values, assumptions, and interactions, is necessary to form an operational framework used to perform gap analysis between the current situation and the desired outcome.

The Interrelation Between OC and Digital Technologies

The interaction between the introduction of new technologies and OC is a two-way relationship. Creating a service OC demands the integration of advanced technologies to facilitate service creation and value delivery. However, when new information technology is introduced, different employee reactions are expected and, at the same time, OC context will assist the employees to acclimate themselves to the technological development (Xie, et al., 2013). Employees' acclimation to the use of new IT depends on the employees' interactions with one another, such as expressing their reactions, sharing stories and tales, and the effectiveness of the embedded knowledge communication channels within the organization (Xie, et al., 2013). Technology, as an OC artifact, acts to reshape the existing OC values, as long as these technologies meet employees' expectations (Xie, et al., 2013). However, engaging in OC rituals can serve as a kind of social protection against employee anxieties about new technology developments in the workplace (Perona et al., 2017).

The Interrelation Between OC, OS, and Operations

Janicijevic (2013) stated that the relationship between OS and OC is reciprocal, thus new cultures legitimize new structures, and new structures serve to shape new cultures in a condition of employees' acceptance of a new structure proposition. For the servitized organization, it is conclusive that a model of the organic OS is more likely applicable in a service OC, as it is more flexible, innovative, and has the ability to adapt to changes (Garg & Krishnan, 2003). Galbraith (2002) proposed a well-known model for service-oriented business called the "front back hybrid model," which emphasizes the assumptions of an organic model, with distinctive features of establishing front and back offices or divisions.

The Interrelation Between Leadership Behavior and OS and Operations

Leaders can change their roles from directing internal production processes to developing outside relations with customers (Nie et al., 2013). Moreover, they can change their focus from "operand resources" management, e.g. materials and equipment, to "operant resources" management, such as skills and knowledge, which primarily depend upon employees' intellect (Nie et al., 2013).

Burns (1978) stated that transformational leader is an independent power in changing OS. Pawar and Eastman (1997) argued that transformational leader suits the "adaptation organization," which is described as a dynamic environment that introduces change in response to the demands of environmental conditions. Further, the transformational leader will adopt a revolutionary act as long as he or she faces an organizational context with a bureaucratic-based OS; otherwise, the leader will act as a reformer and exploiter of organizational context (Pawar & Eastman, 1997).

The Interrelation Between Leadership Behavior and Digital Technologies

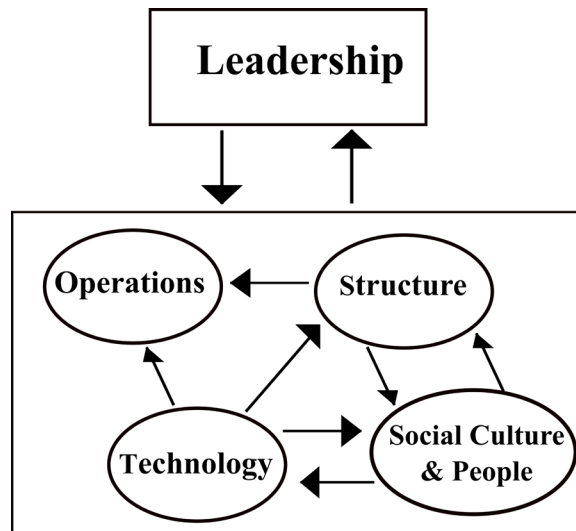
In general, leaders have the power and authority to influence, support, and execute, the needed service transition in technological systems. In the competitive and complex business environment that is facing servitized organizations, it is necessary that leaders create an OC that facilitates innovation and IT integration. The philosophy of management and the OC plays a primary role in determining the consequences that will result from the introduction of technology (Peyman et al., 2011).

The Interrelation Between Digital Technologies, OS, and Operations

Digital technology clearly impacts OS (Peyman et al., 2011). It determines the complexity of the OS, as the more the technology in use advances, the greater the complexity of the built OS must be in order to ensure additional coordination, control, and communication mechanisms (Peyman et al., 2011).

Peyman et al. (2011) stated that applying IT would facilitate organizational restructuring from the traditional hierarchical OS into a flexible matrix design, with minimum organizational borders. All tasks are integrated using information technology networks, the tasks' pattern changes from one task performed by an individual to group of tasks performed individually, and employee roles change from routine, simple tasks to designing customized solutions (Peyman et al., 2011). IT is also used within organizational operations to fulfill many different purposes. For a product-oriented organization, it is used to automate processes. For service companies, it is used to facilitate service offering and relationships with customers (Baines et al., 2009).

Figure 1. The interaction between servitization enablers



CONCLUSION

Presently, servitization as a new business model is recognized by many manufactures. However, the service transition is accepted when the transition is consistent with the different elements of the organizational culture. The more the direct attempts and efforts to change an organization's culture, the more the employees show resistance, therefore, the OC change attempts will end up in improving only the visible parts of the organizational culture. Thus, the transformational leadership style is recommended for integrating service orientation into an organization as it has strong capabilities to create an environment for higher employees engagement. Moreover, implementing servitization requires employees with more social, personal, and technical skills. It is also suggested that successful businesses incorporate the latest digital technologies into their business models to accelerate the organization's transition to services, develop new service offerings and ways of delivery. It should be noted that as the organization shifts its core business from selling products to selling services and building long- term customer relations, independent service units are required with redesigning of its internal operations. Finally, servitization enablers are interrelated deeply within servitization processes. The paper examined these relations at a macro level. However, the extent of change or transition of these enablers depends primarily on the required level of service integration.

FUTURE RESEARCH DIRECTIONS

This paper, being of an investigative nature, suggests a number of opportunities for future research in terms of theoretical improvement and concept validation. Further work is essential in:

1. Examining these enablers and their interactions within empirical research.
2. Examining the impact of these enablers on the different levels of servitization design.

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KEY TERMS AND DEFINITIONS

Digital Technology: Device or application to record, process, receive, transmit, or display information in a numerical form.

Service Culture: Culture where employees have a desire and ability to serve customers and solve their problems.

Service Structure: Set of people, technologies, and shared information designed to perform services.

Servitization: A shift of firms, mainly manufacturers, from selling products to selling customer solutions coupled with their existing products.

Transformational Leadership: Leadership style that motivates change of individuals and social systems.

Ambient–Intelligent Decision Support System (Am–IDSS) for Smart Manufacturing

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INTRODUCTION

Competitiveness among companies and nations is forcing decision makers in companies to strategically re-creating manufacturing processes and supply chains toward smart production. The goals of smart manufacturing include: 1) optimizing production and increasing profitability and innovation, 2) responding to market changes faster and with agility, 3) better-informed decisions, and 4) more flexibility in physical processes, cf., Clemons, 2018. Smart manufacturing can create dynamic, competitive operations, and global supply chains by using intelligent computerized control, advanced information technologies, the Internet of Things (IoT) technologies, and flexible manufacturing systems.

Research in the broad area of smart manufacturing and its challenges for encompassing IDSS into the production process appeared in a wide range of topics and methodologies. For instance, Simeone et al. (2019) investigated the requirements for cloud manufacturing platform for making a sharing platform in the smart manufacturing network. Weber (2018) introduced effective stakeholders in measuring key performance indicators (KPIs) for the smart production process in the high-tech industry. Meng et al. (2018) considered the smart recovery decision-making process for sustainable manufacturing purposes. Latorre-Biel et al. (2018) designed a Petri net model of a smart factory regarding the Industry 4.0 paradigm as virtualization for decision making support. Avventuroso et al. (2017) introduced a networked production system to implement virtual enterprise and product lifecycle information loops. Preuveneers et al. (2017) reviewed the emerging trends on the smartness of manufacturing, including the relevant research challenges and opportunities to shape an IDSS. Brodsky et al. (2014) investigated the decision support system for reusable components, including knowledge, data, control variables, and decisions, for leading the environment to the smartness. However, there is a lack of a good snapshot of quantitative modeling approaches and trends based on system engineering design, emphasizing system requirements analysis and specification, the use of alternative analytical methods and systems' evaluation.

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The purpose of this article is to introduce an IDSS based on AmI technology for smart manufacturing landscape, emphasizing on design and structure of AmI technology and covers the technological foundations of smart manufacturing. To build essential knowledge around AI technology and its role in influencing Am-IDSS platform, we are focusing almost exclusively on issues relevant to understanding, constructing, and analyzing the different challenges of smart manufacturing from the system engineering point of views based on human-centric computer (HCC) interaction design.

Our approach is to explain the basic principles of Am-IDSS structure in the area of smart manufacturing. First, we address the new and rapidly growing role of the internet and high-tech computing in manufacturing. Other topics include the definition of smart manufacturing, smart DSS, AI potentials for smart manufacturing, and the necessity for advance Am-IDSS in smart manufacturing. Thereafter, problems of coordinating the advanced robotics, Cyber-Physical systems (CPS), IoT and admitting the big-data, machine learning, and cloud and cognitive computing in industrial development will discuss. Following these topics, the structure of Am-IDSS including component of collaborations, services and logical issues in Am-IDSS, infrastructural layers of Am-IDSS such as physical, functional, integrated, and human-computer layers, architecture of human-centered DSS, components of database module, information collection components, components of knowledge management (KM) module, decision making process components, and user-interface components will be reviewed. The system engineering design of each model implements the role of AI in different segments of Am-IDSS. Models and applications of Am-IDSS for smart manufacturing will be explored, including (not limited) the advanced manufacturing processes, rapid prototyping, collaborative virtual factory (VF) platforms, advanced human-machine interaction (HMI), machine-to-machine (M2M) communication, and open manufacturing. The development and future trend of IDSS for smart manufacturing such as HCC and Information architect (IA) will discuss.

The study will be concluded by providing recommendations for further research and align our mindset for the next step. From the gap in the literature, we propose some areas for further investigation, for those who are interested in walking into the field of IDSS for smart manufacturing.

BACKGROUND

AmI is becoming an interesting emerging topic after the birth of the fourth industrial revolution and smart manufacturing. In a manufacturing environment with AmI setting, human's senses and their actions, machine and materials, temperature, etc. are becoming feasible; therefore, creating a platform or software to interpret and act on data from sensors in real-time is a significant problem. In this sphere of influence, several studies have been done to show how AmI can bring impact for decision makers in different fields, such as transportation (Ocalir-Akunal, 2016), healthcare (Tawfik & Anya, 2015), and disaster management (Fersini et al., 2017). However, only limited works consummated in this sphere for smart manufacturing.

A unified structure of an integrated expert system and DSS for designing an IDSS for the first time was discussed in the late 80s by Teng et al. (1988). Later, after the birth of AmI in the late 1990s and increase of interest in user-experience and user-evaluation, during the revolution from mass production to mass customization, Kim et al. (2004) were among of the first researchers who integrated the human-centered knowledge into the IDSS. Following them, Filip (2008) designed the IDSS for large-scale complex systems with the perspective of advanced IDSS, including the AI-based techniques, the concept of the AmI, and mixed-knowledge IDSS approach. Marreiros et al. (2009) invented the augmented DSS

based on intelligent sensors which can simulate the behavior of human users. Vrana and Aly (2009) enter to this area from reverse engineering solution, where they design the infrastructure of AmI into DSS after the implementation of smart decision making into the managerial level, and analyzing the system requirements, quality, and performance from human performance.

Although, almost all researches investigated on the benefits and bright future of consolidation of AmI and decision making and production process, Gandy (2010) surveyed on challenges, difficulties and disadvantage of using AmI in DSS including, ethical concerns, data quality, human emotionalism, and economical concerns due to technological assessments and discriminations. Some studies considered knowledge management, and re-usability of knowledge from the machine for human users or human users for machines into the IDSS (Brodsky et al., 2017; Kim et al. 2008; Urosevic et al. 2006). In the work of Chen & Chen (2010) ubiquitous computing environment is combined into decision-making process and presented the context-aware DSS.

More recently, after the genesis of the fourth industrial revolution, literature involved with the concept and application of smart and intelligent manufacturing multiplied. Kaklauskas (2015) deliberated the ideas of AmI and IoT and their link into the IDSS; however, the article mainly discussed on concepts rather than the design of the systems. Robinson et al. (2015) investigated the application of AmI in manufacturing for energy saving and efficiency. In their study, in addition to presenting a comprehensive survey on the use of AmI, they suggested general information regards to the system implementation and requirements of AmI adhered processes. Tyrychtr et al. (2016) merged the concept of online analytical processing (OLAP) into the AmI for constructing a smarter DSS. Martinho et al. (2017) introduced a ubiquitous group decision support system for facilitating human-human interaction in IDSS. Gomes et al. (2016) had an in-depth look at the architecture of production and control planning of a system merged with AmI technology. Similarly, Menascé et al. (2015) designed a structure for automated smart manufacturing upon the IDSS for production and control planning.

Our approach in this study is the general framework of the used case analysis presented in Gomes et al. (2016) for Am-IDSS. In this study, we flashback to the past, when Kim et al. (2004) brought the human-centered knowledge into the decision-making system. Regards to their modeling and design, we update it with the AmI and smart manufacturing perspective.

SYSTEM DESIGN OF IDSS: CHALLENGES AND COMPONENTS

The collaborative component is the first and most constructive component of an Am-IDSS. It can provide different aspects of design for an Am-IDSS. It also helps the nature of organizations or businesses to become more distributed and dynamic. The distributed concepts could be any properties or entities of an organization such as knowledge, humans, specialization, tasks, and contexts when there is no limitation regarding roles, time, geography, and structure. A collaborative component can describe through the 1) application of collaboration, 2) collaborators (human users), 3) fundamental, process, and issues of collaboration, and 4) collaboration enable technology and environment.

Knowledge is the next and the most vital component for Am-IDSS. It can be originated from data, expert system, collaboration, documents, and intelligent models (Power et al., 2018). It can increase the level of understanding of problem-solving and decision making. Knowledge should be shareable (knowledge sharing, KS), producible (knowledge production, KP), integrative (knowledge integration, KI), and acquisitional (Knowledge acquisition, KA). Within the decision-making process, firstly, knowledge is captured (KA) either manually or automatically. Knowledge is represented in different

formats and is required to be stored and fusion (KI) for further analysis. Later knowledge needs to be shared (KS) among different parts of an organization for human brainstorming or system enhancement and preventive maintenance. KS causes the creation of new knowledge or innovation (KP). At the end of each loop, KP should be validated to become KA for the next loop.

Interaction among the participants in a collaborative Am-IDSS to use the knowledge can take place in a distributed environment. A distributed environment for intelligent processing required actuators, sensors, and mobile devices to make collaboration and communication possible, depending on how wide the environment is expanded. Besides, the interaction and processing should proceed in a real-time but virtual system. Additional technologies, such as word sense disambiguation (Ruas et al., 2019), are enforced to interpret the knowledge of different languages (such as image, signal) and formats to a unique and singular terminology. AI, as a comprehensive and intelligent tool, can deal with different parts of the knowledge processing from KA to KP.

In a collaborative environment, the participants' interaction is not entirely accepted and respected by all users. Decision makers may have arguments for supporting or ignoring alternative solutions. The level of acceptance or rejection is highly depended on the level of interaction and understanding the shared knowledge. Therefore, communication in any scale from M2M, human-to-machine (H2M) or human-to-human (H2H) depends on the point of interaction called interface. The better the interface is, the higher the level of interaction will be.

Interfaced interaction should be independent of time, location, and the number of users (group or individual). Consider the independence characteristic of interfaced interactions, semantic web could be as one of the best environments for sharing and interaction. Semantic web increases the accessibility and interface-ability, and a consequently higher number of users, which leads to more innovative and accurate decisions.

An increase in the number of users brings diversity. Therefore, considering the independence characteristics of interfaced interaction, an interactive user interface system is required for better communication and interaction among users (human or machine). HCC can manage the interaction between users through human-computer interaction. Note that HCC can manage the H2H interaction, since, in a distributed environment and semantic web, humans communicate through the machine with each other, either in hierarchy or anarchy level. However, regardless of the levels of interfaces, in any level of interaction, either in H2H, M2M, or H2M communication and interaction may not be understandable for all users. Additional technologies (such as word sense disambiguation) are required to determine the sense of ambiguous interactions according to its context and prepare it for the needs of all levels of users.

Consider the aforementioned components of an Am-IDSS; Figure 1 illustrates a collaborative Am-IDSS module, and Figure 2 performs the class diagram for AmI based design.

Figure 1. A collaborative module of an intelligent decision support system based on AmI

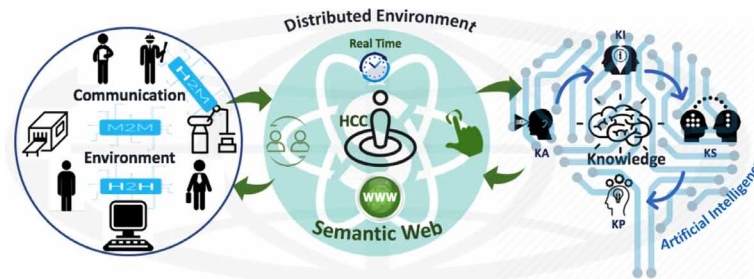
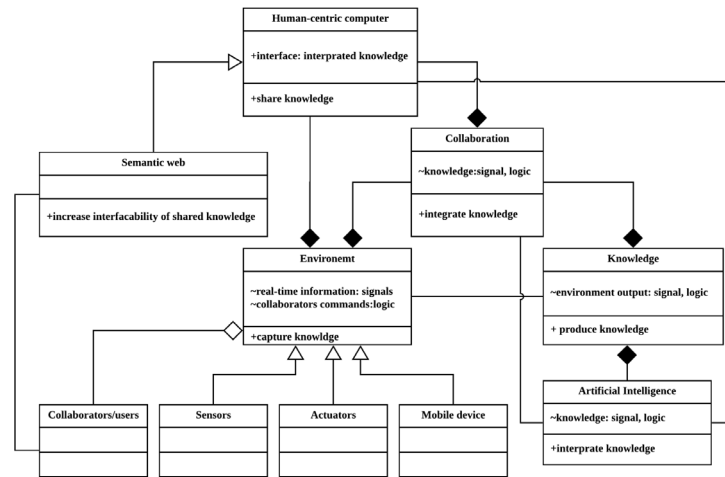


Figure 2. Class diagram for AmI based design



MODEL AND APPLICATION OF AMBIENT INTELLIGENCE FOR IDSS

A. AmI's components

According to the Aarts & Marzano (2003), the main components of AmI are classified into two classes of intelligent aspects including “personalization,” “adaptability” and “anticipatory,” and ambient aspects including “context-aware” and “embedded.” Following we describe the meaning of each concept.

Am-IDSS is embedded (Agana et al., 2019; Bonci et al., 2019). In an embedded system, many networked devices are integrated into the environment and environment intelligently processes in a real-time setting. The core part of the embedded system is microcontrollers or microprocessors, which are available in a wide range of devices such as the smartwatch, intelligent traffic light, hybrid vehicle, and medical devices.

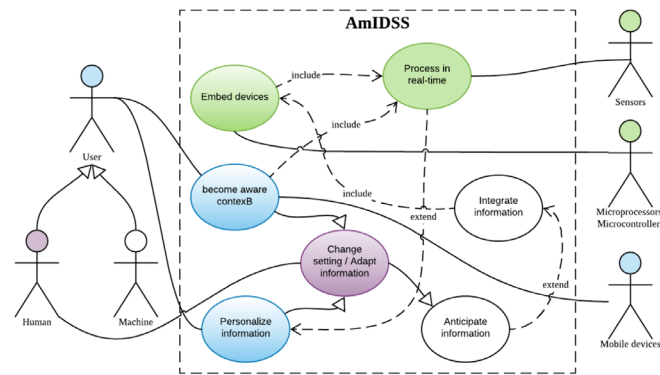
Am-IDSS is context-aware (Mahfooz Ul Haque et al., 2019; Triboan et al., 2019; Belkadi et al., 2019). In a context-aware system, a mobile device in a network is integrated into the environment to identify the situation (mainly location) of the user. The essential requirement of a context-aware system is connecting devices into the pervasive or ubiquitous computing system to deal with the network linking and environmental ambiguous.

Am-IDSS is personalized (Park et al., 2019; Bag et al., 2019). In a personalized system, environment and information are customized for users’ preference. Personalization is included the behavior, context, historical data, technology, and collaborators. The goal of personalization is user/customer satisfaction. Therefore, AmI is tightly engaged with mass customization or mass personalization.

Am-IDSS is adaptive (Murphy et al., 2019). In an adaptive system, the setting of the environment is changeable based on the need and preference of the user; in fact, the user can change the setting. The intelligent adaptation is from the machine, algorithm, or decision for humans, but the diverse form of adaptation from human to machine is not in the context of the Am-IDSS. In other words, humans will not adapt themselves to machines.

Am-IDSS is anticipatory (Lughofer, 2019; Panetto et al., 2019). In an anticipated system, the environment can make a decision and act based on that decision in an appropriate way. The Am-IDSS takes

Figure 3. The use case diagram to identify the action and relation among users and components of Am-IDSS



future events into account and builds, predicts, and evaluates a model for the future. Anticipation has employed the concepts of the AI, such as case-based reasoning (CBR) to anticipate the user's desire.

The use case diagram in Figure 3, illustrates the relationship, performance, and actions among the users and the components of the Am-IDSS system.

B. Aml's Features

AmI is applied for smart manufacturing for supporting industrial communication among components involved in the production process, manufacturing data flow, and advanced machinery. The shareable information should be understandable between users and ambiance. Following features identify how AmI can merge and help to the IDSS.

In the manufacturing process, a part of the information is explicated from human operators.

- The information could be in the form of natural input such as spoken language and handwriting through the touch screen panel and gesture. Technologies which can help in capturing information in this step could be digital pen or handwriting and speech recognition.
- The information could be in the form of observations and experiences about the statue and problems in the process and from the environment. Wireless handheld devices, tablet, mobile phones, wearable devices such as keyboards, in-cloth, data gloves, smart glasses or augmented reality (AR) can be used for recording the information during the observation or experience. Biometric authentication and authorization can help the operator to be identified and record the observed or experienced information.
- The information could be in the form of a request from the operator. Consider operator has the lowest knowledge about the information (no name of information, no information about the location or format), mobile communication and interoperability technologies such as Bluetooth, wireless local area network (WLAN), general packet radio service (GPRS), and universal mobile telecommunications system (UMTS) can aid operator to access to get an update the information. The collaborative working environment is the core for providing these services to the operator.
- Information could be unstructured, about any needs, or forwarding materials from a single operator, or during the collaborative work. For the unstructured information, the interoperability network and ubiquitous communication system could handle the information sharing procedure task.

In the manufacturing process, a part of the information is the output of devices in AmI system.

- The output information could be in the form of personalized information about the operator, or context-dependent. Wireless handheld devices or wearable output devices, such as the headset, head-mounted display, AR or other display attached devices could record this information from the operator.
- The output information could be assistance or answer from active users in return of operator's question. The active assistance or answer could deliver to the operator through visual infrastructure equipment or optical/acoustic output devices such as light, pointer, and horn.
- Any other communication in the form of visual and voice user interfaces for communication with a collaborative partner or ambiance can be done in network interoperability and ubiquitous communication system.
- Information which is impossible and inaccessible to be captured or recorded can be simulated from haptic or kinesthetic computing for remote control.

In the manufacturing process, a part of the information is the environmental input.

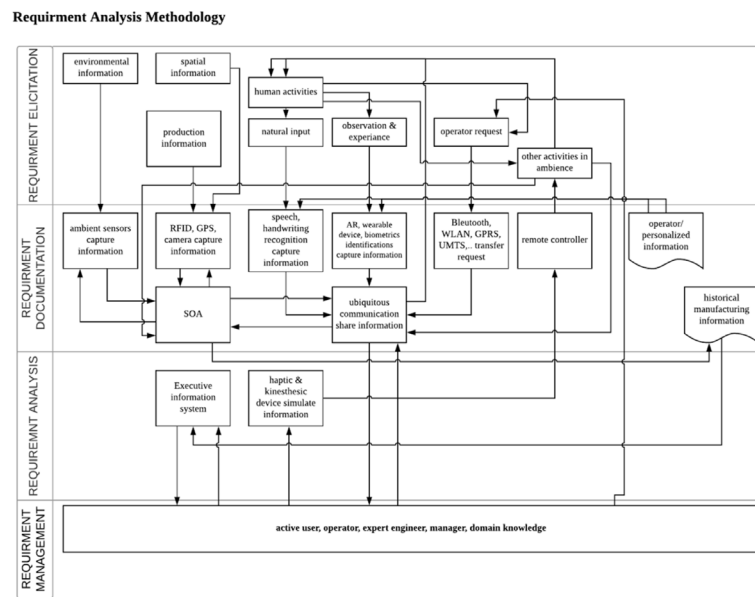
- The information could be from sensors of the underlying environmental conditions such as temperature, humidity, and vibration. Basic ambient sensors could capture this information.
- The information could be in the form of the spatial situation. The camera system or spatial surveillance and change detectors could identify the location and identification of things.
- The information could be about the hazardous changes in the environment. The sensitive sensors could alert about these critical changes.

In a manufacturing process, a part of the information is the knowledge about the ambiance, process, and interactions.

- The information could be about the status of the process, machine, products, and material, such as spatial structure, location, and movement. The radio frequency identification (RFID) tags, camera system, and geographical positioning system (GPS) could capture the location and movement information, and service-oriented architecture (SOA) in collaboration with the data acquisition system could handle the device communication targeting on the internet or web-based system.
- The knowledge could be about the current or historical status of manufacturing components, devices, and products. The manufacturing status could show environmental characteristics, date/time information, or human activities. For KM, the multi-agent technology can be employed in a distributed information and communication technology (ICT) environment and executive information systems (EIS) such as CBR and rule-based reasoning (RBR) for managing knowledge sharing and interpretation.
- The knowledge could be about the business process or semantic relationship of user activities and production process. This form of knowledge can be restored, shared, and analyzed through the SOA, semantic web, ontologies, network interoperability, and ubiquitous communication system.

The features of AmI are described through the elicitation, documentation, and managerial aspects of a system in Figure 4.

Figure 4. Analysis methodology for features of Am-IDSS



C. AmI's Implementation into IDSS

Analytical techniques for decision making continue to advance in efficacy, as well as complexity. However, it is sometimes unrealistic to employ complex analyses during time-constrained. Embedded analytics tools provided by AmI can offer an effective and practical means for real-time decision making and emergencies. For this purpose, embedded devices can be implemented in the manufacturing tools and machinery to collect and record all the necessary information, on the other side, decision-makers can be equipped with *embedded* intelligent devices to capture online data and analyzed the system configuration.

To deal with different working situations, users and decision makers have to be aware of essential elements in the situation and to interpret it correctly. Being constantly aware of all these elements is a difficult task for human users and may lead to cognitive overload. Based on contextual knowledge re-use, high-speed simulation, and advanced visualization techniques, context-aware products can provide proactive support for different manufacturing tasks. The context-aware roadmap can support decision makers to be aware of sudden changes in the manufacturing environment when they are facing a massive pool of decision information.

In a smart manufacturing environment, decentralized DSS can be used and managed by decentralized decision makers. In such cases, local decision-makers require a customized DSS system based on their knowledge, working environment, and decision tasks. AmI can support IDSS to be personalized for different levels of users and decision makers.

Smart manufacturing is a dynamic manufacturing environment which is flexible with any change from customer orders to scheduling, inventory, supply chains, and retails. Therefore, all components of the production process are adaptable with any changes, including an IDSS. Also, decision making for smart manufacturing is a group decision-making process (centralized) where each in the group has their authority to make and implement a regional decision (decentralized). Therefore, a decentralized IDSS in the inner layer and a centralized IDSS in the outer layer are adaptable with all types of assessments, theory, and pleasant thoughts.

Preventive maintenance, cost prediction, customer order forecasting, response-based supply chain, remanufacturing program, time-dependent sustainability, open manufacturing, and many other phenomena in this era of digital transformation are all possible under the umbrella of anticipated IDSS. Anticipation is required to prepare the current setting to face future trends. Future trends can be based on national strategy roadmaps, potential co-manufacturing (i.e., the case of fabless companies or open manufacturing), and customer expectation and evaluation.

FUTURE RESEARCH DIRECTIONS

Developing IDSS for AmI environments such as homes, hospitals, industrial factories, touristy spots, cultural-heritage sites, and work-places is required for advanced technological research and development. For implementing AmI, three questions should be asked about products or services, including: How this product is intelligence? Where is the location of the intelligent device? Is it a single item or aggregation of different items?

For proposing future research directions, we attempt to offer a broader vision of the requirements for designing a smart DSS associated with ambient intelligence. These requirements are barely addressed in the literature with regards to analytic context and thus are known as being the new obligations for the next step towards smart decision making. In the following, we discuss some of the highlighted topics in this chain.

Game and Am-IDSS: Applying game theory and learning algorithm for Am-IDSS and behavioral modeling in the IoT-based system would be novel future research. Players decide to leave or stay in their node by receiving the information from the neighbor nodes. The utilities of players' actions in the game will be changed by the rewards and penalties of interaction with the environment, which can be considered as a bargaining game model.

Am-IDSS Applications in Agriculture: Am-IDSS is very critical in precision agriculture, including farm processes, farm management, data chain, network management organization, and network management technology. The cloud-based cyber-physical management cycle of smart agriculture has three aspects of smart sensing & monitoring, smart control, and smart analysis & planning. More researches are needed on AmI based farm management, which is based on sensing and monitoring the farm performance, analysis, and decision making to reach the vision performance, and intervention to revise the farm processes. Moreover, in Am-IDSS agriculture environment, there are many challenges in data ownership associated with security and privacy, data quality, farm intelligent processing and analytics, sustainable integration of farm big data sources, stockholders' business models, and openness of farm solution platforms. A fruitful future research direction would be Am-IDSS for agricultural environment considering the big data challenges.

Combining AI and Operations Research in the planning of Am-IDSS Systems: Planning can be divided into deliberative (plan and execute without dealing with unexpected events), reactive (reacting to stimulus in a much more fundamental way) or hybrid (combining the best of deliberative and reactive policies). The environment of ambient systems should support planning and guide users intelligently. Planning should be intelligent either offline or online, and most of the time is related to some optimization task. Intelligent-computational and nature-inspired algorithms such as Taboo Search, Genetic Algorithm, Particle Swarm Optimization, Simulated Annealing, and Ant Colony could play the role of optimization engine. For example, in intelligent transportation DSS, the driver should get feedback both from inside the vehicle and outside such as pickup and delivery route planning under time windows, three-dimensional

loading, and network congestion. Developing more integrated optimization and AI techniques (such as hidden Markov models, logical programming, fuzzy systems, case-based programming, multi-agent programming, and ontologies) for the planning of Am-IDSS would be another challenging topic.

Am-IDSS in healthcare: Our final suggestion as a future research possibility is to integrate inter-connected Am-IDSS, service innovation, and open innovation in Health 4.0 and smart hospitals. In a smart hospital, the IDSS can be used by different layers of users, including, patients, staff, and patients' companions. Ambiance can be classified in various departments and sections, such as pharmacy, patient room, operation room, nursing station, waiting room, emergency department, laboratory, etc.

Digital Twins and Am-IDSS: Personalized production and distributed manufacturing are in the center of attention during this revolutionary period in industrial technology. On the other hand, mass customization and production required additional investigation on the cost and time for design and production. Digital twins, as a digital representation of products, can be utilized for configuration of manufacturing elements, synchronized information, and functional units. In the Am-IDSS real-time monitoring of the present production, tracking information from the past, and operational decision-making support for the future is feasible for implementation of digital twins.

Blockchain and Am-IDSS: In an open and distributed decision-making system, trust, efficiency, and accuracy are the key important factors for decision makers. A platform that can guarantee the quality of data and identify trustee users is necessary for an Am-IDSS. Blockchain is a platform that can be used to express and enforce inter-organizational agreements, control all H2H interactions, and provide an immense interfaced interaction environment for human users.

CONCLUSION

IDSS is critical for intelligent decision making in smart manufacturing. In this study, we have reviewed the roles of human factors in IDSS to design an AmI structure for smart manufacturing systems and engineering applications. Integrating HCC modeling, human factors, SOA, semantic web, and AI propose novel ideas for making smart decisions with complex objectives in smart manufacturing. In smart manufacturing and Industry 4.0, communication among machine users and human users play a critical role in automating strategic, knowledge sharing, and tactical decision making. Therefore, the implementation of an IDSS in manufacturing ecosystem will lead managers towards smarter decision making for the efficiency and effectiveness uses of human resources. In conclusion, there are many large scale optimization problems in IDSS based on AmI in smart manufacturing that we encourage readers for further investigation refer to Fathi et al., (2019) and Velasquez et al., (2019).

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KEY TERMS AND DEFINITIONS

Ambient Intelligence (AmI): Refers to a data-intensive environment that senses changes in state and responds appropriately to correct, act and alert. The goal of this sensor-rich AmI environment is stability and homeostasis.

Case-Based Reasoning: The process of learning to solve new problems based on the solutions of similar past problems.

Context Awareness: The property of mobile devices which define the location awareness. The location is used to identify how a particular process is operating around a contributed device, such as a smartphone.

Executive Information Systems (EIS): A branch of management information system which facilitates the decision-making system's needs. EIS merges with user-experience knowledge. In recent years, by entering advance technologies such as augmented reality, and turning to a smarter environment, EIS lost its popularity.

Haptic/Kinesthetic Computing: A mechanical simulation for creating the sense of touch by applying vibrations, forces, or motions to users for controlling the virtual devices or remote-control machines or robots.

Human-Centric Computer (HCC): The design, development, and analysis of a mixed-initiative human-computer system. It emerges two concepts of human-computer interaction and information science together to increase the usability of information and system by human and machine.

Pervasive/Ubiquitous Computing: Accessibility of computing in any place at any device and with any format, through the aid of mobile computing, sensors, internet, AI, context awareness and human-computer interaction.

Rule-Based Reasoning: The process of learning to solve new problems based on the research and the application of AI.

Semantic Web: An integrator which provides a framework for sharing and reusing data for every application, enterprise, and community. It is an extension or the World Wide Web.

Service-Oriented Architecture (SOA): The software-based design of services for application components over a network and communication protocol. One individual SOA system can contain other sub-SOA, it is self-contained and acts and updates independently from its vendor.

Decision Support for Smart Manufacturing

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INTRODUCTION

A post-industrial revolution is encouraging the deployment of novel concepts both for designing smart factories and for creating a new generation of monitoring, control and man-machine collaboration systems. In general, companies are embracing an era of smart manufacturing built upon Cyber Physical Systems (CPS), the Internet of Things (IoT), and Cloud and Cognitive computing. Using digital technologies with advanced manufacturing tools can provide opportunities for building smart decision support systems (DSS) to improve manufacturing analysis, monitoring, output, and performance. Despite the potential of improved Decision Support Systems (DSS), the major challenge is successfully adapting smart manufacturing processes to use new digital technologies that can enable the implementation of Intelligent systems and improved DSS.

Additionally, to move towards smart manufacturing, better means are required for technology deployments. The speed of technology implementation should be significantly faster, and machines should have greater accuracy of calibration in comparison to traditional manufacturing. One approach to enhancing deployment is incorporating optimization models into manufacturing systems. This change should provide a design that provides ease of use for operators and decision makers in real-time during the manufacturing process.

This chapter defines requirements for various types of DSS (see Power, 2002 and 2004, for details on the typology of DSS) in a smart manufacturing environment based upon increased use of optimization. It focuses on identifying key barriers which prevent the development and use of enhanced or “smart” DSS in manufacturing and then provides the requirement and architecture for a system engineering design for using optimization and other techniques with advanced computing and manufacturing technologies.

This review aims to promote a standard design or framework that is useful for both the manufacturing and academic communities that can facilitate needed efforts and innovation while stimulating adoption and use of smart manufacturing technologies.

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BACKGROUND

Mathematical models and optimization techniques are the driver for model-driven DSS. With regards to the structure of data and a problem's objective and constraints, many programming tools and mathematical algorithms are available to aid decision-makers in building a DSS with optimal recommendations. The critical step is to know the type of optimization algorithm needed to solve the problem. For more details on a taxonomy of optimization problems, one can refer to a comprehensive collection of optimization resources at <https://neos-guide.org/>.

Mathematical algorithms support convergence towards optimal solutions. This review classifies optimization problems in terms of traditional and intelligent approaches. The most commonly used intelligent optimization models are search-based (i.e., metaheuristic models), learning-based (i.e., machine learning models), uncertainty-based (i.e., robust optimization; stochastic optimization), simulation-based (i.e., Markov Chain Monte Carlo) and Markov Decision Process (MDP) (see Tao et al., 2016, for a comprehensive review on intelligent optimization).

Although using an intelligent optimization algorithm can gradually adapt a specific model-driven DSS for smart manufacturing, such a DSS requires several other criteria be met to be adequately intelligent. More intelligent DSS are created with a learning algorithm, a knowledge sharing system, and with cognitive computing capabilities. Nevertheless, in a smart manufacturing system, with connectivity among all manufacturing processes, an intelligent, integrated DSS is required to manage a manufacturing system. Features of an integrated, intelligent DSS include expert knowledge, risk management, production control, quality monitoring, marketing and sales management, project management, and supply chain (SC) support. Guo (2016) provides an extensive collection of DSS capabilities and features needed for managerial tasks of smart manufacturing integrated with intelligent optimization algorithms.

There is a gap in the literature on the applications of optimization techniques in DSS for smart manufacturing. Moreover, there is a lack of a comprehensive system design which can cover all types of DSS and managerial decision making (DM). This analysis identifies the requirements of parameter alignment, and conceptual design of an integrated, intelligent DSS for smart manufacturing by considering the core of an optimization procedure.

DECISION SUPPORT CAN AID SMART MANUFACTURING INITIATIVES

Manufacturing in developed nations must incorporate more data capture and decision support to control costs and maintain product quality. Digital transformation of manufacturing means production must be transformed using technologies like robotics, IoT, Intelligent systems, and real-time analytics. Smart manufacturing means all aspects of production are transformed so they are data, computing, and decision support intensive. Smart manufacturing has been defined by i-SCOOP.eu as the “fully-integrated, collaborative manufacturing systems that respond in real time to meet changing demands and conditions in the factory, in the supply network, and in customer needs.” Various decision support and data-driven capabilities must be incorporated in smart manufacturing systems, including:

Knowledge-Driven DSS

In a smart manufacturing environment, sharing expert domain knowledge at the manager-operator and operator-machine interface level is very important. Recommender systems and opinion mining can

support real-time, data-based decision making. Machine/user relationship mining and clustering can increase the self-awareness, self-learning, and self-maintenance of production systems. Finally, Reciprocal Learning-Based DSS (RL-DSS) can make repetitive decisions and reduce the human decision making load. Routine decision tasks can be programmed and learning algorithms can enhance performance. Then decision makers can update their knowledge and the improved system helps create better decisions than previously possible for semi-structured decisions. Research challenges include:

- **Providing Man-Machine Knowledge-Sharing**
- **Knowledge-Mining**
- **Creating Reciprocal Learning-Based DSS**

Data-Driven DSS / Document-Driven DSS

Big Data Management in the Cloud can improve data management and distribution for both “machine-generated data” and “human-generated data.” Real-time automated fault detection, classification and root-cause detection should be optimized using data from sensors. Finally, data-driven DSS should integrate real-time and special study data analytics. New and expanded data sources can enhance predictive analytics and output can be quickly shared using visualization tools.

Model-Driven DSS

Factories of the Future (<http://www.effra.eu/factories-future>) require integrated supply chain management, improved demand forecasting, and technology integration throughout the supply chain management process. Sensors combined with quantitative models can reduce costs and identify faults in the supply network itself, such as sensor failure and degradation. Ideally models will optimize the frequency and timing of sensor measurement and will eliminate or reduce supply chain network delays.

Creation of an Intelligent Feedback Control System can improve product quality and can provide feedback for system management, which can be used to improve production scheduling, to maintain machinery, and improve proactive maintenance.

Communication-Driven DSS

More machine to machine and person to machine decision support can facilitate the sharing of machines across different tasks or under different conditions. Developing simulation tools can help train operators and decision makers, prevent impending problems, and help in taking corrective action in a timely manner. If Artificially Intelligent machines communicate, then security challenges will increase, but shared decision making will increase in the capabilities of the production network.

Challenges to Improving DSS

Smart manufacturing requires intelligent systems and decision support for human participants. Improving DSS capabilities is necessitated by the development and deployment of smart manufacturing systems. The main sources of challenge are:

- **Innovation:** The fast growth of start-up firms has led to accelerating change in manufacturing environments. The production function has become a source of innovation. On the other hand, innovation in an organization often leads to increased personalization. However, the sustainability in innovation due to rapid change in technology is often temporary. Invest in decision support may be delayed.
- **Changes in Social Behavior:** Customers are becoming more knowledgeable; and their demand for quality, customer service, and rapid product adaptation to new technologies is increasing. Therefore, manufacturing servitization, developing capabilities needed to provide services and solutions that supplement traditional product offerings, is required. New service capabilities often necessitate creating more integrated products, increased customer focus, more automated services, support, and more knowledge integration in an effort to produce value-added products. Additionally, rapid changes in leadership and culture must occur to respond to rapid market, business, and technological change.
- **Changes in Technology:** Changes in technology set new standards for evaluating the performance of manufacturing firms, such that from a quality management perspective, since 1987 (ISO 9000 series) society has moved to environmental management in 1992 (ISO 14000 series) and, recently, to an energy management perspective (ISO 50000 series). Other indices, such as the Key

Table 1. Optimization-based solutions for overcoming DSS challenges in smart manufacturing

Quick Solutions	Detailed Solutions
Digitalize knowledge-based DSS	• Incorporating the behavior of human decision makers with proposed solutions. • Automating decisions previously made by humans. • Improving the interface of Information Systems for humans.
Incorporate dynamics into the solutions	• Developing stochastic and dynamic versions of solutions and deterministic models. • Anticipating stochasticity in the models based on dynamic programming, robust optimization, and stochastic programming.
Design software-based solutions with a user-friendly interface	• Considering the role of high-tech computing techniques, including cloud computing techniques in DM and parallel computing on Graphics Processing Units (GPU). • Knowing the restrictions of management software for smart manufacturing management, process, and production. • Proposing alternative software solutions, including service-oriented computing and software agents for planning and scheduling applications.
Create a hybrid configuration of optimization models	• Facilitating planning problems and a DM-based optimization and data analysis perspective. • Implementing “Manufacturing Execution System” (MES), “Enterprise Resource Planning” (ERP), and “Advanced Planning and Scheduling” (APS) for developing integrated production planning and scheduling solutions. • Decreasing measurement uncertainty by merging the hybrid metrology with state-of-the-art statistical analyses.
Enable Simulation and Data-driven solutions	• Simulating the physical environment to comprehend the connections amid real-world circumstances; and planning to find solution-based approaches in a risk-free environment before applying those solutions. • Visualizing production planning processes by use of event-driven process. • Modeling and analyzing manufacturing challenges by utilization of various simulation paradigms. • Supporting the different aspects of DM in smart manufacturing by embedding the actual simulation methods in existing and forthcoming information systems.
Encourage Process integration	• Integrating decisions made by the different elements of the system to avoid <i>ad hoc</i> situations. • Integrating high-tech computing procedures to derive computationally tractable models, and to engage in discourse regarding the diverse uncertainties encounterable in the industry. • Incorporating sustainability aspects into proposed solutions and deterministic models. • Taking the product’s lifetime into account and integrating with demand planning.

Performance Indicators (KPI), must radically change in both definition and metrics due to cross-factory integration.

- **Changes in Market Behavior:** Merging of small, medium, and large enterprises changes the nature of competition in many markets. Lowering the general cost of IT infrastructure like server and networks and market forces that are increasing the cost of innovative technologies are increasing the dynamism and volatility in many industries. Robots and machines participate in smart manufacturing systems by means of Artificial Intelligence (AI). Therefore, the concept of a supply chain is not limited to moving services and products from the supplier to customers; rather, supply chains must describe all transactions among different parts of production systems and of the network both inside and outside of a manufacturing environment.

Despite the challenges mentioned above, Table 1 summarizes some specific suggestions for developing DSS and smart manufacturing solutions that can overcome them.

KEY COMPONENTS OF INTELLIGENT, INTEGRATED DSS

This section defines a framework and a reference architecture to support the requirements for more intelligent, “smarter” DSS. Three components are explored: 1) the environment, 2) the architecture, and 3) the requirements. The discussion is based upon common principles, assumptions, and terminology for better integration and interoperability.

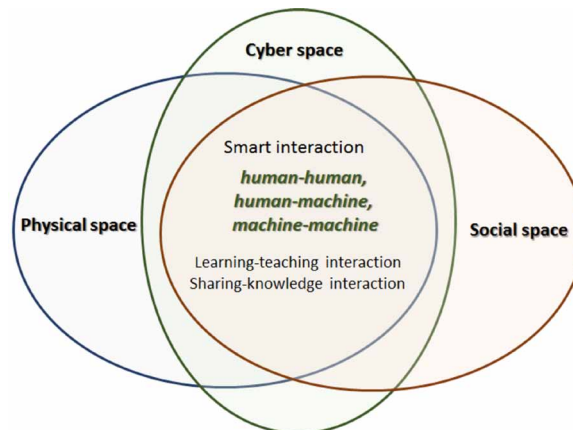
A. Environment

Cyber-Physical Systems (CPS) integrate computation, networking, and physical processes. A CPS links cyberspace with the physical world through a network of interrelated elements such as sensors and actuators, robotics, and computational engines. These systems are highly automated, intelligent, and collaborative. A CPS is sufficient when only standalone model-driven, data-driven, and document-driven DSS are implemented. However, when knowledge-driven and communication-driven DSS are integrated with other types of DSS, the CPS itself cannot adequately cover interactions among the system components. In this case, only a Cyber-Physical-Social System (CPSS) can support all aspects of decision support needed in the system. Semantic integration transfers information between the physical world and CPSS, and delivers knowledge between a CPSS and communities of practice. In smart manufacturing, communities include expert engineers/managers and/or machines/manufacturing tools. Communication can be defined in terms of its occurrence either on a vertical level (between members at different expertise and application levels) or on a horizontal level. Machines in the same group and similar application can form a community if they are carrying out knowledge activities and if they can either learn from or teach other members of the group. A schematic of the CPSS is illustrated in Figure 1.

Ideally, the CPSS environment will be an autonomous, sustainable, and intelligent system that can gather and organize resources into semantically rich forms that both machines and decision makers can efficiently use. Additionally, each space is required to be capable of self-evaluation.

The evolution of socialnomics, especially social network peer reviews, related to products/services in manufacturing organizations and more integrated operational structures defines a new concept of social manufacturing systems, see Jiang et al. (2016). Information technology and decision support must process these new data sources, especially for consumer facing goods.

Figure 1. Schematic of a Cyber-Physical-Social System



B. Architecture

DSS can create a sophisticated management system. In general, DSS can integrate multidisciplinary data sources and related tools to generate value-added information to support DM. This section outlines a functional description of components required for realizing a system based on CPSS. The architecture comprises inherent layers that are typically considered in requirements specifications for production systems and associated analytics, and decision processes. The ten proposed architecture layers are as follows:

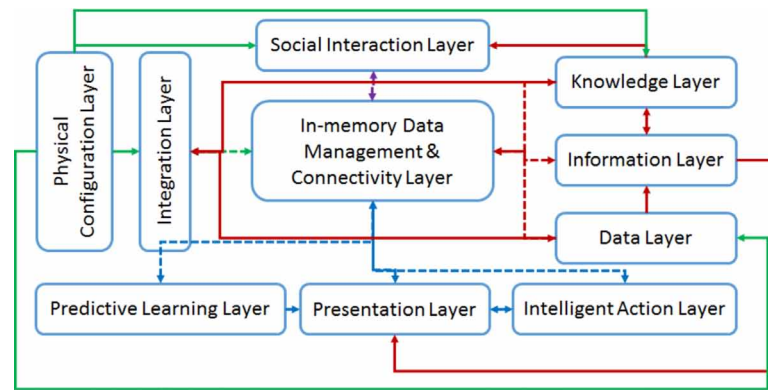
1. **Data Layer:** Contains distributed spatial, constraint, and relational databases—and their meta-data information. This layer provides transparent access to data without concern for their original formats. Since the data layer is the most frequently accessed layer, a data warehouse system usually exists to help improve performance. The data layer also provides the base for building data-driven and document-driven DSS.
2. **Information Layer:** Contains a collection of domain-specific mathematic or analytic tools or simulation models that help aggregate data into information. The analytic tools can be distributed over a network of computers in each of the other layers in the architecture. The analytic tools include domain-specific statistics, optimization, and simulation models. These domain-specific tools can provide value-added information based on raw data from the data layer.
3. **Knowledge Layer:** Knowledge is created or discovered by combining information when it transfers from an expert/intelligent engineer/machine to other parties in the system. Tools or applications that provide or recognize domain-specific knowledge include data mining, knowledge discovery algorithms, or traditional statistical inference approaches. The tools in the knowledge layer do not make decisions. Instead, they contribute and organize knowledge that is used in the decision making process. This layer also provides the knowledge base needed to build a knowledge-driven DSS.
4. **Integration Layer:** In a smart manufacturing context, additional adapters for sensor and IoT object integration are required. Due to the extensive variety in the use of various sensors, an initial classification into an ontology-based enterprise data model is needed. The integration layer can provide access for all types of DSS. In the integration layer, data from multidisciplinary sources is combined into information that can be used as domain knowledge either by non-experts or by machines. Those multidisciplinary data sources and related tools can be organized under a hier-

archical architecture structure to clarify their relationship. The system in this layer cannot express the information context inside a domain-specific application for decision making.

5. **Physical Configuration Layer:** This layer deals with the practical deployment of essential hardware for implementing CPSS such as sensors, actuators, machines, and personnel. Information about the task, process plans, quality requirements, and real-time data can be stored in the physical devices, which can repeatedly be read and written for production management usage. The physical devices flow via wireless communications in the manufacturing environment, and the information network and databases extracted from physical devices are configured and connected with each other for information sharing.
6. **Social Interaction Layer:** The social interaction layer plays the role of a mediator to assist the communication and collaboration among manufacturing components as described in the social space of the CPSS. This layer also provides the base to build more comprehensive communication-driven DSS.
7. **In-Memory Data Management and Connectivity Layer:** Due to the high volume of data and the velocity by which it is generated by physical devices, an in-memory data management platform is utilized, allowing for distributed in-memory data management with predictable latency and fast data access for real-time data handling. An in-memory data store will act as a central point of coordination, aggregation, and distribution. Besides data management, events such as alerts or system messages communicate with users in this layer.
8. **Predictive Learning Layer:** Real-time data access via the in-memory data management platform can be preprocessed, and the results are fed back to the in-memory data store. The aggregated data are used for in-situ analysis. Historical data can be analyzed for pattern detection and correlated with respective manufacturing process behaviors. Based on these patterns, manufacturing abnormalities can be detected, learned, optimized, and applied to monitor real-time data streams. Furthermore, modern Markov Decision Process (MDP) approaches could be combined with historical data to optimize the learning procedure.
9. **Presentation Layer:** To enable decision makers to make quality real-time decisions, all relevant data needs to be aggregated and visualized appropriately. Additionally, process engineers must be notified proactively if a decision is required or when a deviation in the current state of a process is detected. Moreover, a recommendation should be generated based on historical process analysis, and drill-down functionality should allow for navigation to Bayesian information and enable decision makers to make high quality decisions. Also, the presentation layer creates a user interface platform for displaying decision rules to decision makers. It manages the multidisciplinary meta-information from the layers beyond it. Based on the meta-information, it can reflect and provide internal data and services to users by means of a user interface diagram. The user interface can take many forms, such as a Web portal.
10. **Intelligent Action Layer:** DM happens in this layer based upon presented information. Manufacturing processes can be adapted by adjusting the current decision. However, adaptations in one process can lead to necessary changes in other interlinked processes. A consistent transition of changes must be fed back into the process execution system(s) when adaptations have taken place.

Figure 2 illustrates the relationship among the different layers.

Figure 2. The schematic of the relationship among different layers of architecture



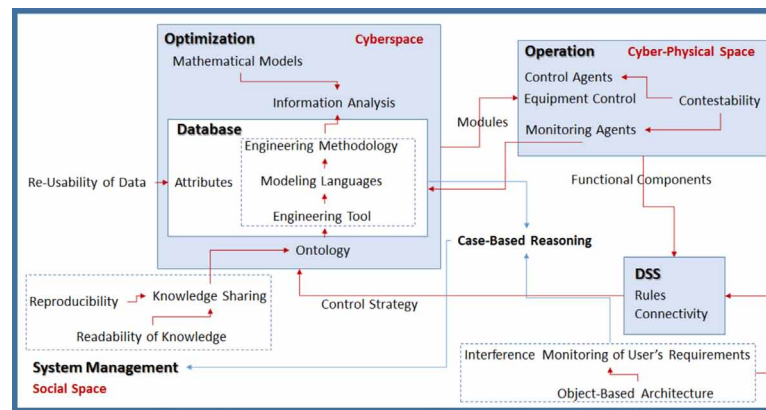
C. Requirements

To create the architecture needed required reasoning about a CPSS. A generalized framework of methods, tools and concepts can describe the needed components required for all types of DSS in a smart enterprise manufacturing environment. We define the following requirements:

- **Engineering Methodologies:** The combining of different engineering tools to build different models of a smart plant; this may be expressed in the form of process models using different process modeling languages. Methodologies decide which model to produce and which modeling languages to use to describe the model.
- **Modeling Languages:** Used for shaping the different aspects of the system and its entities—aspects including human roles, operational processes, functions, information, the workplace, and production technologies.
- **Engineering Tools:** Used for implementing modeling languages, which are supported by engineering methodologies, and model concepts to create, use, manage, analyze, evaluate, and enact models for simulation and to provide a shared design repository or database.
- **Model Concepts:** Define and formalize the most generic concepts of models in the form of ontological models, meta-models, or reference models.
- **Modules:** Used to implement the operating systems supported by models.
- **Functional Components:** For connecting to DSS in the operation phase. The functional components of DSS are included in all defined phases of software development and support the rapid adaptability and reconfigurability of manufacturing within the smart environment.
- **Information Analysis:** Consists of the analytical process modeling, statistical data and information modeling and analysis, quality management, and optimization.
- **System Management:** Involves the definition of requirements and parametric constraints. The reference structure of system management is open, which permits the possibility of expansion and improvement of the system. It can also specify hardware, processes, personnel, and facilities.
- **Mathematical Models:** Adequate models of the processes for achieving the control tasks of the system modules and equipment are required. The mathematical models allow for the optimization of the process parameters, function, and behavior of the system, information maintenance, operations and data management, and organizational structure.

- **Database:** Methods, tools, and models are arranged in a database. The methods and tools have to be characterized by their attributes for a database. Attributes determine their applicability from the system requirements. The database contains a case library and a set of solutions related to these cases. The attributes represent the objects in the database.
- **Attributes:** Defined within the ontology model as relating to properties for each concept. The attributes which are only used by the corresponding methods in each group, form the basis for choice of a suitable method or tool for the given task. Attributes characterize the prepared cases in detail and are stored in the database to be utilized in case-based reasoning.
- **Ontology:** Describes the meaning and relationships among modeling concepts (definitions) available in modeling languages, to improve the analytic capability of engineering tools and the usefulness of the models. Different components have different ontologies that coincide only partially or even mismatch. However, ontologies can merge and create a single coherent ontology; or they can align and reuse information from one another.
- **Monitoring Agents:** These follow system behavior after applying the recommended method for design and control. The “data collection and acquisition” subsystem is available and connected with monitoring agents.
- **Control Agents (Actuators):** These execute control algorithms. During the real-time control, the actuators interfere with an equipment control block initiated by some industrial controller devices or which may occur following operator manipulation. State feedback regulators can be implemented after receiving signals from measuring devices.
- **Equipment Control:** Usually designed by equipment producers. It includes sources of the actual measurement of data for the state of the physical or cyberspace equipment by sensors or other measuring devices.
- **Object-Based Architectures:** The most promising approach in modeling interactive systems. These model the interface software as a composition of co-operating objects. These models are highly modular and support concurrency, distribution of applications, and multithread dialogues.
- **Interference Monitoring of a User’s Requirements:** Defines outputs and inputs for the identification of control work for making connection of external applications via the internet or a local network for distributed computing. It is required to start as an independent component and to connect to a server for computing. The resources could be physically accessible in cyberspace.
- **Readability of Knowledge:** Knowledge has to be represented in a form which can be read by a human or by a machine/computer.
- **Reusability of Data:** All data about the specific domains have to be stored, archived, and organized for future reuse.
- **Reproducibility:** New knowledge has to be reproducible (based on historical information), and it should be organized as a structured database.
- **Contestability:** Monitoring agents update the database with newly achieved results for subsequent usage and application if all of the requirements are satisfied – or else the monitoring and control agents have to repeat their operations.
- **Connectivity:** The data collection and acquisition, the information system, and system management have to connect to DSS to provide decision makers, operators, and managers with key information that enables them to make efficient and consistent decisions.
- **Knowledge Sharing:** Representation is the application of logic, computation, and ontology for the task of constructing models for an application domain. Knowledge can integrate with conjoint use of ontology and software patterns inside each component.

Figure 3. Block diagram of requirements for intelligent, integrated DSS



- **Rules:** Defined within an interference engine; serve to find solutions for the user according to the user's requirements.
- **Control Strategies:** Defined for searching solutions by predefined rules in both forward chaining and backward chaining.
- **Case-Based Reasoning:** Used within the system to find a solution that matches best with the user's requirements, using data stored in a database.

With regards to the environment and the architecture mentioned previously relative to intelligent, integrated DSS, Figure 3 is a block diagram of requirements for improved DSS to support the essential characteristics of smart manufacturing.

FUTURE RESEARCH DIRECTIONS

In proposing future research directions, we attempt to provide a broad vision of a design for “smart” DSS for “smart” manufacturing. These design requirements are not discussed in the literature with regards to an analytic and decision support context and thus are new directions for the next step towards smart manufacturing. In the following bullet points, we discuss some of the highlighted topics in this technology chain.

- **Area 1: Bi-level optimization** is an approach where the outer optimization problem is embedded (nested) within an inner optimization problem (including lower-level variables). Many multi-level DMs exist—DMs such as strategic planning of marketing and sales channels; global SC simulation models based on a marketing-operations perspective; and positioning order penetration points (OPP) in global SCs in smart manufacturing, which can be modeled by Bi-level optimization approach. As an example, in a Bi-level DM, both the leader and the follower may have multiple objectives with uncertain values and constraints which can be modeled as a *fuzzy multi-objective Bi-level programming* DSS.
- **Area 2:** Developments in electronic communication, computing, and DM – coupled with new interest on the part of organizations to improve meeting effectiveness – are spurring research in the area of *group DSS* (GDSS). GDSS combines communication, computing, and DM to facili-

tate the formulation and solution of unstructured problems by a group of people. Another area of future research would be developing mathematical models of group DM in DSS of the smart manufacturing environment.

- **Area 3:** Optimizing the product design process in smart manufacturing has a significant impact on the global SC. The role of having a smart DSS for optimal product design in smart manufacturing is crucial. *Multi-level DM programming* can be applied for capturing different features in design stages and for evaluating design alternatives based on correlated criteria such as functionality, reliability, and manufacturability to perform automated DSS for product design criteria. Consequently, multi-level optimization – as a useful and practical tool – provides the what-if analysis for product design (i.e., “What would happen if a particular decision is taken?”).
- **Area 4:** Smart manufacturing employs computer control and high levels of adaptability. There are an increasing number of computer systems in smart manufacturing which can be considered as autonomous agents. Another area of future research would be developing Game Theory models for making rational choices—*DSS in a negotiation and bargaining game*.
- **Area 5:** Applying *cooperative and noncooperative multi-level programming* is a generalized future research direction in control and optimization of cooperative systems in the smart manufacturing environment.
- **Area 6:** Other topics in SC and operation management in smart manufacturing: 1) Integrated DSS for operation and maintenance optimization; 2) Integrated and coordinated DSS for SC optimization; and 3) Integrated DSS for maintenance, spare parts, inventory, and logistics.

CONCLUSION

More sophisticated decision support is critical for intelligent decision making in smart manufacturing environments. In this analysis, we have reviewed briefly the role of optimization and other mathematical and machine learning models in DSS to solve complex decision making tasks in smart manufacturing systems. We have proposed a systematic structure for engineering decision support applications. Integrating operations research modeling, optimization, big data analytics, and AI provide a means for making better decisions with complex objectives in a smart manufacturing setting. In smart manufacturing and in an Industry or Manufacturing 4.0 context, optimization techniques can play a critical role in automating strategic, operational, and tactical decision making and can provide more precise error analysis. Smarter decision support should lead managers to make better decisions to improve the efficiency and effectiveness of smart manufacturing systems.

We are early in the journey toward smarter manufacturing and personalization of goods. We are moving towards automation and using and integrating data capture is facilitating process improvements.

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KEY TERMS AND DEFINITIONS

Advanced Planning and Scheduling: Refers to a manufacturing management process by which raw materials and production capacity are optimally allocated to meet demand.

Case-Based Reasoning: The process of learning to solve new problems based on the solutions of similar past problems.

Enterprise Resource Planning: The real-time integrated management of core business processes, mediated by software and technology.

Manufacturing Execution System: Computerized systems used in manufacturing to track and document the transformation of raw materials to finished goods.

Markov Decision Process: Describes the environment for solving the optimization problem by reinforcement learning or dynamic programming. Provides a mathematical framework for modeling DM in situations where outcomes are fully or partially observable.

Order Penetration Point (OPP): Defines the stage in the manufacturing value chain, where a particular product is linked to a specific customer order.

Semantic Integration: The process of integrating information from diverse sources. In this regard, semantics focuses on the organization of, and action upon, information by acting as an intermediary between heterogeneous data sources which may conflict not only in structure but also in context or value.

Modelling Quality and Pricing in Next Generation Telecom Networks

14

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INTRODUCTION

Business processes in telecommunication sector have evolved from rigid structures to a highly competitive environment due to the dynamics of the open market. Future telecommunications infrastructure are expected to be built upon the concept of next generation network (NGN) referring to an architecture of telecommunication core and access networks, which assumes transport of all information and services over a common network, typically built around the Internet Protocol (IP).

Many service providers (SPs) are looking to NGN services as a means to attract and/or retain the most gainful users. In NGN users are expected to choose the SP offering the best price and quality of service (QoS) combination. As a result, SPs operating in the same telecommunication market will end up competing for users by adjusting QoS they offer and the price they charge for their services.

Quality of NGN services can be estimated based on the three aspects: QoS, quality of experience (QoE) and quality of business (QoBiz). The main goal for SP is to maximize his revenue while providing users the required QoS at the acceptable price. QoS can be defined as a set of characteristics of a telecommunications service that bear on its ability to satisfy users' requirements (ITU-T E.800, 2008). While QoS is related to the service performances that can be measured and controlled, QoE relates to the experience realized by a user when using the service and it depends upon users' actions and subjective opinions. In addition to SPs' aspirations to ensure the required QoS to their users, profitability is of the most importance to them. QoBiz in particular covers service providers' profitability. It deals with the financial aspects of service provisioning and refers to all those parameters that are expressed in monetary units. QoS, QoE and QoBiz are integral parts of a service level agreement (SLA) which can be contracted between two SPs or a SP and a user.

This chapter aims to provide new possibilities for SPs to enhance their revenues using the appropriate pricing scheme. Features and applicability of responsive pricing scheme and hybrid pricing for charging end users in NGN are discussed. Game theory is used as an underlying concept for the implementation of pricing. In addition, transparent mapping of QoS parameters to QoBiz are considered, encompassing service price dependence on QoS violation, which is consequently reflected on SP's revenue.

BACKGROUND

Pricing with QoS guarantees has gained a strong momentum in telecommunication networks in past decade. It has led to a new interdisciplinary research area of "Telecommunication Economics", which

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investigates telecommunication networks from an economical rather than from a technical perspective and allows innovative solutions in network management, control and pricing (Courcoubetis & Weber, 2003).

QoS describes the ability of a network to provide a service with an assured service level but it appears that in NGN QoS differentiation will not provide a suitable economic framework for the trade-off between quality delivered by SPs and willingness to pay from users' side. QoE is an alternative framework for pricing service quality according to the user perception (ITU-T G.1011, 2013). It is affected not only by technical (i.e. QoS) aspects, but on non-technical aspects of service too, such as service set-up, content, price and customer support, which are essential for both QoE and QoBiz evaluation.

The distinction between QoS, QoE and QoBiz metrics in case of Internet services are first emphasized by Moorsel (2001). In Wolter and Moorsel (2001) possible relationships between QoS and QoBiz metrics are pointed out, particularly the effects of QoS degradations on the profitability of e-services. This research considers dynamic relationship between QoS and QoBiz metrics with pricing as an important tool for balancing users' behaviour. Further, for the purpose of evaluating the impact of service composition and utility computing on QoBiz aspects of SPs, a distributed architecture of control systems that manages SLAs is proposed in Machiraju et al. (2002). Yu and Bouguettaya (2007) proposed the model for supporting optimized access of web services through service-oriented queries. Besides QoBiz parameters, this model captures functionality and users' behaviour, as the key features of web services. Bjekovic and Kubicki (2011) address the need for an integration of non-functional aspects of service from the business perspective with aim of improving cooperation among business enterprises. Rivera et al. (2016) presented a framework for evaluating QoE of a web-based over the top (OTT) service from QoS, QoE, and QoBiz perspective. In focus of QoBiz consideration was revenue maximization. In Radonjic Djogatovic, Djogatovic and Stanojevic (2018) the model performing transparent mapping from QoS to QoBiz parameters is proposed. This model is based on several QoS parameters that significantly affect both users' demand and a SP's requirements from the business perspective.

Telecom provider's QoBiz is tightly related to the selection of the appropriate network pricing method. Price based bandwidth allocation has been the focus of many research efforts that aimed to guarantee an appropriate QoS to users. Some methods allow congestion which results in blocking of the lower-priced traffic classes and the acceptance of the higher-priced traffic classes in case of congestion (Marbach, 2004). The concept of responsive pricing was proposed with the aim to incorporate a feedback generated by the network. When the network announces a price based on the cost of using network resources price-sensitive users adjust their traffic in accordance of their own network service valuation (MacKie-Mason, Murphy, L. & Murphy, J., 1997). Chod and Rudi (2005) considered responsive pricing with resource flexibility as well as effects of demands variability and correlation, assuming normally distributed demand curve. In Ninan and Devetsikiotis (2005) a model for incorporating pricing in NGNs with users sharing bandwidth under a fixed charge per bandwidth amount was presented. Optimal resource allocation of NGN services under a flat pricing scheme and QoS policies were considered by Kallitsis et al. (2007). Congestion pricing with various user demands over time was analyzed by Hande et al. (2010). With the goal of maximization SPs' revenue the same authors applied the optimal combination of flat-rate and usage-based access price components. The importance of selection of the appropriate pricing method for a business model framework in case of providing assured quality services is emphasized in Ghezzi et al. (2014). An overview of usage-based pricing schemes and accounting protocols that can be used in NGN are given in Radonjic Djogatovic and Kostic-Ljubisavljevic (2015). The significance of quality and pricing as major causes of customer churn is highlighted in Floris (2017). In the same publication QoE-aware collaboration approach between OTT and Internet SP has been proposed, which is driven by revenue maximization based on pricing, quality, user churn, and marketing actions. Jin et al. (2019)

proposed a location-dependent pricing strategy, taking into consideration the congestion level of different sites within the framework that integrates the advantages of information-centric forwarding and content delivery networks.

PRICING AND QUALITY ISSUES IN NGN

The evolution of networks to NGNs must allow the continuity of, and interoperability with, existing networks while enabling the implementation of new capabilities (ITU-T Y.2012, 2010). Suitable pricing and business models need to be designed which is expected to provide the appropriate incentives for both SPs and users.

Generally, the concept of pricing implies the process of determining prices which should be based on the appropriate pricing model and controlled by a pricing policy. It is expected that competition will force SPs to rapidly create and deploy different pricing concepts with aim of fulfilment a trade-off between providing satisfying user's utility and provider's profit, still preserving implementation efficiency and feasibility. User's utility can be expressed as a function of available network resource offered to a user which indicates a user's sensitivity to changes in QoS. A wide range of different pricing schemes is likely to be applied in NGN (Ninan & Devetsikiotis, 2005; Pandey, Ghosal & Mukherjee, 2007; Radonjic & Acimovic-Raspopovic, 2010). Pricing schemes that should be implemented in NGN have to be defined and evaluated with respect to the heterogeneous technical, economic and social aspects. The main evaluation criteria encompass efficiency in the context of maximizing utilities of users and providers, fairness and feasibility.

In NGN there is a need for shifting from static pricing schemes, in which users are charged independently of the resource consumption and QoS delivered, towards dynamic pricing schemes. In dynamic pricing, price is determined as a cost per unit of consumption and according to the level of QoS guarantees provided for the observed service class. The main problem with dynamic pricing refers to the need of intensive monitoring of network resources in order to dynamically adjust per-class prices to resources usage and the QoS provided for each service class. Any NGN architecture must guarantee fair access to the shared resources in the access network and control load distribution with aim of avoiding focused overload in the core. Also, NGN should support hard guarantees to users and pricing different QoS classes.

Due to the rapidly increasing deployment of interactive and multimedia applications in telecommunication services, QoS becomes an integral part of various protocols and mechanisms for enabling computing and telecommunication systems. QoS is defined by SLA which consists of two parts: the technical part and the administrative part. The technical part encompasses a set of descriptors and associated attributes that describe the particular service class and the traffic profile. The administrative part covers financial and legal aspects: information about pricing, charging, billing and payment, penalties for both user and service provider in the case of contract violation, etc. (Stojanovic, Kostic-Ljubisavljevic & Radonjic Djogatovic, 2013). As users' needs are constantly increasing, as well as competition between service providers, SLA becomes more complex.

Although QoS is usually represented by delay, loss and jitter, which are difficult to measure precisely, frequently used QoS parameters for determination whether a required service level is being achieved, are network availability and bandwidth. Network availability includes the availability of many items the network consists of, e.g. multiple physical connections, networking device redundancy. It is also important to distinguish available and guaranteed bandwidth. In many dynamic pricing schemes users are allowed to compete for the available bandwidth and their obtained bandwidth depends upon amount

of traffic from other users in the network at any observed time (Chod & Rudi, 2005). The term guaranteed bandwidth implies a guaranteed minimum bandwidth SP provides or burst bandwidth in SLA. The service with guaranteed bandwidth has higher priority and is priced higher compared to the available bandwidth service.

By introducing QoS differentiation users are encouraged to choose the service that meets their needs in the most adequate manner, which can be achieved through pricing. Providing service with strong QoS guarantees keeps users satisfied and thereby maintains the confidence in the SP. However, it is necessary to take into account user experience and business indicators too. Therefore, quality of NGN services can be estimated based on three aspects: QoS, QoE and QoBiz.

Obviously, QoS is related to the service performances that can be measured and controlled, while QoE relates to the experience realized by a user when using the service. QoE depends upon users' actions and subjective opinions. It takes into consideration users' satisfaction with the service, subjective evaluation, the degree of their expectations fulfilment and in what context they use it or intend to (Barakovic, S., Barakovic, J. & Bajric, 2010).

In addition to SPs' aspirations to ensure the required QoS to their users, QoBiz is an important aspect in providing quality of NGN services that is being increasingly used in the pursuit of better business. It deals with the financial aspect of service provisioning and refers specifically to measures such as service price, service provisioning costs, revenue from the service provisioning, revenue per transaction, lost transactions etc. In general, QoBiz parameters are all those parameters that are expressed in monetary units. According to the more precise interpretation, it is a monetary value that matches the quality of delivered service, expressed through connection of QoS parameters with monetary value within the SLA (Radonjic Djogatovic et al., 2018).

SOLUTIONS AND RECOMMENDATIONS

A model for QoBiz improvement of next generation telecom network should include business aspects that are specific and important for telecom sector. It should reflect involved parties' preferences which allow discovering, negotiating and contracting a service between a user and a provider. In this chapter we propose two models for pricing and quality improvement. The first model is designed for eliminating or at least alleviating congestion along with service price optimization regarding QoS and QoE and revenue maximization, which is reflected on QoBiz. Since it relies on responsive pricing, we will denote it as the responsive model. The second model assumes that SP offers tariff packages based on users' requirements and transparent mapping of QoS parameters to QoBiz including direct reflection of QoS violation on service prices and consequently on SP's revenue. Therefore, the second model is denoted as the mapping model.

In the responsive model, congestion and pricing management have been done via proper bandwidth assignment considering the capacity constraint, i.e. adapting the network price to optimize network performances. It is achieved by a usage-based scheme with users getting charged for the amount of traffic they consume. For maintaining social optimality these charges would have to be set equal to the marginal cost of usage. Since bandwidth scarcity occurs only during congestion, this marginal cost is essentially the same as the congestion cost. In order to achieve satisfying network and economic efficiency the responsive pricing scheme is used (Chod & Rudi, 2005). Price is emphasized as an alternative means for congestion control to ensure proper network operation and in particular to guarantee different service levels. In this pricing scheme, in the case of high network utilization, provider increases the prices for

the resources and adaptive users then reduce traffic offered to the network. Similarly, in the case of low network utilization, by decreasing the price adaptive users are encouraged to increase their offered traffic.

Bandwidth management server (BMS) is introduced in order to enhance scalability and to allow connection control functions independently of the underlying network, which makes it suitable for NGN. BMS acts as an interface between the connection control functions and the network specific bearer functions. The interface between BMS and the underlying network elements is provided to allow BMS to set up and tear down aggregate bandwidth reservations across the network. The most important features of BMS are the ability to release bandwidth when it is no longer needed and to reserve bandwidth to the particular destination of the particular QoS class. The underlying network elements must be able to inform BMS of any changes affecting current reservations. The interface should allow this information to be passed upwards to BMS immediately such an event takes place and the information should reach BMS with the shortest possible delay.

During SLA negotiation, the SP estimates resource usage according to the required traffic profile. Although it is common that the agreement between the SP and a user for a service consumption has to be settled for a long time period, in this model allocations are performed in short time scales. In practice, it would be impossible for each user to update his bandwidth in a short time scale. Instead of that, with the aim of maximizing SP's revenue, updates are performed by BMS considering network congestion and network capacity utilization. Updates are based on users' parameters of desired bandwidth, maximal price they are willing to pay and their individual utility functions. During the service provisioning interval, the usage-based traffic monitoring should be applied only with respect to deviations from the contracted traffic profile. Such approach is called hybrid pricing scheme. It needs less storage of monitoring data in comparison with monitoring per unit of consumption (i.e. dynamic pricing) and should be implemented only at the edge routers, in which traffic conditioning is performed. The solution of the problem encompasses the optimal bandwidth allocation and the optimal price for that allocation. The actual price is calculated at the end of service provisioning interval according to SP's specific policy, which should aim to force users to wisely select the most appropriate traffic profiles and to properly adjust to them. Each user has to pay the price that is equal to the sum of products of each optimal price and his bandwidth consumption during all his sessions in the agreed time period.

In the responsive model, problem of determining service prices is divided into optimization with respect to users' utility and the optimization of the provider's revenue. In this fashion, the model incorporates not only QoS but QoE and QoBiz too. Users' preferences may be modelled with utility functions that describe users' sensitivity to changes of QoS. Since it is not easy to predict actual QoS parameters, such as delay or packet losses in most real networks, utility is often expressed as a function of the amount of available network resources (i.e. bandwidth) offered to each user (Ninan & Devetsikiotis, 2005). Thus, the utility indirectly indicates user's sensitivity to changes in QoS.

The optimization procedure is performed for different categories of users, which can be alternatively done for different service classes. According to the elasticity criteria, users are classified into three categories: inelastic, partially elastic and elastic users (Radonjic Djogatovic & Kostic-Ljubisavljevic, 2015). Inelastic users are users who have strict requirements in terms of delay but can tolerate losses to some extent and their utility has been most commonly described by the sigmoid function. A utility function which best models elastic and partially elastic users' behaviour is a generalization of the logarithmic function. Elastic users do not tolerate losses but can accept a delay to some extent. Partially elastic users are also not tolerant of losses but they have stronger requirements in respect to delay. Users' utility functions vary in accordance to the elasticity criterion of a user. For all users' types, QoS is defined by

bandwidth, θ obtained from the SP. Users are assumed to be non-cooperative, meaning that they refuse to reveal their utility functions to one another in the fear of being misused.

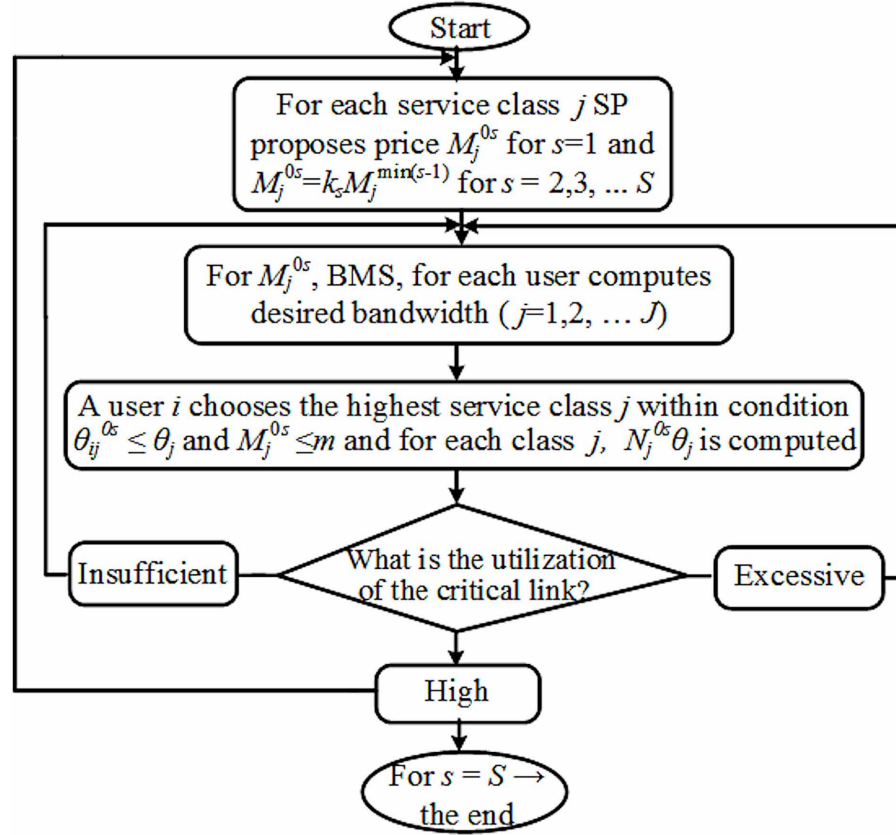
The SP employs a usage-based pricing policy by charging M per unit bandwidth consumed. Depending upon the QoS requested, i.e. the class of service he chose, each user would require a minimum bandwidth γ . Fewer bandwidth than γ on average is of no utility to the user (Ninan & Devetsikiotis, 2005). The law of diminishing marginal utility ensures that the user derives the same amount of satisfaction from any bandwidth more than the maximum π . It is considered that the user is willing to pay a maximum price m per unit of bandwidth. When the price M equals the maximal price m , the user will desire only the minimum acceptable bandwidth, γ . For all types of users, any price beyond the maximal price reduces a user's desired bandwidth to zero. Each user will try to choose his bandwidth θ so as to maximize his net benefit (i.e., utility minus cost). Ideally any resource allocation between users should ensure that the total user utility is maximized. On the other hand, the SP's utility T depends on the total revenue generated and hence is a function of the market price and the bandwidth allocated to the various users. In order to maximize his revenue, the SP settles the price per bandwidth unit according to the concept of responsive pricing reflecting the state of resource utilization.

The interaction of the SP and users is defined as a Stackelberg leader-follower game within responsive pricing scheme driving the system towards optimality. Generally, in Stackelberg model at least one player is defined as the leader who can make the decision and commit the strategy before other players who are defined as followers (Briest, Hoefer & Krysta, 2008). In the proposed model, players are the SP, acting as the leader and users, acting as followers. They act in a definite sequence and interaction between them is dynamic rather than static. The strategy chosen by the SP can be observed by users, so they can adapt their decisions in accordance to their preferences. The SP can choose such a strategy which allows him to maximize revenues, assuming that users will choose their best responses. With backward induction, the best responses of users are obtained first. The best responses of both SP and users in this leader-follower competition can be obtained in the following way. Given the price offered by the SP, based on a demand function, the amount of bandwidth users requested can be determined. For example, if the price is high, the amount of bandwidth requested by users will be small and vice versa. Then, this best response is used to compute the revenue of the SP, and he chooses a strategy that leads to his revenue maximization.

In the proposed usage-based pricing algorithm within the responsive model (Figure 1), prices optimization is performed for a single critical resource link in a SP's network. Such a link usually does not behave badly all the time, but only under certain worst-case conditions. On the observed link, the total number of users is N . For each user, bandwidth and price parameters, representing QoS and QoE respectively, are parts of the SLA. Each user gives his parameters of desired bandwidth and maximal price that can't be changed during the agreement period. The bandwidth allotment to user i is denoted as θ_i^* and that is his best response to the price SP determined. The algorithm can be performed for scenarios with different number of service classes in order to optimize bandwidth usage, price per bandwidth unit and a total capacity of the critical link in the network.

There are S rounds in total and in each round s , l_s iterations are performed, where $s = 1, 2, \dots, S$. Each round s consists of several iterative steps. The algorithm, shown in Figure 1, converges quickly after few tens of rounds. Optimization is performed for each service class j . The algorithm begins when the provider assigns an initial price, M^0 for each service class j . The initial price can be set either randomly or based on historical data. BMS simulates users' behavior in a manner that for each user requiring a certain service class, calculates the desired bandwidth and forwards the data to the provider. The provider then checks whether all user requirements can be met with the existing capacity and if the answer

Figure 1. Pricing algorithm (Radonjic & Acimovic-Raspopovic, 2010)



is yes and if the facilities are not used enough, it proceeds to a new iteration with lower prices. In case that requests exceed the network capacity, next iteration is performed with higher prices. In this fashion, users' responses are adapted to the state of network capacity utilization. A round ends when satisfactory utilization of the network capacity is achieved (over 90%). In each round different values of the network capacity are adopted as well as different values of the initial price for each service class. The price offered by the SP, which maximizes his revenue along with the best response bandwidth of each user constitutes the Stackelberg equilibrium (Radonjic & Acimovic-Raspopovic, 2010). In this manner, revenue, as a significant aspect of QoBiz can be improved.

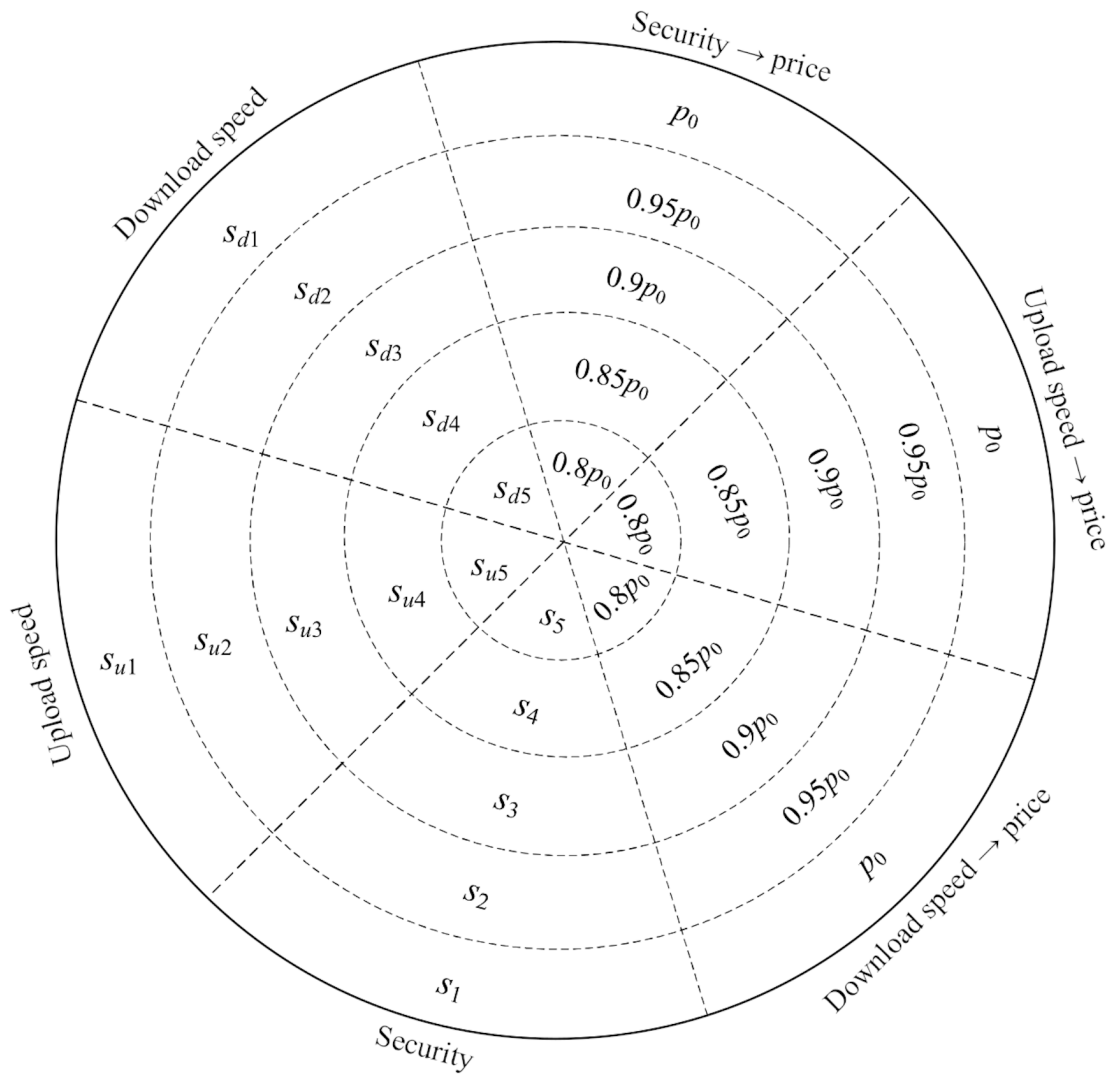
Further, we propose the mapping model, considering that SP strives to maximize its revenue while providing users the required QoS at the acceptable price. We focus on mapping QoS to QoBiz parameters (Radonjic Djogatovic et al., 2018). In the mapping model we take into account only requirements regarding QoS that are significant and transparent enough to users and thereby relevant for SP's QoBiz. Before the development of the model it is necessary to select QoS parameters that significantly affect QoBiz requirements, and identify key QoBiz parameters. Next step include finding the most appropriate solution for mapping QoS to QoBiz. We choose available bit rate, i.e. download and upload speed, as well as security as key QoS parameters for mapping to QoBiz. Considering price is one of the most significant parameters for users while the main goal for SP is to maximize its revenue, we focus on a service price and SP's revenue, as key QoBiz parameters.

We propose the spiral solution for mapping QoS to QoBiz with different settings for each QoS parameter (Figure 2):

- download speed ($s_{d1}, s_{d2}, s_{d3}, s_{d4}, s_{d5}$), where $s_{d1} > s_{d2} > s_{d3} > s_{d4} > s_{d5}$,
- upload speed ($s_{u1}, s_{u2}, s_{u3}, s_{u4}, s_{u5}$), where $s_{u1} > s_{u2} > s_{u3} > s_{u4} > s_{u5}$ and
- security (s_1, s_2, s_3, s_4, s_5), where s_1 indicates the highest level of security while each subsequent level indicates a bit lower security, so s_5 point out to the lowest level of security.

Each of these values corresponds to a specific price, as it is illustrated in Figure 2. Service with the best performances (s_{d1}, s_{u1}, s_1) is charged with maximum price, denoted as p_0 . It is assumed that a price equally depends on each QoS parameter, i.e. it decreases for 5% with any QoS degradation, which implies that a service with the worst performances by all QoS parameters (s_{d5}, s_{u5}, s_5) is charged with 60% lower price compared to a service with the best performances.

Figure 2. Spiral QoS to QoBiz mapping (Radonjic Djogatovic et al., 2018)



Users are classified in eight different types according to their preferences regarding to QoS and price:

1. Users who prefer high speed Internet access with maximum download speed,
2. Users who prefer high speed Internet access with maximum upload speed,
3. Users who prefer maximum security protection,
4. Users who can tolerate slightly lower download speed
5. Users who can tolerate slightly lower upload speed
6. Users who can tolerate slightly lower level of security
7. Users who are willing to pay no more than p_1 ($p_1 > 0.4 p_0$) for monthly Internet usage and
8. Users who are willing to pay no more than p_2 ($p_2 \geq 0.4 p_0$) for monthly Internet usage (the assumption is that $p_2 < p_1$).

Users can belong to more than one type but some types are mutually exclusive. We assume type 7 and 8 don't have any QoS preferences specified for previous types, so they will be assigned lower QoS values than previous types and consequently they will be charged with lower prices. Based on QoS parameters combinations and users' requirements, SP defines tariff packages (TPs), shown in Table 1.

Table 1. Tariff packages (Radonjic Djogatovic et al., 2018)

QoS/ QoBiz	Download speed	Upload speed	Security	Price
TP1	s_{d1}	s_{u1}	s_1	p_{TP1}
TP2	s_{d1}	s_{u1}	s_2	p_{TP2}
TP3	s_{d1}	s_{u2}	s_1	p_{TP3}
TP4	s_{d2}	s_{u1}	s_1	p_{TP4}
TP5	s_{d1}	s_{u1}	s_3	p_{TP5}
TP6	s_{d1}	s_{u3}	s_1	p_{TP6}
TP7	s_{d3}	s_{u1}	s_1	p_{TP7}
TP8	s_{d1}	s_{u3}	s_3	p_{TP8}
TP9	s_{d3}	s_{u1}	s_3	p_{TP9}
TP10	s_{d3}	s_{u3}	s_1	p_{TP10}
TP11	s_{d4}	s_{u4}	s_4	p_{TP11}
TP12	s_{d5}	s_{u5}	s_5	p_{TP12}

Accordingly, SP's revenue can be determined as: $R = \sum_{i=1}^k p_{TPi} \cdot n_{TPi}$, where p_{TPi} is monthly price per tariff package TPi , n_{TPi} is number of users per tariff package TPi and k is the number of TPs (in this case $k=12$). Monthly prices are determined according to spiral QoS to QoBiz mapping. Thus, $p_{TP1} = p_0$, $p_{TP2} = p_{TP3} = p_{TP4} = 0.95p_0$, $p_{TP5} = p_{TP6} = p_{TP7} = 0.9p_0$, $p_{TP8} = p_{TP9} = p_{TP10} = 0.8p_0$, $p_{TP11} = 0.55p_0$, $p_{TP12} = 0.4p_0$.

Finally, we assume SP applies hybrid pricing scheme, which is implemented in a fashion that the monthly price is reduced by a certain percentage if users, due to excessive network load, experience significantly lower speed than declared during period longer than defined time interval (typically several minutes). Based on simulation model and the results for an example of the mapping model, given in Radonjic Djogatovic et al. (2018), it is shown that prices decrease for most tariff packages. Applying

hybrid pricing scheme, SP is likely to attract new users, but in order to maximize his revenue, his aspiration should be directed towards improving QoS parameters, which can be performed by additional investments in the network.

FUTURE RESEARCH DIRECTIONS

In order to provide the appropriate incentives for providers, suitable business and pricing models need to be designed. QoBiz stands out as a significant concept which deals with the financial aspects of service provisioning. For QoBiz evaluation, it is essential to consider service demand, price structures and revenue trends. The need for new pricing solutions that coordinate the competing requirements of providers and users in NGN environment is evident.

In future research, new possibilities for solving similar problems of pricing and interconnection between multiple providers in NGN should be considered. A general research direction should comprise market modelling, cost and risk consideration as well as network design. The proposed models can be extended to cover cost optimization for SP in order to optimize trade-off between cost investments and expected revenue from new users. Moreover, the proposed models may include contemporary real market situation in which several service providers compete for users. Different types of providers should be considered along with quantifying their impact on the price setting and overall QoBiz. More specific research direction could include applying different game models (e.g. repeated/cooperative games, Cournot and Bertrand games) under dynamic and hybrid pricing schemes. Furthermore, future research should be directed towards more precise mapping between QoE and QoBiz parameters.

CONCLUSION

The adoption of an appropriate pricing scheme can significantly affect business operation of a NGN provider. NGNs must be flexible enough to enable the use of different pricing and business models. Growth in demand due to the popularity of NGN applications requires significant investment in infrastructure but brings a negligible return.

Service providers, therefore, strive for a new network model giving priority to managed services whose usage is controlled by a particular pricing scheme. They are searching for ways to brand and bundle new services, achieve operational cost reductions and strategically position themselves in relation to their competition. Many SPs are looking to NGN services as a means to attract and/or retain the most gainful users. In NGN users are expected to choose the SP offering the best price and QoS combination. As a result, SPs operating in the same telecommunication market will end up competing for users by adjusting QoS they offer and the price they charge for their services.

With the aim of telecom provider's QoBiz improvement, in this chapter two models for the service price optimization are proposed. It has been shown that applying responsive pricing scheme along with Stackelberg game, leads to improvement of the SP's revenue, as a significant aspect of QoBiz. The target market for the application of the responsive model are business users, such as small and medium enterprises. The introduction of the responsive model should be done gradually to the coexistence with the current pricing models. The main advantage of the mapping model is transparent mapping QoS parameters to QoBiz with direct reflection of QoS violation on service prices and accordingly on SP's

revenue. In addition, the mapping model implies that users are charged based not only to declared QoS but also with regards to achieved QoS, which results in lower prices.

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KEY TERMS AND DEFINITIONS

Dynamic Pricing: The process of allocating the price as a cost per unit of resource consumption and according to level of QoS guarantees provided for the particular service class.

Hybrid Pricing: The process of applying the static price in regular network operation mode while during congestion the dynamic pricing is enforced allowing deviations from contracted traffic profile.

Next Generation Network (NGN): An architectural concept of future telecommunication core and access networks, which assumes transport of all information and services over a common network, typically built around the IP.

Quality of Business (QoBiz): A monetary value that matches the quality of delivered service, expressed through connection of QoS parameters with monetary value within the SLA.

Quality of Experience (QoE): The overall acceptability of an application or service, as perceived subjectively by the end-user.

Quality of Service (QoS): A set of service requirements that a network should meet when transferring traffic flows.

Responsive Pricing: A pricing scheme which incorporates feedback generated by a network assuming that users are adaptive to the service price changes.

Service Level Agreement (SLA): A contract between service providers or a service provider and a user, which defines responsibilities of all contracting parties, QoS guarantees, performance metrics, measurement methods and pricing principles.

Service Provider (SP): A general reference to an enterprise that provides telecommunication services to users.

Stackelberg Game: A strategic game in which at least one player is defined as the leader who can make a decision and commit a strategy before other players who are defined as followers.

Resources, Recycling, Regulations, and Reputation in the Comparison of Operations Sustainability Techniques

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INTRODUCTION

Sustainability as a Strategy Sustainability is a growing concern and challenge for companies around the globe. Batra (2012), McDonagh and Clark (1995), Menon, Menon, Chowdhury, and Jankovich (1999), and Moisander (2007) attribute this challenge to the over-consumption of the Earth's resources, especially in developed countries, and the unexpected rapid increase in the world's population throughout the last century. Many corporate management have realize that in a world with decreasing resources and increasing population, that it is imperative to consider sustainability in their own operations (Simintiras, Schlegelmilch, & Diamantopoulos, 1994; Straughan & Roberts, 1999; Thøgersen, 2006; Van Liere & Dunlap, 1981; Vesilind, Heine, & Hendry, 2006). When evaluating sustainability in production processes the four "R's" of sustainability is a useful tool. These are the resources used by the production process, the recycling of production materials and product components, the regulations that apply, and the firm's reputation (Hooley, Saunders, & Pierry, 1998; Iyer & Banerjee, 1993; Jain & Kaur, 2006). A company can assess their organization and use the four "R's" to determine where improvements can be made. Companies are often unaware of the advantages sustainability can bring. Searcy (2009) points out that there were few published examples of indicators being used either in Board-level and strategic decision-making, or in managing supply chains or even business units. The world would benefit if more corporations began implementing sustainability processes.

Resources are used primarily by the firm's operations segment. This suggests that there are many opportunities to use human, financial, and material resources in a sustainable manner (Kayas, McLean, Hines, & Wright, 2008; Kilbourne, 1995; Kroes & Ghosh, 2010; Laroche, Bergeron, & Barbaro-Forleo, 2001). Reducing resources is the most common way companies implement the four "R's". When a firm reduces the amount of resources used, costs will also be lowered. Low costs and resource use help increase the company's profit margins while also incorporating a sustainable approach. There are many different ways that a company can reduce their resource consumption. One common approach is to lower energy and water costs. Another example is reducing the amounts of materials used in a process. Advancing technology allows firms to become more efficient in their materials use.

BACKGROUND

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Waste Management

Waste is another aspect of sustainability that every company must deal with. There are only 3 things that can be done with waste: burn it, bury it, or reuse it (Hooley, et al. 1998; Jain & Kaur, 2006). Burning waste is not a sustainable practice because it pollutes the atmosphere and increases greenhouse gasses. Burying creates even more problems; we have a limited amount of space that will eventually run out and it also pollutes ecosystems and can have dangerous consequences. Therefore, it is essential that management attempt to design products and services that utilize the cradle to cradle approach. In this process design, we can follow the product from creation to destruction while having no effect on the environment. There are numerous ways that a firm can recycle whether plastic, glass, or metals, and there are always opportunities for a firm to become more sustainable in the recycling arena.

Laws and regulations affecting transportation, waste, and noise are proliferating and can be as much of a challenge as reducing resource use (Kroes & Ghosh, 2010; Laroche, et al., 2001). Regulations may impact a company negatively but they are necessary in a world with finite resources. Governmental agencies are aware that we will not be able to take from the environment indefinitely and are attempting to correct the imbalance. Companies can face fines or taxes for not complying with regulations; therefore, it is in the best interest of the company as well as the environment for firms to attempt to curb pollution as much as possible. This is often referred to as a carbon footprint reduction and represents the firm's impact on the environment.

Another evaluation criterion of sustainability is the firm's reputation. Many companies today are realizing that sustainability can be an advantageous marketing technique. Consumers are becoming more aware of sustainability practices and will do business with companies that reflect these values (Granzin & Olsen, 1991; Haanpää, 2007; Hooley, Saunders, & Pierry, 1998; Iyer & Banerjee, 1993). Although firms are not required to commit to sustainable values, they often gain market share because they embrace the techniques. A comment made in a recent Harvard Business Review article stated, "Impressive as the cost efficiencies are, more intriguing is the growth that companies in emerging markets have gained by extending their sustainability efforts to the operation of their customers. Companies are building unique business models by boosting customers buying power and, in the process, creating interdependencies that are difficult for competition to copy" (Haanaes et al., 2013). Seeing that sustainability is unlikely to disappear, firms would be suited to use this marketing technique to their advantage.

Purpose of Study

This paper will use the case study approach to evaluate two different firms and the sustainability of their operations. The first company is the University of Pittsburgh Medical Center (UPMC), which is a global nonprofit health enterprise. They are considered one of the leading healthcare providers in the U.S. and one of the largest employers in the Pittsburgh region. The second company is Seneca Resources Corporation (SRC), which is a subsidiary of National Fuel Corporation. Seneca Resources handles the prospecting for, development of, and purchase of natural gas and oil reserves. Their primary focus is on the Marcellus Shale in Pennsylvania. The paper will analyze these companies in terms of general characteristics, operations sustainability and compare these two different companies.

CASE STUDIES

Company Profile: University of Pittsburgh Medical Center (UPMC)

UPMC is comprised of 4 major divisions: Hospital and Community Services, Physician Services, Insurance Services, and International and Commercial Services. UPMC's system wide revenue reached \$10.19B for FY 2012, making it the largest non-profit healthcare system in the United States in terms of gross revenue (UPMC, 2012). It is also Pennsylvania's largest employer with over 58,000 employees (UPMC, 2012). UPMC has consistently gained national recognition for providing excellent patient care and was ranked 10 on U.S. News and World Report's 2012-2013 Honor Roll (Romoff, 2012). Shortly after establishing its Insurance Services division, UPMC launched the International and Commercial Services division. The goal of this division is to expand UPMC's reach and influence to different markets, both nationally and internationally. Hospitals specializing in transplants and cancer treatments have since been established in foreign nations such as Italy and Ireland. The division also seeks to share ideas and processes through consulting services and various international partnerships.

No single factor, however, will present a greater challenge than the recently passed Patient Protection and Affordable Care Act (PPACA). In summary, the act aims to increase health insurance coverage for all citizens while reducing the cost and increasing the quality of healthcare. While this act will eventually benefit individuals, it will put tremendous pressure on healthcare providers and hospitals to tighten operations and become leaner and more efficient than ever before. The provision of the act that could possibly have the greatest effect on operations deals with Medicare reimbursements to hospitals and healthcare providers. Currently, care providers are reimbursed by Medicare on a fee-for-service basis. This means that each medical service is billed and reimbursed separately. Under PPACA effective in 2014, Medicare will only be disbursing "bundled payments" in which one lump sum will be paid to cover all aspects and stages of treatment. For a hip replacement under the current system, for example, Medicare makes separate disbursements for aspect of treatment (e.g., surgery, surgeon fee, post-op care, rehab, etc.) based on what is billed by each department. Under the new system, however, Medicare will pay one standard lump-sum amount based on the type of episode. According to Cutler and Gosh (2012), an analysis of the costs associated with some of the more expensive episodes showed that bundled payments do have the potential to significantly reduce costs by forcing hospitals to increase efficiency in the provision of care. Another provision of the act that has begun to take effect is a penalty fee that is charged based on certain types of re-admittances. If a care provider reports a certain amount of unnecessary readmittances, they will in turn be docked a percentage (up to 3%) of their Medicare reimbursement.

A major challenge that has recently arisen is the city of Pittsburgh's decision to challenge the tax-exempt status of UPMC as a charitable organization. Mayor Luke Ravenstahl issued the following statement regarding the city's decision to challenge the status: "They haven't been operating as a charity and it's time that this community step up in that regard. The reality of the situation is the taxpayers ... are currently subsidizing UPMC's non-profit status." (Balingit, 2013). A ruling in favor of the city could result in UPMC absorbing over \$30M in property taxes that it is currently except from as a charitable organization (Schooley, 2013).

Healthcare Sustainability Considerations

In order for UPMC to remain a major player in the healthcare provider industry and overcome these challenges, the company must rely on the key success factors and core competencies that allowed it to rise

to its current position. UPMC's major key success factor is its broad and diverse network of healthcare facilities that range from physician's offices to hospitals to rehabilitation centers. It allows for a patient to be diagnosed, treated, and rehabilitated without having to go outside of UPMC. This contributes greatly to the improvement of operations management in a number of ways. First, it allows UPMC to better manage costs, especially in the era of PPACA. Controlling all aspects and stages of patient treatment allows for UPMC to control entire processes instead of individual stages as other hospitals might do. Quality of treatment is better maintained when UPMC is able to monitor a patient's progress throughout various stages of treatment. According to Donald Riefner, Vice President of Finance and Chief Revenue Officer, the number one detriment to quality is the handoff, which is when patients are transferred from one care division to another (Riefner, personal communication, 2013). By integrating and monitoring a diverse network of healthcare divisions, UPMC is better able to monitor patient handoff and a patient's overall experience at facilities. According to Mechanic and Tompkins (2012), UPMC will have additional opportunities to fine-tune operations as the bundled-payment initiative provides an opportunity for hospitals to gain experience with coordinating care across a continuum of services for discrete clinical conditions.

Sustaining Operations for the Future at UPMC

The healthcare that UPMC offers is award winning, recently receiving an excellence accreditation from the National Committee for Quality Assurance (UPMC Health Plan, 2013). Over the past few years UPMC has been working to take their excellence a step further beyond the area of healthcare and into the realm of operational sustainability coinciding with environmental concerns. UPMC recognizes that they not only have a responsibility to provide great healthcare, but also to be more socially accountable, which will not only positively affect their patients but also the western Pennsylvania region. According to Laura Kinney, the healthcare industry spends \$8.3 billion on energy each year as well as being the largest water user in communities and producing two tons of waste per year (Kinney, L., 2010). Not only will social responsibility by UPMC improve the quality of life for the surrounding communities, but can significantly lower the costs that the company incurs. To show their commitment to green sustainability, UPMC has incorporated environmental sustainability in all aspects of the company. Sustainability measures in the areas of regulations, resources, recycling, and reputation are necessary for UPMC to continue its success and meet patient demands.

UPMC is continually working towards improved management and reduction in the use of resources as well as encouragement of recycling throughout the company. Their goal is to promote sustainability throughout their company, on all levels. A partnership with Duquesne Light has allowed UPMC to more actively handle its use of power and reduce it. Duquesne Light has established software within UPMC that puts computers into "sleep" mode at a suitable intermission of non-use. This small change alone has resulted in computer power usage being reduced by fifty percent ("A Network for Sustainable Business," 2013). UPMC also reduced its use of paper and the resulting paper waste by promoting paperless meetings, making medical records available electronically, switching to direct deposit for employee pay, and appropriately recycling paper that is used. As a result of these changes in paper usage, more than one million pounds of paper is recycled on an annual basis. UPMC also incorporates recycling and resource management into hospital services by not only changing to biodegradable products for use in food services, but they also use locally grown produce in healthy meals serviced throughout the hospital. UPMC purchases produce from local vendors, promoting local sustainability and community, as well as growing their own produce and herbs in gardens at Magee-Women's Hospital.

UPMC demonstrated their commitment to recycling and resource reduction when building the new Children's Hospital of Pittsburgh. UPMC used recycled building materials as well as local materials; a water reduction and air filtration system was put in place, green roofing and shading systems were installed to lower costs of cooling the hospital, among many other areas of environmental concern being addressed. This successful commitment to efficiency resulted in Children's Hospital of Pittsburgh of UPMC receiving Leadership in Energy and Environmental Design (LEED) certification. Renovations of the UPMC offices located in the U.S. Steel Tower also resulted in LEED certification. Green renovations in the U.S. Steel Tower consisted of low-flow water systems, rapidly renewable finishes, and low-emitting furniture, carpeting, and paint ("U.S. Steel Tower," 2012). UPMC is also in the process of expanding its presence in the western Pennsylvania region by building a campus in Monroeville, PA as well as expanding the existing campus in McCandless, PA. It can certainly be expected that UPMC will continue its success in green sustainability with these expansions and strives to earn additional LEED certifications.

The healthcare industry uses a significant amount of water, energy, and resources, resulting in considerable amounts of waste and pollution. There are a variety of agencies, both on the state and federal level, which are responsible for the regulation of functions in various healthcare facilities. The U.S. Environmental Protection Agency (EPA) focuses on protecting our planet, and primarily needs to regulate the healthcare industry due to the hazardous chemicals and drugs used. The Clean Water Act (CWA), Clean Air Act (CAA), and Resource Conservation and Recovery Act (RCRA) are all in place in an attempt to curtail contamination and make sure waste is properly disposed of within healthcare facilities. The Centers for Disease Control and Prevention (CDC) also has a noteworthy authority on healthcare facilities by focusing on disease control as well as cleanliness and sterilization. If CDC recommendations are followed, then the general public can be protected from outbreaks of infection as well as medical waste disposed of improperly. UPMC has in a way gone a step further and begun regulating itself through the creation of policy and programs focused on social and environmental responsibility. UPMC has focused on promoting environmentally preferred purchases within its supply chain management purchasing policy. As a part of this policy, contracts must include an option for green products or services, promotion conducting business with suppliers that are concerned with green sustainability, and working with the UPMC appointed team to identify new environmentally friend services and products as well as industry standards that can impact the environment (Sustainability, 2013). UPMC is also working directly with the U.S. Department of Energy to focus on creating a national healthcare industry program that will focus on cutting costs, minimizing pollution, and lowering energy use (Environmental Initiatives, 2013).

UPMC has successfully maintained a reputation of superior medical services and quality patient care. UPMC has succeeded at taking their positive standing a step further by improving their value of patient care through environmental and social responsibility. In 2007, UPMC banned smoking in all of their facilities, which is an effort made with the goal of improving quality of life for patients and reducing pollution. UPMC has also been a strong supporter of education for patients, staff, and the community. Free smoking-cessation classes offered for staff and patient classes such as childbirth for new mothers includes education on environmental-related health concerns as well as lectures on environmental-related topics being offered for the local community to attend (Environmental Initiatives, 2013). The positive results of UPMC taking the time to educate those within the facility and the local community is two-fold. Not only is UPMC helping to break the cycle of misinformation and illnesses that can easily be avoided, but according to EcoHealth there is significant evidence that human related environmental changes, such as urbanization, has resulted in a considerable amount of health challenges facing the world today (Patrick, R., Capetola, T., Townsend, M., & Hanna, L., 2011). Hopefully by UPMC educating the community on

the impact of their carbon footprint and how to reduce it, the impact on our planet can be minimized. UPMC has also shown their concern for quality of life by making the majority of facilities mercury, DEHP, and PVC free, as these substances can cause a variety of illnesses. UPMC has also built a positive reputation by looking beyond the region where it is located and towards the international stage. In an effort to reduce waste and recycle, UPMC has partnered with Global Links to provide surplus medical supplies, previously meant for the landfills, to developing countries in need of these medical supplies (Recycling to Save Lives, 2008). The sustainability efforts made by UPMC have led to a leaner, more environmentally friendly, and higher quality operation.

Company Profile: Seneca Resources Corporation (SRC)

SRC is a subsidiary of National Fuel Gas Company, and is in the business of exploring, developing, and purchasing natural gas and oil reserves in California, in the Appalachian region of the U.S. and in Kansas. SRC (and its predecessor affiliates) has been in this business for over 100 years, and can be broken down into a West Division and an East Division. The West Division was established through the acquisition of several properties across the west coast of the U.S. West coast operations are focused on the development of current properties and future acquisitions of new properties that will have low to moderate risk. The East Division includes over 3,000 shallow wells and is known for its stable, long life natural gas reserves. This division is also known for its Marcellus Shale production which, in recent years, has become one of the most fruitful natural gas fields in the world. With control over 745,000 acres of Marcellus drillable land, this division offers a significant future cash flow opportunity for the company.

SRC has announced significant Marcellus shale well results over the past several months. In January 2013, they completed 15 new wells in Lycoming County, PA, with five of the wells representing the highest peak production rates of any wells previously or currently operated by Seneca. They expect to have 16 more wells completed in fiscal year 2013, and 25 more wells completed in fiscal year 2014. David F. Smith, CEO of National Fuel Gas Company, stated that “The success we are achieving in Lycoming County validates the prolific nature of the Marcellus in this area” (National Fuel Announces, 2013). SRC 2013 first quarter production of crude oil and natural gas increased by 34% over the prior year’s first quarter. When considering production in only the Appalachian region (primarily Marcellus shale wells), production increased by 48% (National Fuel Reports, 2013).

SRC would not be able to maintain profitable operations without the presence of key success factors and core competencies in the natural gas field. Key success factors of SRC include sufficiency of financial resources, technological capabilities, and capacity of reserve. The oil and gas industry is an expensive one; profitability cannot be achieved without the financial means to purchase the expensive drilling equipment and the vast amount of land that is necessary for drilling. The company must possess highly skilled engineers who have the appropriate knowledge and the proper technology required to complete the job. Additionally, the company must have reserves that extend far enough into future years to ensure that the wells will not dry up before they have had the chance to develop new ones. All of these things are key success factors that SRC does well, although they are not enough on their own to ensure a competitive advantage in the industry.

To remain competitive, SRC must also have a core competency on which to focus. The concept of a core competency explores how competitive advantage is related to the unique resources of a firm that provide for a value added process (Hafeez, 2007). SRC remains competitive by having a core competency of innovation. They are able to quickly adapt new processes and ideas into profitable solutions for long term problems. For example, SRC was the first company in the state to successfully convert its drilling

rigs to use natural gas (Boyer, 2012). The company wanted to set an example that natural gas is a safe, reliable, and efficient energy source in this country, and what better example is there than to use natural gas itself to power the drilling rigs that they use every day. Studies show that using natural gas reduces the emission of carbon dioxide and other harmful pollutants, thus allowing for a safer and cleaner environment for the future. Innovative ideas such as this one set SRC apart from their competition, and will allow them to remain profitable for many years to come.

The Marcellus Shale boom in the Appalachia region has provided great opportunities to the SRC. In recent years, SRC has spent the capital to position itself as a major player in the Marcellus Shale natural gas boom, and the demand for natural gas is expected to continue to increase. According to William Liss (2012), from the Gas Technology Institute, the United States is on a path toward the elimination of gas imports and the EIA has projected that the anticipated U.S. demand for natural gas in year 2020 will amount to 26 Tcf with U.S. production slightly below the demand. This implies that the amount of opportunity for SRC is high, but with this opportunity comes the need to increase awareness of how present actions will impact the future.

SRC: Sustaining Operations to Keep Pace with Demand

With this optimistic projection in demand for natural gas comes a great responsibility for SRC as the company has been faced with many business decisions concerning the sustainability of their operations for years to come. Sustainability provides incentive for SRC to perform well and protect the environment as the company develops and refines the production process of natural gas. Without implementing sustainability into a firm's operations management strategy, a firm risks misusing precious resources (Dey, 2011). SRC must also ensure that they are using their resources wisely, and must continuously seek out acquisition opportunities for new drilling sites to replenish resources as they are used. SRC employs "best practice" techniques in all of its operations, including regulatory requirements. They strive to conduct their business in a way that protects the environment and ensures safety. SRC has implemented policies and measures focused on abiding by industry regulations, effectively managing and procuring resources, promoting recycling, and building reputation.

A large part of sustainability for a company in the oil and gas industry involves the need to remain compliant with the various regulations of the industry. The oil and gas industry is a highly regulated primarily by the U.S. Environmental Protection Agency (EPA) with the use of the several statutes. These statutes include the Resource Conservation and Recovery act (RCRA), the Clean Air Act (CAA), the Safe Drinking Water Act (SDWA) and the Clean Water Act (CWA), and the Toxic Substances Control Act (TSCA) (Ternes, 2012). These acts regulate the production and transportation of natural gas produced in Appalachia and provides increasing pressure on SRC to reduce by-products that yield greenhouse gasses and pollute the air and water. SRC has not only risen to the regulatory challenges of the natural gas industry, but also they have excelled in surpassing them. Recently, SRC converted their drilling rigs from diesel use to liquefied natural gas use (Boyer, 2012). The cost of the conversion is a huge capital expenditure, but it yields a very friendly impact to the environment. In fact, Rob Boulware, Public Relations Manager for SRC noted that the Liquefied Natural Gas (LNG) engine is the first drill rig engine in the country to be operated on LNG and is even certified by the EPA. The new engine is cleaner for the environment and even quieter than the traditional diesel engines (Boyer, 2012). Not only has SRC provided a more environmentally friendly engine, but SRC also anticipates a reduction in fuel costs to power the rigs which can result in 60% lower fuel costs and reduce overall combustion emissions up to 25% (Diesel & Gas Turbine Worldwide, 2012). The benefit of the LNG engine has also allowed SRC

to start creating a new vehicle fleet to run off LNG engines, which can reduce fuel costs by more than 25%. Diesel to LNG conversions can be seen as a win-win for the SRC as there is a significant friendly emission impact while saving on fuel costs. The change to LNG engines clearly supports the conservation of the environment.

SRC realizes that sustainability cannot be achieved through meeting regulatory requirements alone. Recently, SRC has had two major projects that promote recycling and waste reduction of resources. First, SRC has developed a water project that withdrawals water from a creek when water levels are high to support their hydraulic fracturing operations. SRC's water project was a result of a recent Pennsylvania Department of Conservation and Natural Resources (DCNR) lease that presented a unique challenge as there were poor road conditions to the leased land. Hydraulic fracturing operations for SRC alone require over 70,000 truck trips in a highly populated area with a small road system that is also used by other operators with land rights in the area (Jacobs, 2012). These conditions lead to congestion, layout issues, and increased pollution due to the high number trucks. In order to alleviate these problems, SRC plans on making a pipeline available to other operators to help cover capital costs and to reduce the number of water trucks in the region which could have totaled more than 200,000 truckloads including the other operators (Jacobs, 2012). The new water pipeline would withdrawal water from the Johnson creek in Lycoming County under strict conditions which focused on when water can be withdrawn and how the water needs to be continuously monitored for contamination (Jacobs, 2012). In addition to the elimination of water truck traffic, SRC also picked a creek that has been contaminated by an abandoned coal mine and the creek currently has no life. Doug Keppler, a VP and Biologist of SRC, was the individual who presented the idea to SRC officials and determined that there are no ill effects produced from using the contaminated water (Phillips, 2013). Taking the water from the contaminated creek helps minimize the amount of pollution that flows into the Tioga River. The creation of a water pipeline was a tremendous capital expenditure to SRC; however, it has greatly improved environmental conditions by reducing truck traffic and emissions while using contaminated water withdrawn from the Johnson Creek.

The second project geared toward recycling and waste reduction is a mission to recycle and to treat all of their fracturing fluid used in operations so that it can be reused on future hydraulic fracturing operations. Hydraulic fracturing has many environmental concerns, and there have been great strides in the industry toward recycling water that is flowed-back to the surface after the hydraulic fracturing process. This "flowback" fluid poses great challenges for companies, and technology has been introduced that allows companies to recycle this byproduct. According to David Grottenthaler (2011), general manager of Kroff Well Services, Inc., the challenge to Marcellus Shale companies is that a recycling plan needs adopted to manage water so the shale will be a sustainable resource in the future. The challenge for recycling "flowback" water is that the solids in the water need removed before the water can be treated and reused in future hydraulic fracturing jobs. For "flowback" fluid to be reusable, the recycling process must involve removing iron deposition, suspended solids and microorganisms while addressing pH levels so that the right water attributes are obtained to achieve adequate friction reduction (Grottenthaler, 2011). According to National Fuel (2013), the parent company of SRC, SRC has a goal to recycle 100% of all hydraulic fracturing fluid (frac fluid) to use in other well operations. Frac fluid is the hazardous chemical that poses a risk to the environment and needs to be separated from the water and sand as part of the recycling process. The end result of this recycling process is a zero discharge of its operations, which means reuse of the "flowback" fluid while recycling the water, sand, and hydraulic fracturing fluid for use in other well operations (National Fuel, 2013).

SRC has been at the forefront of innovation in operations sustainability and has created a reputation that focuses on the sustainability of the shale boom. As mentioned earlier, SRC has done a variety of

things to promote a clean environment that can potentially save the company money in the long run through large, up-front capital investments. SRC believes that a good reputation can lead to future business ventures, especially since the PA DCNR has historically made available large quantities of land for gas exploration and production. So far, SRC has leased four major tracts of land from the DCNR and has established a strong working relationship with the state agency. Currently, SRC and the DCNR are looking into contracts with other gas operators that would utilize the SRC built roads to minimize the impact in the state forests. In 2012, DCNR forest program specialist Dix (2019) identified a problem on state access roads, and SRC promptly obtained emergency permits from the DEP for streambank stabilization. The road was eroding and all work was done at SRC's expense. Cooperation between SRC, the DEP, the DCNR, and the Pennsylvania Fish and Boat Commission allowed for quick completion of the project before the collapse of the road into the parallel stream. An appealing retaining wall was built and Rich Glinksi, District Forester of Loyasock State Forest, stated that "If the DCNR were to have done the repair in the future, it would have taken funding away from other projects such as bridges and facilities" (Dix, 2019, p. 1). The response and sections of SRC in this case highlights their focus on reputation, commitment to environmental sustainability, and desire to build relationships with organizations who promote similar goals. Establishing relationships of this type can lead to cooperation and collaboration in future sustainability efforts.

In a separate matter, SRC also fully discloses the chemicals used in their hydraulic fracturing process voluntarily to "FracFocus," which is a nationally recognized non-profit organization that provides public transparency in the oil and gas industry by disclosing what ingredients are used during hydraulic fracturing. The website www.fracfocus.org allows anyone to search for the ingredients used in each well that has been registered with the organization. SRC believes that a strong reputation is a key to future operations and understands that the oil and gas industry is a free enterprise system that operates on a voluntary basis. If SRC is unable to obtain leases on land for drilling, then SRC will not be able to continue to utilize and share their sustainable operations techniques throughout the remainder of the Marcellus Shale boom.

Comparison of Sustainability Techniques

The policies, processes, and techniques implemented by UPMC and SRC presented in this research, provide evidence that shows how operations sustainability presents various incentives to firms, and also how it benefits people, the community, and the environment. Even though these companies operate in two vastly different industries, they share the feeling of responsibility to change in order to create a better future. "SRC employs best practices in all aspects of its operations, and continues to revise those practices in keeping with technological advances, regulatory requirements and the lessons learned through daily operations" ("Best Practices", 2013). They both exhibit this devotion and understanding of being sustainable in numerous ways. Both companies leveraged their core competencies into their sustainability practices: UPMC by running many unmatched specialty care facilities as compared to their competitors and SRC by exhibiting its core competency of being innovative. More specifically, UPMC and SRC both focus on utilizing resources and emphasize the importance of recycling. These operational techniques allow the companies to be recognized as reputable businesses in the Pittsburgh region, and both not only satisfied the regulatory requirements of their respective industries, but also set internal standards that exceeded those set by external agencies.

Both companies exhibited their dedication to being a sustainable business by responsibly using resources. UPMC uses locally grown produce as well as their own grown produce and herbs in meals served at the

hospitals. They exhibited the insight of knowing how green is better than using biodegradable products in foods. They also practiced sustainability by making their facilities free of Mercury, DEHP and PVC, since they knew the harm these products can cause to the environment. Similarly, SRC strived to reduce the amount of truck traffic from water trucks travelling in and out of the fracking sites. To accomplish this, the company built a pipeline that SRC and other Operators can use to transport water to the drilling locations which would drastically reduce congestion. Not only does this initiative result in fewer truck trips that reduced diesel gas use and costs, but also allows SRC plans to create a new revenue stream that will offset their costs for establishing the new water pipe.

The importance of recycling by re-using waste products is a technique used by SRC and UPMC. SRC used the cradle-to-cradle practice by recycling 100% of all hydraulic fracturing fluid to use in other wells, which leads to extra cost saving. The need to recycle resources was not only formed based on the extra monetary incentives for SRC, but also based on creating a win-win situation through their reuse of the contaminated coal waste water, indirectly leading to replenishing the natural resources that had been improperly disposed of in the past. UPMC transformed many waste products into the UPMC Children's Hospital during construction of the facility. This not only promotes a great use of supposed waste, but also it highlights the importance of realizing that reuse opportunities are typically possible no matter the industry. Effective management of resources and recycling also leads to improvement in reputation. UPMC and SRC did not simply satisfy their social obligations, but instead went over and above them, which contributes to the positive image these firms try to maintain. "The strategic issues of environmental and socio-economic stewardship have already and will continue to be the focus of economic activities and innovations worldwide" (Lee, Pati, & Roh, 2011, p. 74). UPMC and SRC both illustrate this. Another similarity between both firms was the impact that laws, acts, and regulations played on each firm's willingness and quickness to adapt sustainable practices. This illustrates the significant role that the government plays in setting sustainability standards and how companies are adopting standards that exceed government requirements. What may have once been an inconvenience is now a routine function in the daily activities of both UPMC and SRC. Both external and internal regulations indirectly helped UPMC and SRC to control costs and improve performance. UPMC has gone beyond the environmental and health regulations set forth by the EPA and CRC and adopted practices to create and maintain a green supply chain. SRC has satisfied the requirements of the oil and natural gas industry through disclosure to third party firms such as "FracFocus," but also raised the industry standard through their water recycling and diesel to LNG conversion projects.

CONCLUSION

Sustainability Case Studies

The research conducted on the sustainability practices of UPMC and SRC has highlighted some major techniques and practices that other firms can adapt to ensure the sustainability of their own operations. Both companies in this study illustrated how reuse of resources can lower costs, improve performance, and help the environment. For these reasons alone, companies would surely benefit by investigating how resources in their particular industry could be used for other purposes internally and also externally. This study indicated that environmental stability and improvement of social welfare cannot be achieved by just abiding by predetermined standards and existing regulations. Firms must strive to set their own standards that surpass what exists and collaborate with the governing bodies of their industries to deter-

mine and improve best practices. In a society with growing concern over global warming, recycling has proved to be as important as ever. In some cases, however, significant capital investment is required in order to implement effective recycling practices such as with SRC's innovative solutions and UPMC's building construction projects. Lastly, this study has shown that there is a clear linkage between social responsibilities and reputation. Creating and maintaining a positive image is directly related to the amount of time and effort companies place on giving back to society and creating a safer and healthier world for the future.

FUTURE RESEARCH DIRECTIONS

Ultimately, the best actions to take in order to increase operational sustainability are those that fall within the core competencies of a firm and make the firm successful. UPMC is a healthcare provider, and the majority of examples provided in this study revolve around UPMC creating a healthier and safer environment for patients and safer work place for their employees. SRC has been characterized as an innovative firm. Throughout this study, we have shown that SRC's success in sustainability has come from their ability to implement new products, technologies, and processes in the natural gas industry. Both firms also face their share of challenges, which makes achieving sustainability difficult. UPMC has had to deal with new Medicare policies forcing them to adopt leaner operations, new competition within the Pittsburgh area, and the threat of losing tax-exempt status. SRC has also faced fierce competition during the Marcellus shale boom in Pennsylvania as well as the continuous battle to maintain a positive reputation. These challenges have not stopped either firm from taking initiative to protect the environment and fulfill their social responsibilities to create a more sustainable business and future for others. In fact, the sustainability measures discussed in this study have aided both firms in facing and in some cases overcoming the difficulties they face. This should provide a sense of hope and motivation for all firms to promote sustainability from within, especially by finding ways to use resources more effectively, recycling to protect the environment, satisfying and exceeding industry regulations, and improving the way they are perceived by their customers and the world.

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KEY TERMS AND DEFINITIONS

LEED Certification: Leadership in Energy and Environmental Design is probably the world’s most widely used green building rating system. It is noted for an eco-friendly framework for evaluation the

energy conservation of most building, community, home projects that is both highly efficient and cost-savings.

Patient Protection and Affordable Care Act (PPACA): The PPACA is part of a healthcare reform or Obamacare and was a law enacted on March 23, 2010. It provided new rules and guidelines on healthcare coverage and administration in the U.S.

Sustainable Operations: Due to changes in the market conditions, operations and production management continue to innovate to remain competitive, management must adapt their SC strategies well. Currently, consumers, both internal and external, are more conscious about the change happening in the environment and what steps corporations are taking to prevent the pollution. International laws and local laws have come into the effect so that every company has to follow those rules and guidelines (hopefully).

RFID Technologies and Warehouse Applications: Case Studies

14

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INTRODUCTION

Chapter Overview of RFID Technologies and its Applications

Although radio frequency identification (RFID) technologies have been around for some time, the use of the technology in supply chain management (SCM) and its associated operations is still being explored and yet to be fully implemented/adopted by many companies. Basically, RFID uses electromagnetic fields to help with identifying and tracking objects. The number of ways that the technology can be used is almost endless as many examples can be found in preventing theft, expediting inspections, keeping track of surgical sponges, safeguarding pharmaceuticals, helping farmers with vital crop and social moisture information, to name a few (Hamidi, Farahmand, Sajjadi, & Nygard, 2012; Kumar, Shankar, & Yadav, 2011; Mathirajan, Manoj, & Ramachandran, 2011; More & Babu, 2012). RFID technology used in warehouses for receiving product, picking orders, packaging shipments, and tracking deliveries can save a company time and money and is part of an array of available Automatic identification and data capture technologies (AIDC), including the universally accepted barcodes. For growing companies such as the University of Pittsburgh Medical Center (UPMC) and Boeing, the introduction can help them remain efficient during these times of prosperity and growth.

BACKGROUND

Overview of RFID Technology

RFID is defined any method of identifying unique items using radio waves. This is usually done when a reader (or an interrogator) communicates with a transponder (Smith, 2017a, 2017b, 2017c). This transfer of information happens without the devices making any actual physical contact and is used in items we use every day like car keys, employee identification cards, medical history, highway toll tags, and security access cards. In essence, RFID is a modern and impactful technology that is changing the way a logistics operates. As this research paper has shared in earlier sections, the technology surrounding RFID technology has existed since the earlier 1900's and has more recently been implemented to support the transportation industry due to technology and cost improvements. Formally, according to the RFID journal is "any method of identifying unique items using radio waves such as through a reader which communicates with a transponder and holds digital information in a microchip. There are chipless forms of RFID tags that use material to reflect back a portion of the radio waves beamed at them (Radio

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Frequency Identification).” RFID has been a way of continuing to evolve in many practices specifically as it relates to SCM. Historically, as this course has demonstrated, SCM productivity evolved from the human based way of tracking and transporting inventory for companies to more automated systems such as bar codes and RFID technology. RFID systems are important components in the Toyota Production System (TPS) in effective manufacturing and SCM.

Probably, the first venture began with bar code technology as a way of tracking and transmitting information. The optical nature of barcode requires labels to be within the proper line-of-sight between label and reader, which is often difficult, if not impractical, to achieve in industrial environments. A barcode reader must have typically clean, clear optics, the label must be clean and free of abrasion, and the reader and label must be properly oriented with respect to each other” (“Advantages of RFID,” 2018, p. 1). RFID-enabled technology helps to solve many of the issues and challenges caused by direct line of sight technology by allowing information to be transmitted through a receiving device. Improvements in such technology have allowed tag reading from greater distances and in harsh environments. RFID technology is the next wave, arguably the current and sustainable wave in industrial applications, of being able to efficiently track and transmit information in order to provide greater efficiency improvements to logistics and SCM systems (Zelbst, Green, Sower, & Reyes, 2012).

Low-frequency systems were developed first then products moved up the radio spectrum to high frequency which means there is a greater range and data can be transferred at much higher rates (Roberti, 2005). High-frequency systems are used to track cargo containers, payment systems, and contactless smart cards. In the 1990s, IBM developed ultra-high frequency (UHF) RFID systems which offered even greater ranges and faster data transfers. They originally worked with Wal-Mart in their development and then in warehouses and farming. UHF RFID technology was taken to the next level in 1999 when the Uniform Code Council, EAN International, Procter & Gamble, and Gillette funded the establishment of the Auto-ID Center at MIT. They developed a low-cost RFID tag to put onto all products to track them through the supply chain and then linked this information to the Internet (Roberti, 2005). This was the first time that information contained in an RFID tag was available beyond the tag and reader themselves. The Auto-ID Center received support from over 100 large companies between 1999 and 2003 including the Department of Defense. It then opened up facilities in Australia, the United Kingdom, Switzerland, Japan, and China. Protocols, a numbering system called Electronic Product Code (EPC), and a network were developed and in 2003 the technology was licensed to the Uniform Code Council.

Currently, many companies are trying to develop smaller and smaller tags, some containing just 2 components (Landt, 2005). This means that RFID tags can now be found even in paper-like labels which can be affixed to almost anything. Advancements in RFID technology continues to grow at faster rates and the applications for use continue to grow as well.

Implications for Technology-based Supplier Integrations

A lack of universal application and its fully implementation of RFID-based technologies is very typically that in the absence of proactive management, the companies under consideration would find itself under this situation to not see the vision of implementation of such technologies to supplier integrations (Basu & Nair, 2012; Paksoy & Cavlak, 2011; Pettersson & Segerstedt, 2011; Pradhananga, Hanaoka, & Sattayaprasert, (2011; Von Haartman, 2012). With the current climate with top management in many companies regarding any change is “if it is not broken do not fix it” and “how much is it going to cost us?” no wonder they find themselves in this predicament. It is a wonder they even perceive that there is a problem. Perhaps, one of the first steps is to see if the firm’s management really want to have a formal

supplier development program or is it something they heard of as a good thing and do not want to be perceived as a traditional, backward company. Some more traditional, backward-looking companies that only want to a superficial approach to a supplier development program, having a plan for change is difficult. Before proceeding, there needs to be formal recognition of top-management support, a written commitment to such a program, a detailed listing of its objectives and potential benefits, a budget that would allow such a program to be successfully implemented. After all, individual reputation is at risk as well and qualified people would not serve as a consultant in such a project unless there is a clear path to success. If not, such people would be part of the firm's deceptive program of "supplier development wash!"

In defining, what management hopes to gain from a supplier development program and assuming that management is serious about such a venture, there must be a series of metrics that all suppliers agree upon as having a common unifying thread that binds them together (Smith, 2019; Smith, Shock, & Beaves, 2019). An interesting study by Farris II and Hutchison (2002), the authors discuss what a cash-to-cash (C2C) metric in within the supply chain partners may be and how to calculate it. C2C is the average days required to turn a dollar invested in raw material into a dollar collected from a customer. Companies like Dell and Cisco have implemented this model to help their businesses become more cost efficient and profitable; thus rewarding its various suppliers with cash bonus and more orders. However, Farris II and Hutchison state that approximately two-thirds of companies are even aware of this concept. In order to use this metric effectively, a business must understand what comprises the metric. It explains the importance of measuring C2C as it relates to accounting and supply chain, and how it can be strategically leveraged in a supplier development program. As noted by Melnyk, Davis, Spekman, & Sandor, 2000; Trebilcock, 2015, if suppliers are willing to negotiate and meet costs targets, will they be forced to continually lower their costs and potential profit margins. There needs to be some level of both cost and profit sharing programs may be worthwhile. Suppliers must be able to understand the premise of such a proposed supplier development program, learn to trust each other, have informational transparency, and mutually agree on the long-term strategic benefit of such a program (Brito & Botter, 2012; Hamidi, Farahmand, Sajjadi, & Nygard, 2012; Kumar, Shankar, & Yadav, 2011). With such a disparity among supplier partners, building trust would be difficult and the suppliers with the larger share of the buyer's business has no interest in sharing that business with the other suppliers (Bulcsu, 2011; Carvalho, Cruz-Machado, & Tavares, 2012).

The C2C concept to specific principles of supplier development and how valuable C2C is from a supply chain perspective would be helpfully to implement RFID-based technologies within a supply integration program. An efficient supply chain focuses on achieving the lowest total cost through interaction of all supply chain components instead of silos. The C2C metric is important because it bridges together many supply chain activities. Measuring C2C cycle time helps to determine how well a supply chain is performing and if there is room for improvement. Many companies who use C2C as a standard performance measure outperform their competitors by significant amounts. In such actions, it would be helpful to point out because we often hear and learn about the same types of performance metrics for a supply chain and yet there is no differentiation among supplier performance. Thus, everyone simply meets the minimum standards set by the parent company and there is essentially no competition among suppliers to perform better than their peers. Perhaps, introducing C2C and how it can relate to a supply chain can be useful for future business analysis and decisions to foster competition among suppliers.

Another useful aspect of the work by Farris II and Hutchison (2002) is that it gives specific ways a business can improve its C2C metric. These "leverage points" can be considered for any type of business and are a great starting point for evaluating a C2C metric. The authors state that the three advantage points for managing a C2C metric are to extend average accounts payable, to shorten production cycle

to reduce inventory days of supply and to reduce average accounts receivable. These are a great starting point for someone in a firm who has never measured C2C before but wants to start. These things will help measure C2C and are goals a firm should strive for even if it was not measuring C2C because it would help profitability. The article also goes into the importance of collaboration among firms within the supply chain. This is important for many reasons, including cost reduction and efficiency, and can help improve the C2C metric. The authors recognize that C2C is a relatively new concept in the business world. While there is proof that it can help a firm become more profitable, there is still research to be completed. Questions such as what target for C2C is appropriate and if one target is right for different types of business will be helpful to explore and can benefit firms once more research is complete.

In the definitions of mutual benefits of supplier development goals, it would be important to emphasize a very clear description of this process. This may be obtained by applying an industry standard in information technologies and contractual procedures. This not only enhances one firm's supply chain, but this makes supply chains in the entire industry much more efficient. This forces supply chain partners to have a collaborative relationship, which as we have seen in other articles we have read, makes supply chains more efficient and less expensive. The overall goal of supplier development is for the ultimate customer to realize the savings of the efficient supply chain.

CASE STUDIES

Overview of UPMC Central Distribution Center

The University of Pittsburgh Medical Center (UPMC) is a US\$17-billion-dollar healthcare provider and insurer based in Pittsburgh, PA. UPMC currently operates over 30 hospitals, more than 600 doctors' offices and outpatient centers, has over 4,000 physicians employed, along with a variety of rehabilitation centers, retirement communities, and long-term care facilities. To operate and run all of these locations UPMC needs many supplies delivered JIT and to maintain their operating margins via inventory control principles; hence, they need the supplies in the most efficient means possible. The goal of UPMC's supply chain is simple: establish the most cost effective and efficient means of supporting UPMC facilities and their patients. Part of this goal includes the utilization of a Centralized Distribution Center. Having a centralized warehouse allows supply chain to purchase products at lower prices by eliminating traditional healthcare distributors such as Cardinal Health or Owens & Minor. With one warehouse supporting all hospital locations, savings are also found in consolidating products such as all facilities use the same brand of exam glove which again gives supply chain the ability to leverage contract prices.

The UPMC Central Distribution Center has over 60 employees, is 150,000 square feet and maintains over 4,000 SKUs. The distribution center operates 24 hours a day 5 days a week and picks, packs, and ships over 2.3 million lines per year. It also manages over 250,000 cross-docked non-stock parcels annually. There are 9 delivery vehicles which run over 490,000 miles per year. The distribution center also utilizes Voice Directed Picking technology, which helped them reduce their picking errors by 25%, leaves the pickers hands free for picking and labeling, and is environmentally friendly with the reduction of paper. All of these numbers are for UPMC at its current size but UPMC just bought an additional 18 hospitals from Jamestown, New York to Harrisburg, PA. The addition of these new facilities will mean an increased need to be even more efficient and effective. Part of this would be to explore the option of using RFID technology.

Overview of Boeing Factory in Everett, WA

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The Boeing Company Factory based in Everett, WA is a highly coordinated logistics and manufacturing operation that helps produce commercial and military aircraft for the worldwide aviation market. The Boeing Company is the “world’s largest aerospace company and leading manufacturer of commercial jetliners and defense, space and security systems. A top U.S. exporter, the company supports airlines and U.S. and allied government customers in 150 countries. Boeing products and tailored services include commercial and military aircraft, satellites, weapons, electronic and defense systems, launch systems, advanced information and communication systems, and performance-based logistics and training. Boeing is noted as having the largest manufacturing building in the world, producing the 747, 767, 777, and the 787 airplanes. Their manufacturing product facilities employ thousands in aircraft fabrication and production, product development, aviation safety and security and airplane certifications. This factory covers nearly 100 acres of land under one roof in order to assemble and coordinate the various components required to build aircraft with over 30,000 people supporting the daily construction of this aircraft.

There are numerous logistical and transportation needs to build the aircraft. The 747 and 767, the older and original aircraft of this factory, follow a traditional assembly process that combines components such as wings, elevators, rudders, and other parts at one of four stage of assembly. The parts of this aircraft are assembled in a nearby bay which arrives via rail and truck from various U.S. suppliers from across the world. However, through this assembly process which dates back to the mid-1960s, Boeing has been able to innovate their logistics and assembly practice with modern processes. The 777 and 787 process, mostly in part due to the aircraft being new and one of the first in the world to be designed completely using a computer rather than an actual model, implement just-in-time (JIT) practices for the delivery of the various components and assemble the aircraft on a slow moving assembly line.

This process is successful due to a very close and transparent partnership with suppliers from across the world which is engaged to ensure the parts - as large as an aircraft fuselage - arrive exactly when they are required. From this point, each task and step of assembly is precisely timed out for workers to complete in order to maximize productivity. The parts for the workers assembling the various aspects of the aircraft are delivered through mobile robotic carts in the factory which are delivered to the exact location of the workers as the aircraft assembly line ever so slowly moves. This orchestra of various parts and workers ensure the products are assembled on time as well as uses barcode and RFID technology to ensure products are able to be tracked and easily moved throughout the factory.

Managerial Implications

For companies such as UPMC and Boeing which have been reviewed in this chapter, these 2 companies operate in 2 separate industries though hold various applicability of how RFID technology can impact managerial decisions. RFID-based technologies, through its evolution since WWII technology, have found many ways to benefit managers in various types of industries who are looking to quickly, efficiently, and accurately track the inventory of their product. In particular, companies with large amounts of individual components to complete a service or products, such as UPMC and Boeing respectively, have numerous benefits for managers. First, the reduction of human errors and implementation of consistency that RFID technology can provide is impactful for managers. RFID allows the constant and consistent flow of information through an established system of transmitters and receivers that is not dependent on humans who may collect information differently. This also ensures that human errors, even by the best of employees, can be reduced and even eliminated.

Secondly, RFID technology allows for the delivery of information and components exactly when it is needed. At the Boeing factory, the right amount and type of components is delivered precisely when workers require the components which reduces errors and ensures maximum efficiency. For a company such as UPMC which is growing the number of hospitals in their network, RFID can provide the company a consistent source of data collection across a wide range of employees and staff. Overall implications of RFID technology to manager in SCM and to leaders in companies such as UPMC and Boeing is noticeable with the ability to be quantified in time, costs, and efficiency savings. The efficiency of RFID technology to collect this information with reduced errors translates into more accurate information for managers to make decisions at often a much lower potential cost.

Research has been done on the effectiveness and success of introducing RFID technology into the supply chain. A study by Wu and Ku (2013) investigated what happens in upstream and downstream firms when RFID technology is brought into the supply chain. The authors used the Adaptive Structuration Theory and Structural Equation Modeling to analyze upstream and downstream firms who had business in manufacturing, logistics, warehousing, retailing, and selling. Due to the benefits of RFID technology including reducing costs and reducing data entry errors, which have their own downstream effect, Wu and Ku wanted to see if there were any difficulties upstream and downstream that firms encountered when RFID technology is introduced. They researched 7 different ways RFID could prove difficult for firms including its effect on operation structure, group cooperation, and influence on issues derived from RFID technology. Although almost all of their findings confirmed that RFID technology has a positive influence on supply chains, there were a couple of negative outcomes. These were mostly around the changes that would take place with the introduction of RFID technology to a firm and the extent of this change is largely unknown.

RFID technology applicability can be applied to an even greater sense at both companies. UPMC for example has a large hospital system with multiple staff members covering a wide variety of shifts at the hospital. This dynamic in the healthcare industry is also more complex with all the various supplies and tools needed to treat patients in a hospital. While much of the supplies are tracked with bar codes today, RFID tags can help to collect data and perform an inventory in real time. This inventory can be more easily known as needed as well as tracked through its usage throughout a time period to better predict when supplies or tools may be needed for predictable procedures or treatments. UPMC as a result can better predict when a supply may be needed and can also reduce storage space in a hospital. In turn, Boeing Company is moving more towards RFID technology from the bar coded technology that was historically used at the factory. Boeing today uses the RFID chips to track and guide the movement of robots with the components for their aircraft. However, for Boeing their use can also be far greater by being able to integrate RFID technology not only in the logistical process to assemble the aircraft but also in the actual maintenance of an aircraft. For example, safety checks for inspections of aircraft can be more efficient and accurate if RFID technology could be implemented to monitoring the existing systems of their aircraft. Mechanics could then know precisely where to look onboard an aircraft with this more accurate information to better maintain their fleet. While RFID technology at Boeing cannot fully take the place of a human inspection, it can help to ensure the accuracy and speed at to which inspections could occur. For companies such as UPMC and Boeing, surveying the work force that interacts with these components and the management can be an important step to understand the potential impact and scope of RFID technology at both these companies.

CONCLUSIONS

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General Conclusions and Implications

RFID technology has demonstrated its ability to evolve into a logistics solution since its inception in the 1900's. As technology has improved by becoming less expensive on a per chip basis and through a much smaller size, RFID technology is a competitive advantage for managers involved in SCM. Various aspects of the supply chain process are now able to be more accurately and easily tracked based upon their location and the data associated with the chip rather than through line of sight technology that exists through bar code technology. Managers can now be empowered with time and a constant flow of data that allows them to make fact based decisions and projections which have helped to save time and money through efficiency for their companies. Companies such as Boeing are demonstrating the existing potential of RFID technology while companies such as UPMC can take RFID technology the next level by tracking thousands of supplies that exist in a hospital.

DIRECTIONS FOR FUTURE RESEARCH

As with any technology, there is an initial and substantial investment that is required to implement RFID-based technologies. While this group recognizes the benefit of RFID technology, performing a case study on individual companies to understand the cost-benefit of this technology is important. Additionally, completing a detailed survey of UPMC and Boeing is a key aspect of future work that would allow for a strong understanding of RFID at each of the companies. Overall, the benefits of RFID technology are likely to improve as the technology for transmitting and receiving devices continues to be more cost efficient and widely implemented in the SCM system. As shown in the case studies, RFID solutions and its the approach is to assume that the outcome is acceptable to all (e.g., return of assets, from a financial perspective, elapsed lead time from an operational perspective) and that after it communicated to all stakeholders, and there must be agree of how to address it. Therefore, from a metric-intensive perspective, using predictive measures such as overtime dollars or reducing the number of steps would be a logical approach to properly management the desired outcomes. Technology coordination, which recognizes the presence of interdependency between processes, activities or functions, needs to be properly manage, as coordination can reduce potential conflicts that can occur when individuals want to use their own priorities. All priorities much match the organization's established goals. Future research could focus on how best to satisfy all those competing needs.

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KEY TERMS AND DEFINITIONS

Automatic Identification and Data Capture Technologies (AIDC): Types of AIDC-related technologies to leave the human element out of the data collection and storage functions of information derived from manufacturing, integrated through the manufacturing process, types of authentication concerns and/or e-security strategies, and relationship links to customer profiles. Typical types of AIDC include, bar-coding, RFID, magnetic strips, touch memory, and smart cards.

Inventory Control: Inventory control is the concept by which the negative aspects of maintaining inventories (i.e., less capital to invest elsewhere, costs associated with shrinkage and storage) are balanced with its positive aspects (i.e., having goods and services available in a JIT fashion). A number of traditional models are used to optimize levels of inventory (i.e., Minimum Stock, Economic Order Quantity (EOQ), and Safety Stock methods) that help determine minimum stock necessary to adequately maintain production levels.

JIT: JIT methodologies are intended to maximize the ability to respond to consumer preferences but simultaneously reduce levels of inventories via lean or cost-sensitive approaches. It is hoped by the eliminating any wasteful or non-value added activities, a firm can strategically level automation and its highly skilled.

Radio Frequency Identification (RFID): RFID technologies are types of automatic data capture techniques that use a combination of active and passive senders and receivers to collect and store codified information for further uses. The implementation of such technologies should lead to improved managerial and/or supply chain performance. On the surface, there appears to be few drawbacks to implementing such technology into a production process, assuming it enhances performance and improves output of the product. The main issues surrounding the RFID applications are whether the initial costs and labor required to utilize this technology are worth it, and will result in a positive outcome of revenues.

Toyota Production System (TPS): TPS is an optimum set of approaches to inventory production planning systems by creating economies of scale while producing in relatively small-batch volumes. The aim of the process is to apply scientific methods to obtain the best available quality, lowest costs, and shortest lead times via simultaneously reducing of waste or non-value added activities. TPS has two major considerations, JIT and jidoka.

Green Supply Chains and Enabling RFID Technology

14

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INTRODUCTION

Green, Supply Chains, and RFID

There is considerable evidence the next frontier for achieving a competitive advantage in marketplace is taking up the idea of a green supply chain (GSC) by introducing corporate responsibility (CSR) and sustainability into your day-to-day operations. This chapter of applications of supply chain management (SCM) emphasizes the role of radio frequency identification (RFID) technology. RFID-embedded has been a major technological advance that appears to be on the verge of universal acceptance as an industrial standard that will enable companies with improved data gathering. Therefore, helping managers make more informed decisions, saving capital while improving their environmental friendliness. Since the beginning of RFID since the early 1980s, the technology has blossomed into many sectors and different purposes but there is no consensus on the actual popularity, familiarity, and overall likeability of RFID in any of this. Some of these business sectors include retail, finance, information technology (IT), healthcare, and aerospace industry. As consumers continue to educate themselves and become more environmentally conscious, they will begin looking at a company's green profile or their energy efficiency profile and begin making their purchasing decisions with that in mind. The speed at which companies peruse these indicatives will be directly related to the dollars spent on product by customers demanding green indicatives. Many firms are requiring their suppliers to be cognizant of these ideas and these customer demands, which will in turn drastically affect B2B commerce between the firm and its suppliers. With the wave of environmental friendliness emerging, these supply chains still have to deal with the challenges of keeping their strategy cost-conscious and effective; this is where RFID comes into play.

In a world that is bent on eliminating waste from its operations (i.e. eliminating redundancies, streamlining manual data collections, etc.), there is another form of waste that occurs, physical waste. In other words, the waste that is created by transportation, outside warehousing, damaged inventory, wasted effort in managing these larger fleets, etc. RFID can increase the visibility for manufacturers, distributors, suppliers and retailers, and with real time information, firms can access much more accurate information regarding inventory movement and usage. This will not only reduce wasted costs but can have a large impact on the company's overall environmental standing by reducing the operational waste in the supply chain.

Purpose

The purpose of this research study is to find out, using a wide birth questionnaire to real world, multi-sector participants, how people feel about the use of radio frequency identification (RFID) technology. RFID technology, which is not only a multi-billion-dollar industry but also the grandchild of Radar

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technology, has only been recently becoming more popular across many business sectors, far more than run of the mill retail security tags. This diversification comes at the forefront of oftentimes, the problems of RFID persisting or even getting worse across a supply chain.

The expressed purpose of the propositions presented in this study is to aid in the discovery process of what is the best business practice concerning the usage of RFID technology in the manufacturing and service industries and see if the results corroborate with that much of the current literature says about the popularity of the technology. Across practitioner and scholarly research, have generated many different and often contrasting opinions on how well RFID works in the real world. As well, because the technology has changed so much, many of the articles about RFID scholarly articles and research models are simply obsolete. This study stands to make a more modern look at whom is using RFID technology, based on sector, business, size, longevity, and most of all, the feelings of the business/respondent on the matter.

DISCUSSION

Current Trends

According to Goldenhersh (2009), RFID technology assists firms with the three “R’s” of sustainability.

1. Reducing the number of logistics assets needed to operate the supply chain
2. Reusing those assets as frequently as possible
3. Recycling whenever possible

RFID plays a key role as it can vastly improve the managerial use and visibility of their inventory. A company can track everything from returnable inventory to raw materials, therefore increasing their asset utilization and reducing the strain that maintaining and storing these additional assets has on the environment. Studies have shown that RFID-tracking performance in industrial sites by developing methods that integrate Multidimensional Support Vector Regression (MSVR) and a Kalman filter have been very successful (Zhong, 2015; Song, Xiao, Zhang, & Zipkin, 2017). Zhong (2015) demonstrated that RFID technology can be used in manufacturing industries to create an RFID-enabled ubiquitous environment to advanced real time production planning and scheduling. This can be achieved with the goal of collective intelligence. Song, et al. (2017) investigated SCM inventory policy problem for a dual source with equal success. Rogers (2017, p. 276) empirically determined the key advantages of Military Information System Technology (MIST) as an optimal viscosity RFID system that improves fault tolerance, decreases entropy, decreases costs and decreases backorders. Hence, the technical and business literature have demonstrated that there are many benefits of RFID technology for reducing inventory shrinkage and optimization of SCM

For example, an empirical study case study was performed on several industries, including food and dairy industries, to assess the effectiveness of RFID technology has had on the sustainability goals of each industry (Smith, 2017; Smith & Smith, 2017). It was found that RFID had many practical uses in the food industry and has a major impact on reducing food wastage and perishability. In one company alone, a producer of about 60% of U.S. pistachio crop and exports uses RFID primarily to rationalize the processing of deliveries from its suppliers, which is a critical part of the firm’s supply chain. Because Paramount’s inventory, Pistachios, has a relatively short time horizon in which they can be harvested and processed, time spent picking, shipping and packaging are of great concern as perishability issues

can arise. Paramount went on to say that, their keeping of accurate tracking of inventory delivered was key in maintaining a good working relationship with its suppliers.

RFID has enabled this relationship because Paramount can now weigh its trailers with the nuts to determine the exact amount of inventory that each truck contains. That truck is then RFID tagged as it enters the processing plant to help the managers at Paramount understand exactly how much inventory they have on hand and how much they still need to cover current demand forecast for its product. However, there are some issues Paramount has had with this new technology. First, the surface in which the tags are placed, the metal hulls of the trailers, poses a problem because the metal reflects back the signal, therefore causing some interference. To get around this they now place a “spacer” between the RFID tag and the truck, reducing the interference they were getting when applying it directly to the truck hull. Another issue they were having was the climate in which they were exposing the tags too. By exposing the trailers to extreme temperature swings, Paramount had to use extra durable tags to withstand to change in temperature they would be going through.

Even with these extra costs coming about by the challenges, Paramount reported a staggering success stemming from the utilization of RFID tagging. First, the relationship between them and their suppliers grew and improved considerably by eliminating bad information and disagreements over payment amount and delivery times. Second, the throughput of trucks significantly increased therefore saving the company from having to build a second scale house to handle the increased volume through the facility. Third, there have been better informed management decisions being made by the plant because delivery information is highly accurate, timely, and accessible. Fourth, the company has saved money and gained efficiencies in being able to track expensive assets, like trailers, whose usage was reported to be increasing by 30% since the RFID tagging began.

Another study that was done in the food industry was in Greengard (2007), where the author explored how RFID helps ensure the freshness of processed foods that went through multiple factory operations like the dairy industry. He studied how Wells Dairy uses RFID in its production operations and examines how why tag each case and pallet while running through the production line. Once tagged they are sent to the freezer where Wells ran into problems with the extreme temperature changes the tags were experiencing. Because of this, Wells had to install a verification station in order to ensure that no damage was done to either the cases or tags prior to the pallets leaving the warehouse. However, even with these increased costs, Wells reported great success with the project in that management has a better grasp on their inventory and has been able to make better informed decisions. Due to increased use of RFID tagging during the manufacturing stage, they have seen great efficiencies by being able to track inventory at any stage in the supply chain and understand what percentage is delivered to the final customer versus being returned or destroyed for any reason.

With this long list of advantages that RFID brings with it, there must be just as long a list of disadvantages, right? Not exactly. While it is true that every system you use, there will inherently always be downsides to that system. It is not so simple with RFID tags. RFID is simply a tool, so explaining the disadvantages becomes more difficult. Like a hammer can be used to build a house, so can RFID be used to identify and track objects in real time and improve upon ones supply chain. In other words, RFID is efficient in what it is designed to do, it will not guarantee increased sales or even fix a defunct supply chain, but it should help in identifying what and where certain objects are and help you move towards a more efficient supply chain by having goods on the shelf when customers want them.

What is Radio Frequency Identification (RFID) Technology?

Supply chain management (SCM) has been one of the most difficult and necessary parts of a modern and functional economy. The global market demands that isolationism cannot exist and most all businesses and companies, large and small, foreign and domestic, new and old, have to have a functional and comprehensive supply chain. The advent of new technologies like seafaring freighters, ground transportation, third party suppliers, and outsourcing labor has really changed the face of the profession. Of the many new technologies and adverts, one of the most relevant changes to not only the SCM industry but to a dozen broad sectors is the RFID technology. RFID technology promises revolutions in areas such as supply chain management (Lee & Park, 2008). It is essentially a miniaturized electromagnetic radar that allows some real time tracking of goods, services, persons, or really anything that can be given a transponder and is connected to a receiver.

How is RFID used?

RFID technology can come in many forms and the style, usage, and overall functionality has changed very drastically since the creation around 1980s and further development through 1990s and 2000s. In its modern incarnation, the RFID is a small node with a self-contained power source and transponder, similar to that of an aircraft, which is encoded specifically for the particular receiver. The information that is received at the supply chain manager's computer can track where a tagged good or product is, as a location confirmation or in an assembly line, or in a specific location within a smaller local. According to EEI "A recent Aberdeen Group survey of 200 companies found that more than half of the companies with RFID systems were using the technology in asset tracking" (Michael and Caine, 2005) shows that many of the companies use RFID for asset tracking in real time. This is the most well-known usage but as this research study will show, the usage of RFID has expanded vastly. This chapter will be covering information about the RFID, including what it is, the history of the RFID, and some pros and cons currently of the technology. The chapter will include a discussion of some of the business sectors that are most familiar with RFID technology in one form or another, as well as what they use, how they use that technology, and how it may be changing the field. The chapter will end with the summary and conclusions including a recap, the results, and the researcher's conclusions, followed by the references and a sample of the questionnaire.

RFID Technology

How does RFID work?

Radio Frequency Identification (RFID) technology, as it is generally accepted, as evolved vastly since the creation in the early 1980s. The technology is based strongly on the Radar technology developed during World War II. However, around 1970, Mario Cardullo thought of and developed the idea for the original RFID, which was a simple versatile tag that consisted of a transponder and receiver system. Though the original was a simple 16-bit interfacing tag, the 1990s saw the technology really pick up. As it is now, the RFID is far more than a simple transponder that can broadcast and receive a signal. Much of the early RFID technology was limited by barcodes in order to confirm an assets location while in transportation, but today, a tag is much cheaper and far more versatile, not even needing an active scan or anything. A modern tag can be registered through a "gate" or a receiver even if the tag is embedded

within a box, in metal, or not at all visible. The gate, be it an actual tunnel or a within house monitoring system, then sends the information in real time to the supply chain manager. This kind of real time tracking is a massive benefit for any supply chain manager and today, at some large companies, it is simply mandatory as no number of humans could watch thousands of products move every second.

Historical Aspects of RFID

As briefly mentioned above, the RFID was the grandchild of radar technology developed during World War II. The radar originally used electromagnetic waves and time to measure an object's distance from the apex of the radar. The development of RFID was done concurrently between private technology firms and the US government. The original RFID had a very low frequency signal, around 125 kHz, and increased over time up to 13.56 MHz and UHF level tags, which had far more range and usability than the original, which only worked, within a small space. The true game changer, however, was the integration of the RFID tag from a private network system to the internet connectivity. This, combined with the rise of the WiFi networks and satellite GPS technology, took the RFID global, allowing a supply chain manager to monitor any given good from step one, where the tag is attached, to the final destination with corroborated checkpoints for each partner who has a hand in the process.

Pros of RFID

The obvious benefit and primary usage of the RFID is the real-time location tracking of assets. This can come in the form of many, many different industries tracking their products at different sizes and speeds in order to get an actual monitor of a supply. This could mean, for instance, a shop could watch how much of a certain product is in the store or warehouse, or an agency could watch the “hits” of a certain product, like a passport for instance, where people are showing up and write that information into a database to follow people. With the advent of more sophisticated applications of automation in manufacturing and logistics, such as VAT, the potential benefits of RFID-related technologies are too numerous to list in a comprehensive fashion.

As well, in the instance of a massive assembly line, the captain or manager could see where the product being built is in the “assembly line” and if the KPI are being hit or not. This kind of asset tracking during construction means that companies, which survive on massive contracts, can know whether they are on schedule or not to meet their goals and deadlines. Finally, RFID can be connected in most everywhere today, allowing for a very widespread real time tracking, much like an aircraft's transponder allows for an air traffic controller to see where they are in the sky from takeoff to landing, an individual could watch where the good or service was, being tracked in real time, across the globe. Obviously, this technology is becoming integral to supply chain managers for their work, even in small and large chains across many partners due to the fact that the RFID has not only gotten more advanced, but they are much cheaper, less than a dime per tag.

Cons of RFID

RFID can be a very handy tool to use but it is not without a few hang-ups. As it stands now, depending on the size of the supply chain that the manager is trying to get tagged up, several things are needed. One is a complete and total commitment from all the supply chain partners, meaning that everyone has to invest in one tag, one software, and one overall system completely. While the tags themselves

are not particularly expensive, the setup of the system can be very expensive to get up and running. As one research study states: “By adopting RFID technology, companies will be confronted with a huge amount of data generated by RFID tags” (Lee & Park, 2008). RFID system requires that, as mentioned before, every supply partner and involved distributor, retailer, and raw material constructor, need to be in on the “plan.” This means that, for example, if one-step in the supply chain chooses not to get involved or rejects the idea of an RFID system, the entire system is effectively moot. This can hurt relationships between supplier and distributor or retailer and could even demand that a supply chain manager must find new partners to work, which could really hurt or even stop production.

BUSINESS SECTORS

Who Uses RFID?

In this chapter, we want to see how people in the real world choose to utilize and how much they like or dislike the actual technology. However, a known limitation of this project is that it is impossible for me to know literally every single use of RFID technology, in and out of supply chain management. So for the sake of having a cohesive research project, we will focus not on every use of RFID, but of the more popular uses in sectors and determine at what size of a company, perhaps, uses an RFID technology in some form, and try to determine if they are really worth it or not. The above discussed several instances of this section of the chapter will be discussing some of the known uses. The order listed is in no particular order but will be the business sectors that this chapter.

Retail

Retail traditionally has been one of the most notable sectors to adopt RFID technology across the board. Most people know the common use of tags, for instance, on clothing as security tags, to deter people from shop lifting the tagged clothing that will set off a gate if the tag goes through it. While most people think that this is the most popular use of RFID, another less well-known usage is actual pallet tracking (Thrasher, 2013). When a big box supplier needs to flow what is coming any given week, how much or little of X product is on the way, a company can see that, using gate tracking, assets are being tracked both in-bound, upon arrival, and precisely how far across the supply chain these products actually travel. According to one study “...through its capabilities to uniquely identify, track and trace consumer products along the entire supply chain requiring neither direct human contact nor line of sight” (Bardaki, Pramataris, & Doukidis, 2007, p. 1). This kind of automation is a major strength to retailers from small to large since not only does this save work hours but also it helps remove some of the human element with regards to making a mistake.

Financial

Much the same way that other industries use RFID for asset tracking, this fact, is especially important in financial sectors for tracking money transfer and related financial documents. The way this is most often used is with banks, who use tags on large sums of money in order to manage asset tracking. As well, despite how important it is for a bank to keep track of their money, this saves dozens of man hours’

worth of having to have a teller or accountant count the money between locations, as well as financial firms like large banks being able to track their IT assets.

Information Technology (IT)

Dealing with IT asset tracking, this has become one of the more behind the scenes and prevalent uses of RFID technology. Like in the instance of datacenters and server farms, RFID have changed how high-tech firms manage their equipment. According to one expert on RFID, “A full inventory often took days to complete. With RFID, some financial institutions are accomplishing the task in hours” (Pleshek, 2011, p. 1). Firms who live and die by their technology and database functionality can have much shorter maintenance times and more active time so long as a supply chain manager is able to watch their expensive IT parts in a collaborated database. Information technology uses RFID in other instances as well, for example with GPS connects and US passport tagging to track where people have checked into when traveling. Finally, one of the more innovative technologies that are being implemented is real time dynamic advertising, where objects like phones will receive an ad or message based on a real time location with information received from a nearby store or kiosk.

Healthcare

One of the larger trends we have seen growing according to several studies is the use of RFID in the healthcare system (Rodger, 2017). Healthcare system are the involved hospitals, who are the consumers in this supply chain, and the associated retailers, distributors, and such, that have been benefitting from asset tracking of such important, expensive and specific tools. According to one research article: “Potential benefits that are associated with intelligent healthcare information systems include improved patient safety through reduced medication errors and adverse events, improved medication/test ordering, improved quality of care, and improved efficiency in healthcare delivery” (Tua, Zhou, & Piramuthub, 2009, p. 587). Hospitals can keep an active tracking of their limited and specific supplies in real time in the instance that a situation arises that requires some equipment within seconds. Hospitals are gaining the ability to track their ambulances with RFID and GPS in order to read traffic and location and help expedite getting a critical patient to the hospital as soon as possible.

Aerospace

While most everyone assumes that RFID in aerospace is mostly used in baggage handling, the technology is evolving very quickly and finding its footing in a new functionality. The normal baggage tag, used at the usual large, commercial airports, allows airlines to track the flow on and off baggage in an aircraft along with information related to that baggage such as size and weight in order to create the most balanced baggage situation on a flight. As well, one of the new techniques being used is from large manufacturers like Boeing or Airbus can track the construction of a new aircraft in real time (Pleshek, 2011). A commercial aircraft is made of so many parts that all have to come together in a timely fashion and the construction of an aircraft is so complex that applying RFID tags to different parts can let a manager monitor the situation.

RFID and VMI Implementation Strategies for a Green Supply Chain

The following is a set of guidelines managers can use as they seek to implement RFID into their sustainable supply chain. There is little doubt from the many readings in SCM; a well-documented purchasing portfolio has many admirable characteristics that has the potential for great benefits and profitability. The following sections will present some collaborating evidence for combining these approaches via successful practice of VMI (vendor-managed inventory) with retailer-managed inventory systems.

For example, Mishra and Raghunathan (2004) offered details as to why retailers may want manufacturers to manage their inventories. The authors also present the argument “that VMI intensifies the competition between manufacturers of competing brands” (p. 445). These relationships encourage a collaboration that is not established in the traditional retailer-managed inventory (RMI) system. The type of collaboration that is essential to VMI is information sharing. The authors suggested “information sharing reduces the ‘bullwhip’ effect” (p. 445). Perhaps, their greatest argument is not about bullwhip effect, but that VMI increases competition. Out-of-stocks lead to brand switching, and brand switching over time, can affect market share. Personally, a purchase portfolio concentrates on normal aspects of costs, but not on more creative problems that result in brand switching and vendor selection, product substitution, demand models, and order quantities and profits. Mishra and Raghunathan discuss the role of product substitution as regards to retailer competition. This was an interesting concept, since companies I consulted for that sells to Walmart and all our other customers would consider Walmart to be one of their competitors, if not their biggest competitor. They completed an experiment at 2 items made by two different manufacturers that were considered substitutable. They wanted to test what the customer would do when the preferred brand was out of stock. The customer could buy either the substitute brand or backorder the preferred brand. They used derivatives to combine the price and stocking levels to see how it would affect demand. Some of these discussions were slightly irrelevant to what I do as a VMI analyst/consultant, as many SCM professionals are not typically aware of stocking levels or profit margins of the retailers. With VMI, the opportunity costs of stocking decisions are both the profit lost if out of stocks occur and the profit that could be realized if a competitor takes out of stocks.

Mishra and Raghunathan (2004) and Waller, Johnson, and Davis (1999) summarized the need to fixed prices, the possible benefits of VMI almost seem irrelevant if the retailer is making stocking-level decisions. This is an area that there is much agreement (Rodger, 2017). Mishra and Raghunathan (2004) continued with their experiment using endogenous prices, by describing a backward induction procedure that they use to determine that the retailer would not adjust prices, but they would adjust the stocking level. With regards to VMI, the profits are higher because the stocking levels are higher and considerations of uniformly distributed demand. In their conclusion, they state that competition can be a benefit of VMI. They also believe that the higher stocking results in higher profits for the retailer. Interesting enough, that although the retailer may encourage VMI, they remain in control of stocking levels, which may not necessarily be good for competition. What is good for the retailer is the demand data that is received from the retailer. That alone can be benefit enough for the manufacturer to take up VMI.

Waller, et al. (1999), further suggested that VMI seems to work well for food manufacturers considering how long Proctor and Gamble, Campbell Soup, and Barilla pasta has been practicing it. VMI and related SCM activities may result in the retailer giving up control in exchange for the manufacturer to hit a targeted service level. VMI can save money and the technology required to do so. They discuss the variables that affect VMI and some pitfalls of the process, reduced costs and improved service, which are of no surprise. However, the idea of a smoother demand signal is important to modern SCM systems. Costs are reduced because of the visibility of demand, and the better use of production, warehousing, and

transportation. VMI can provide safeguards against buyer calendars which may be difficult to interpret. The authors believe service is based off of product availability. Improved service may lead to more shelf space and more shelf space may lead to higher revenues. VMI also seems to be the answer to better service during difficult situations, such as product shortages, the introduction of replacement products, and shipment optimization. They touch on EDI, which all of our VMI customers typically use. It would be difficult to imagine doing SCM transactions job without EDI.

Using a simulation of Hewlett-Packard, the authors evaluated the VMI approach. In this section of the paper, the authors specifically call out the effect of demand variability, the effect of VMI adoption rates, and the effect of limited manufacturing capacity. In regard to demand variability, the authors used three measurements: low, medium, and high. Benefits arise from a shorter review period, which may lead to more frequent shipments, however order frequency was not changed. In this respect, the manufacturer was better able to serve all its customers. With VMI, adoption rates the authors looked at light adoption and widespread adoption, while their VMI candidates made up 30% of their total demand. Overall, widespread adoption offers the greatest benefit, but even bringing key customers onto VMI with light adoption is a step in the right direction.

In looking at the effect of limited manufacturing capacity, the authors construct five scenarios. The main learning was that “VMI is even more important for manufacturers with little excess capacity” (Waller, et al., 1999, p. 196). Hence, VMI leads to greater production efficiencies and the “operational benefits of VMI are very compelling” (p. 198). Those benefits include cost reductions and increased service. These benefits are also being received at lower costs due to the declining price of the technology needed. Interesting enough, the authors also admit that customers who are not VMI are still benefiting from the manufacturers who are offering that service to other customers. However, VMI may not be beneficial if the company does not consider the planning and relationships that go into creating a successful partnership. Teamwork, trust, and goals are all needed for the system to be successful.

Does not the need for continuous planning and relationships that go into creating a successful partnership must be developed for any supply collaborating to occur? Many managerial consultants may use the VMI example as a way to emphasize that teamwork, trust and mutually obtainable goals are essential to the overall success of such partnering activities. These goals cannot be successfully attained by using only one analytical approach. The following are suggested approaches to promote these mutually sustainable goals.

1. Top management needs to be involved with the pursuit of sustainability.

According to Case (2007), he found that executives and supply chain managers need to cooperate in establishing rules of engagement for interaction with suppliers, establish a sustainability statement to suppliers, making the decision if green criteria should be included in the certification of the supplier, and deciding the rollout of a “supplier code of conduct” for supporting sustainability practices.

2. Having a strong business case for going green.

Case (2007) suggested that top management must provide a strong business case for implementing a sustainability strategy. Typically, green supply chains are implemented and justified by way of cost savings and gains in efficiency. When you pair that up with the reduction in waste and enabling JIT manufacturing, there are significant gains in sustainability to be achieved.

3. Outline a plan for pursuing a sustainable supply chain.

In Hershauer (2008) suggested that there needs to be a top tier executive or cross functional team that oversees the initiatives will ensure continuity in pursuing these initiatives. There are several supply chain management tools available in assisting with these initiatives and will help the team in developing a supplier code of conduct, supplier scorecards, to name a few.

4. Outline Opportunities using RFID in the business processes.

Hershauer (2008) further pointed out that the focus of the implementation will be promoting the green supply chain, while cutting costs and increasing performance of production. Managers need to identify all business process problems that would benefit with RFID deployment.

5. Identify RFID issues in the IT department.

Case (2007) established that a companywide roll out of RFID initiatives would undoubtedly involve the setup of new enterprise systems to handle the increased data flow. An IT department needs to ensure that users of the data can access it reliably and effortlessly. One such way of achieving this, would be to offer web services in the delivery of this information. Web-based services give suppliers access to the information without giving them access to the company's internal database.

Rallying Suppliers to Support the Green Initiatives

Hershauer (2008), Mishra and Raghunathan (2004), and Waller, et al. (1999) all suggested that there needs to be incentives and penalties tied to the suppliers' participation of this green initiatives. By utilizing the scorecard created in an earlier step, there needs to be continuity across the board and suppliers need to feel that they are treated fairly when rolling out this initiative.

Proposition 1: RFID technology may not be universally applied with the same benefits. While the subject matter that we are testing is inherently quantitative, the questionnaire gives the research study data a degree qualitative merit to see. We believe that in some sectors, the use of RFID technology may be done across the board, hands down but may not be as universally loved due to technical limitations with third party supply partners.

Proposition 2: This proposition suggest that only very large companies have access to the realist, broad margin use of RFID technology in whatever sector they are involved with. For instance, in retail, only the kind of "mega stores" like Walmart, Kroger, Costco, etc. Using correlations between dollar values of the responding subject's business/company and their familiarity with RFID will provide insight into the limit of RFID, whether or not anyone smaller than a massive retail chain or heavy manufacturer like Boeing bother with RFID. The concept behind this proposition is that though much of the RFID system is and has become more affordable, the ceiling placed on supply chain managers and their partners stops most attempts.

Null Hypothesis: The null hypothesis is that RFID technology is, in fact, as popular and widely acknowledged as many research articles and studies indicate. This would be a reversal of the prior two hypothesize that did not completely acknowledge the value of RFID technology. The null hypothesis assumes that all sectors and all sizes have generally positive feelings regarding RFID technology and use them in some aspect.

GENERAL CONCLUSIONS AND IMPLICATIONS

Chapter Summary

This chapter deals with the usages and popularity of RFID-embedded technology. This study aims to discover what the situation is in the modern supply chain in a wide array of sectors. Using previous RFID literature that have referenced the use of RFID-based technology in other sectors, this research study sought to, colloquially, find the “temperature” of how people are feeling and more importantly, using RFID in their business. While some RFID usages are obvious, this research study can find if there are new, more cutting edge uses of RFID that not even any of the previous literature has touched on. This chapter is reminiscent of a professional survey, seeks to add to the conversation about what is possibly working, what is not working, and what people are really thinking ideally.

Strategic Conclusions

Though the proposed empirical study has not yet been conducted, the conclusions that are expected to be reached will be reviewed by all associated peers in the immediate vicinity and academy structure to double check all of the data and reading. If the majority of the reviewers positively review both the study methodology and the study itself, the study will be distributed to other university professionals in the area in order to continue to receive reviewing. Testing these propositions should place a spotlight on the usefulness of RFID-embedded technologies with the SCM industry and help make the situation clearer to other supply chain professionals.

DIRECTIONS FOR FUTURE RESEARCH

Forward-looking companies and supply chains partners need to take a closer look at RFID tagging and the current/future sustainability initiatives that they enable. RFID tagging can help these firms improve their impact on the environment by utilizing the information flow RFID enables, improving logistic assets, and reducing reliance on disposable packaging. Couple these initiatives with the impact that RFID tagging can have in improving business processes and production methods, and your company can cement a solid plan as to why RFID tagging may be instrumental in the implementation of your sustainable supply chain.

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KEY TERMS AND DEFINITIONS

Automatic Identification and Data Capture Technologies (AIDC): Types of AIDC-related technologies to leave the human element out of the data collection and storage functions of information derived from manufacturing, integrated through the manufacturing process, types of authentication concerns and/or e-security strategies, and relationship links to customer profiles. Typical types of AIDC include, bar coding, RFID, magnetic strips, touch memory, and smart cards.

Barcoding Technology: A long-term and very reliable type of AIDC technology, it is known for its very accurate and economical approaches to identity products and machine-readable information from a variety of manufactured goods and services. Most barcodes use a type of standardized bars and spacing coding or symbology that is certified by an international standards body (GS1 System). This system provides for the universal global acceptance of many types of barcodes designed for a variety of shipping and identification applications. Example barcode formats that are in common use today include EAN/UPC, GS1 DataBar, GS1-128, ITF-14, GS1 DataMatrix, GS1 QR Code and Composite Components.

Inventory Control: Inventory control is the concept by which the negative aspects of maintaining inventories (i.e., less capital to invest elsewhere, costs associated with shrinkage and storage) are balanced with its positive aspects (i.e., having goods and services available in a JIT fashion). A number of traditional models are used to optimize levels of inventory (i.e., Minimum Stock, Economic Order Quantity (EOQ), and Safety Stock methods) that help determine minimum stock necessary to adequately maintain production levels.

JIT: JIT methodologies are intended to maximize the ability to respond to consumer preferences but simultaneously reduce levels of inventories via lean or cost-sensitive approaches. It is hoped by the

eliminating any wasteful or non-value-added activities, a firm can strategically level automation and its highly skilled.

Radio Frequency Identification (RFID): RFID technologies are types of automatic data capture techniques that use a combination of active and passive senders and receivers to collect and store codified information for further uses. The implementation of such technologies should lead to improved managerial and/or supply chain performance. On the surface, there appears to be few drawbacks to implementing such technology into a production process, assuming it enhances performance and improves output of the product. The main issues surrounding the RFID applications are whether the initial costs and labor required to utilize this technology are worth it and will result in a positive outcome of revenues.

Supply Chain Management (SCM)/Performance: In basic terms, supply chain is the system of organizations, people, activities, information and resources involved in moving a product or service from supplier to customer. The configuration and management of supply chain operations is a keyway companies obtain and maintain a competitive advantage. The typical manufacturing supply chain begins with raw material suppliers, or inputs. The next link in the chain is the manufacturing, or transformation step; followed the distribution, or localization step. Finally, customers as outputs purchase the finished product or service. Service and Manufacturing managers need to know the impact of supply on their organization's purchasing and logistics processes. However, supply chain performance and its metrics are difficult to develop and actually measure.

Vendor-Managed Inventory Systems (VMI): VMI-based systems are designed to transfer the control of inventory and its planning activities to a manufacturer or distributor in order to provide a beneficial relationship to promote a more transparent and seamless flow of goods and services at lower costs. As in many recent retailer applications, the supplier/vendor assumes responsible for replenishing and stocking inventory at appropriate levels to minimize inconvenience to the ultimate customer.

Virtual Asset Trackers (VAT): Increased transparency in supply chains and the need to track personal as well as physical assets has led to the development of Virtual Asset Trackers (VAT). VAT-based technologies allow for hosted users to automatically received updates on inventories on their RFID handhelds and Web Asset Managers. VAT is a type of application of active RFID tagging that allows healthcare practitioners to enhance security to patients, residents, and hospital staff while providing better patient and resident-care services. Ideally, proper leveraging of VAT-based technologies allow management within the healthcare setting to simultaneously improve regulatory compliance, preventing or reducing inventory shrinkage, reduce labor intensive staff assignments, and lessen spoilage of perishables. These are mainly operational advantages that are commonly associated with active RFID applications.

APPENDIX

RFID by Sectors and Real-World Usage Questionnaire

Radio Frequency Identification (RFID) technology has been one of the most talked about and least understood pieces of supply chain management since the rise of the internet age. Virtually every individual business and supply chain uses RFID differently for mostly tracking and observing small transponders in real time. **Please spend a few moments to answer the following questions regarding your RFID technology usage. Please check the single best answer.**

Business Experience and RFID Familiarity

For the following questions, please check the appropriate response concerning your business/companies experience with RFID. Please note that the questions should be answered on a 1-4 scale.

Strongly Disagree Agree Strongly Disagree Agree

My business/company uses RFID technology ☐ ☐ ☐ ☐

My business/company is very familiar with RFID ☐ ☐ ☐ ☐

My business/company has only recently

(<5 years) started using RFID technology ☐ ☐ ☐ ☐

My business/company has experience ☐ ☐ ☐ ☐

(>5 years) using RFID technology

My business/company is in the (Retail/IT/

Healthcare/Aerospace/Manufacturing) industry ☐ ☐ ☐ ☐

RFID technology has proven to be effective at my workplace ☐ ☐ ☐ ☐

RFID technology has had no problems with implementation/maintenance ☐ ☐ ☐ ☐

Current and/or Past RFID Usage / Primary Uses of RFID Technology

For the following questions, please check the appropriate response concerning the previous/current usage of RFID technology. Please note that the questions should be answered on a 1-4 scale.

Strongly Disagree Agree Strongly Disagree Agree

1. My business/company has previously/currently implemented RFID technology ☐ ☐ ☐ ☐
2. My business/company has plans to implement/expand RFID technology in some form ☐ ☐ ☐ ☐
3. My business/company is, in my opinion, overall happy with RFID technology ☐ ☐ ☐ ☐
4. My business/company uses RFID primarily for purposes ☐ ☐ ☐ ☐
5. My business/company uses RFID primarily for security purposes ☐ ☐ ☐ ☐
6. My business/company uses RFID for logistics purposes ☐ ☐ ☐ ☐
7. My business/company uses RFID for Supply Chain Management (SCM) purposes ☐ ☐ ☐ ☐
8. My business/company has partner(s) that use RFID technology ☐ ☐ ☐ ☐

Ease of Use of RFID Technology

For the following questions, please check the appropriate response concerning the ease of use of RFID technology. Please note that the questions should be answered on a 1-4 scale.

Strongly Disagree Agree Strongly Disagree Agree

1. RFID technology was easy to purchase/implement ☐ ☐ ☐ ☐
2. RFID technology has, generally, worked without error ☐ ☐ ☐ ☐
3. My business/company has continued to commit to RFID usage ☐ ☐ ☐ ☐
4. In general, RFID works as intended for your business's specific need ☐ ☐ ☐ ☐
5. RFID technology is easy to update and expand ☐ ☐ ☐ ☐
6. RFID technology is, generally, well received among all involved supply partners ☐ ☐ ☐ ☐
- My business/company hired/contracted a third party for RFID implementation ☐ ☐ ☐ ☐
1. My business/company hired/contracted a third party for RFID technology maintenance/troubleshooting ☐ ☐ ☐ ☐

Future Development/Implementation of RFID

For the following questions, please check the appropriate response concerning the future of RFID technology at your business/company. Please note that the questions should be answered on a 1-4 scale.

Strongly Disagree Agree Strongly Disagree Agree

1. My business/company has plans to expand their RFID technology ☐ ☐ ☐ ☐
2. My business/company has plans to implement new RFID technologies ☐ ☐ ☐ ☐
3. My business/company has expressed interest in keeping their current RFID technology ☐ ☐ ☐ ☐
4. My business/company has expressed interest in stopping/removing any existing RFID technology ☐ ☐ ☐ ☐
5. My business/company's supply partners have expressed interest in RFID technology ☐ ☐ ☐ ☐
6. My business/company's supply partners have expressed disdain with RFID technology ☐ ☐ ☐ ☐

Final Questions*

For the following questions, please check the appropriate response concerning your personal opinions on RFID technology. Please note that the questions should be answered on a 1-4 scale.

*These answers represent only the individual filling out the survey and do not reflect the feelings of any other entities.

Strongly Disagree Agree Strongly Disagree Agree

1. I like Radio Frequency Identification Technology (RFID) ☐ ☐ ☐ ☐
2. RFID has made supply chain management easier overall ☐ ☐ ☐ ☐
3. RFID technology was implemented properly and works well ☐ ☐ ☐ ☐

Demographic Information

For the following questions, please check the appropriate response:

1. Please state your gender:
 - Male ☐ Female
2. Please state your age group:
 - 18-24
 - 25-34
 - 35-44
 - 45+
3. Please state your level of education:
 - No education
 - High School or equivalent
 - Associate Degree or some college
 - Bachelors' Degree
 - Masters' Degree
 - Doctorate Degree
4. Please state your professional industry:
 - Retail Services
 - Financial Services
 - Healthcare Services
 - Manufacturing/Production
 - Aerospace
 - Computer Information Systems (IT)
 - Other: _____
5. Please state your years of professional experience in your sector (years):
 - 1-3 ☐ 4-6 ☐ 7-10 ☐ 11-15 ☐ 16-25 ☐ 25+

Environmental Friendliness in Low Carbon Supply Chain and Operations

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INTRODUCTION

Increasing environmental concerns has compelled manufacturing firms to reconsider their operation strategy. Rethinking of manufacturing firm's operations to meet customer requirements and to achieve performance in operations, economy, social and environment are necessary (Fernando, Jasmi, & Shaharudin, 2019). Nowadays, environmental issue such as climate change due to carbon emissions from manufacturing industry has become a popular topic among firms, customers and society. Evolution of shifting customer requirements from cost reduction to include more product features to product that not harmful to the environment have demand firms to change its operation management. For instance, manufacturing firms have evolved from mass production to mass customization and now towards energy management and environmental principle (Fernando, Shaharudin, Ismail, Yew, & Ganesan, 2018; Fernando, Shaharudin, Haron, Karim, & Ganesan, 2018). These shifting in strategies have seen manufacturing firms practicing just-in-time (JIT) strategy, total quality management (TQM), flexible manufacturing system (FMS), agile manufacturing (AM) strategy, lean production (LP) and supply chain management (SCM) (Gunasekaran & Ngai, 2012). These strategies are practiced by firms to achieve performances such as economic (Schandl et al., 2016), social (Beitzen-Heineke, Balta-Ozkan, & Reefke, 2017), operations (Mirkouei, Mirzaie, Haapala, Sessions, & Murthy, 2016) and environment (Nouira, Frein, & Hadj-Alouane, 2014).

Nowadays, manufacturing firms are expected to reduce environmental impacts in its supply chain and operations (Willersinn, Möbius, Mouron, Lansche, & Mack, 2017). The importance of reducing environmental impacts and threats has been studied across manufacturing sectors such as in food sector (Camanzi, Alikadic, Compagnoni, & Merloni, 2017), medical sector (Unger & Landis, 2016), automotive sector (Bechtsis, Tsolakis, Vlachos, & Iakovou, 2017), aerospace sector (Ruiz-Benitez, López, & Real, 2018), furniture sector (Fernando, Shaharudin, & Wahid, 2016) and energy sector (Fernando & Hor, 2017). These sectors need to address environmental issues especially in regard to carbon emission. Increasing carbon emission from manufacturing firms' supply chain and operations activities are highlighted as critical issue that need attention from every stakeholder (Shaharudin & Fernando, 2015). Thus, manufacturing firms need to adopt environmental friendliness criteria to appease its stakeholders. Environmental friendliness criteria can be defined as firm's operations that will not harm the environment through energy efficient and clean energy (Gunasekaran & Ngai, 2012).

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Nevertheless, literature on environmental management are divisive for supply chain cluster and operations cluster. Most articles in the literature recognized that green supply chain management (GSCM) (Kamal & Fernando, 2015), low carbon supply chain management (LCSCM) (Shaharudin & Fernando, 2017) and sustainable supply chain management (SSCM) (Balaman, Matopoulos, Wright, & Scott, 2017) have acknowledged the importance of environmental friendliness criteria. Yet, operations cluster has fallen behind in recognizing environmental friendliness criteria (Shaharudin, Fernando, Jabbour, Sroufe, & Jasmi, 2019). While Gunasekaran and Ngai (2012) introduced the concept in operations and Balfaqih, Nopiah, Saibani and Al-Nory (2016) highlighted of its importance, an investigation on environmental friendliness criteria is still limited. Furthermore, an in-depth walkthrough of this criteria such as its definition, features and previous studies discussion should be undertaken by scholars.

Since low carbon operations has been sought after by customers (Böttcher & Müller, 2015), manufacturing firms need to ensure it can meet the customer environmental requirements (Fernando, Wah, & Shaharudin, 2016). Environmental friendliness criteria are based on customer requirement for low carbon operations where it is emphasis on energy and green criteria. The reason for environmental friendliness is critical for manufacturing operations because energy is one of the highest contributor to environmental degradation and pollution (Chang, Hu, & Jan, 2016). As recorded, 49 percent of the carbon emissions come from energy and heat production (World Bank, 2014). Furthermore, firms that failed to record its energy use or adopt energy efficient technology will lag behind firms that have energy management practice in reducing carbon emissions and realising environmental friendliness (Fernando & Hor, 2017). A recent life cycle analysis study in China manufacturing industry has found that 37 percent of carbon emissions come from heating process of energy generation (Ma, Du, Zhang, Wang, & Xie, 2017). These statistical numbers show that energy efficient and low energy consumption have greater impact on operations of firms to reduce carbon emissions. Therefore, manufacturing firms should adopt environmental friendliness principles and energy efficient criteria in its operations.

As environmental friendliness is operations performance measure, this study is bound to generate interest for low carbon operations criteria and contributing to the literature. The insight of this study will prompt future studies in developing environmental friendliness, distinguishing environmental friendliness criteria with other performance measure and addressing literature gaps in regard to understanding the concept of environmental friendliness criteria. Thus, research questions for this study:

1. What is the current knowledge of environmental friendliness from the perspective of supply chain and operations?
2. What is environmental friendliness performance indicator?

BACKGROUND

Environmental Friendliness can be defined as operational performance without harming the environment using less energy consumption, clean energy, has green value and use life cycle assessment to support environmental friendliness principles. This definition is established through understanding several underlying concepts of environmental friendliness by scholars as shown in Table 1.

Features of environmental friendliness for operations in manufacturing industry are shown in Table 2. In regard to environmental friendliness, there are several main features that manufacturing firms can consider. Green value, which consist of recycling, green image, green product features and green materials are critical environmental friendliness features. These features are widely practiced and implemented by

Table 1. Definition of environmental friendliness

Author	Sector	Definition
(Gunasekaran & Ngai, 2012)	Manufacturing	Better performance with no harm to the environment through energy efficient and low energy consumption.
(Ribeiro et al., 2016)	Manufacturing	A method and strategy to reduce environmental impacts incorporated in product.
(Su et al., 2016)	Manufacturing	Communicating, encouraging or promoting environmentally friendly concern to stakeholders.
(Goossens et al., 2017)	Manufacturing	Refers to label of environmental management practice.
(Kushwaha & Sharma, 2016)	Manufacturing	A symbol of green image which includes recycling, eco-friendly, green features of product.
(Carter & Carter, 1998)	Manufacturing	Features of green product.
(Garg, Kannan, Diabat, & Jha, 2015)	Manufacturing	Low greenhouse gasses and less fuel consumption.
(Zailani, Jeyaraman, Vengadasan, & Premkumar, 2012)	Manufacturing	Green features of a product and packaging of product.
(Madu, Kuei, & Madu, 2002)	Manufacturing	Product life cycle with green consideration of a product.

manufacturing firms. In addition, life cycle analysis has been used by scholars and firms to assess product or process. The analysis aids scholars and firms to categorize and analyse green criteria of a product or process. Thus, life cycle analysis should be incorporate in environmental friendliness performance measure as it has proven to be important for reducing environmental impacts (Feitó-Cespón, Sarache, Piedra-Jimenez, & Cespón-Castro, 2017; Goossens et al., 2017; Low, Tjandra, Lu, & Lee, 2016; Palmieri, Forleo, & Salimei, 2017; Prosman & Sacchi, 2017; Rodrigues et al., 2016; Tasca, Nessi, & Rigamonti, 2017; Unger & Landis, 2016; Vasilaki, Katsou, Ponsá, & Colón, 2016; Xing, Qian, & Zaman, 2016). Since energy efficient and energy consumption have greater impacts on the environment, both performance indicators are recommended by scholars for environmental friendliness criteria (Gunasekaran & Ngai, 2012). There are other performance indicators that can be included in this criterion, however these four indicators are found to be relevant in supply chain and operations studies.

Previous studies in regard to environmental friendliness in operations management and supply chain have pointed that environmental criterion is critical for operational performance success. As shown in Table 3, several scholars have underlined the importance of environmental friendliness in manufacturing industry. Moreover, cost reduction that has been one of the main operational performance indicators is still relevant to the industry (Balfaqih et al., 2016; Beamon, 1999). Therefore, operations management and supply chain scholars have tried to relate cost reduction with environmental friendliness so that firms will be able to achieve both objectives (Shanmugan, Shaharudin, Ganesan, & Fernando, 2019). A study by Zhu, Sarkis, and Lai (2013) has found that firms that achieve environmental and operational performance will be able to realise economic benefits. In that sense, firms achieving environmental friendliness in its operations will be able to achieve higher economic and environmental performance. This is the reason why environmental friendliness is critical for operations and for firms to achieve low carbon emissions.

Table 2. Criteria of environmental friendliness

Author	Energy Consumption	Energy Efficiency	Life Cycle Analysis	Eco-Labeling	Green Value	Nanomaterials	Clean Energy Fuel	Green Design	Green Process	Green Package
(Gunasekaran & Ngai, 2012)	✓	✓				✓	✓			
(Ribeiro et al., 2016)					✓			✓	✓	
(Su et al., 2016)					✓					
(Laroche et al., 2001)					✓					
(Goossens et al., 2017)			✓		✓					
(Kushwaha & Sharma, 2016)			✓	✓	✓			✓		✓
(Carter & Carter, 1998)			✓					✓		✓
(Garg et al., 2015)	✓	✓							✓	
(Madu et al., 2002)			✓		✓					

Methods

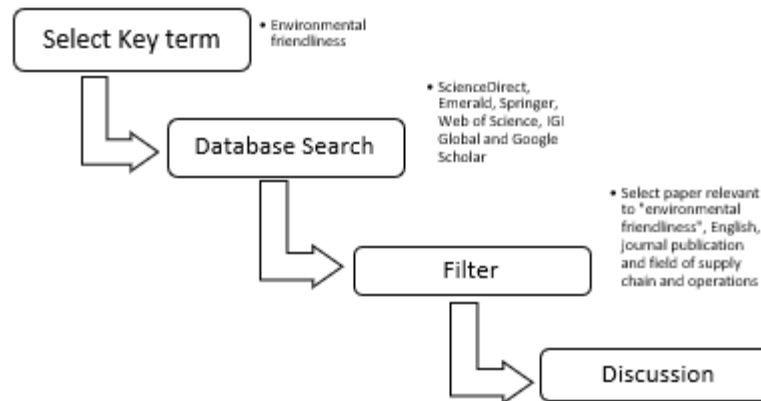
This study investigates environmental friendliness criterion for operational performance in manufacturing industry to achieve low carbon operations. This is due to the environmental friendliness concept has not been widely discussed in the literature even through environmental management literature from supply chain and operations discipline is rich with environmental management concepts. Therefore, this study

Table 3. Previous studies on environmental friendliness

Author	Methodology	Investigation	Findings
(Gunasekaran & Ngai, 2012)	Conceptual	Future performance objectives for operations	Responsiveness, flexibility, dependability, quality, price, safety and environmental friendliness
(Ribeiro et al., 2016)	Case study	Sustainable manufacturing technologies	Environmental friendliness and cost
(Su et al., 2016)	Simulation	Improving sustainable supply chain	Environmental friendliness, cost and responsiveness
(Laroche et al., 2001)	Quantitative	Municipals study on consumer environmental willingness	Environmental friendliness and safety
(Goossens et al., 2017)	Quantitative	Eco-labels of supply chain	Environmental friendliness
(Kushwaha & Sharma, 2016)	Quantitative	Green initiatives for firm's performance	Environmental friendliness, cost and delivery
(Carter & Carter, 1998)	Quantitative	Determinants of environmental purchasing	Environmental friendliness, flexibility and quality
(Garg et al., 2015)	Case study	Optimization of closed loop supply chain	Environmental friendliness and cost
(Zailani et al., 2012)	Quantitative	Sustainable supply chain	Environmental friendliness
(Madu et al., 2002)	Experimental design	Integration of green issues in manufacturing	Cost and environmental friendliness

Figure 1. Content analysis process

Source: (Shaharudin & Fernando, 2017)



has undertaken a review of previous studies in regard to environmental friendliness. The purpose of the investigation is to understand current knowledge of environmental criterion in operations of manufacturing industry and develop a certain performance indicator for environmental friendliness in support of low carbon operations.

In order to perform the investigation, this study followed content analysis method as proposed by Shaharudin and Fernando (2017). To do that, the keyword used for this study is environmental friendliness as this is related to the objectives of this study. Next, the publishers for data collection used for this study are ScienceDirect, Emerald and Springer. In addition, this study also extracts journal articles and review articles from reputable databases such as Web of Science, IGI Global and Google Scholar. The reason for combining publishers and databases for data collection is because even though there will be a duplicate in search, the coverage of articles extraction will be more wide and complete. After data collection through database search, this study then applies filters such as selecting relevant articles in regard to environmental friendliness, considering only research article and review article, selecting only English language article and removing duplicates. This study only interested in the findings for current published journal articles in regard to environmental friendliness and developing performance measure indicators for environmental friendliness. Thus, only articles in the field of supply chain and operations were selected. After completion of selection of key term, database search and filter, this study proceeds with discussion to answer the research questions on environmental friendliness.

FUTURE RESEARCH DIRECTIONS

Current knowledge for environmental friendliness based on content analysis shows that there is limited number of articles discussing greening of operations in manufacturing industry. In the literature, green value that take into consideration of green design, green process, green packaging and eco-labelling are regards as performance indicator for environmental friendliness. Yet, every manufacturing firm might have different performance indicator for environmental friendliness. Therefore, scholars should develop a model or specific criterion for performance measure in regard to environment so that firms can assess

its manufacturing or supply chain performance. In addition, standardise performance indicator is able to help scholar and firms to benchmark operational performance with other firms in the industry.

Early study by Gunasekaran and Ngai (2012) has suggested several operational performance indicators that is critical for firms to sustain its operations. The criteria of performance measure include responsiveness, flexibility, dependability, quality, price, safety and environmental friendliness. There are some articles in the literature that suggested the importance of responsiveness, flexibility and cost reduction. Therefore, future studies should look into developing model that combine critical operational performance indicators with environmental friendliness. This is because environmental friendliness is not only for achieving environmental performance such as low carbon operations but also economic performance (Zhu et al., 2013).

Environmental friendliness indicator to realise operational excellence and low carbon operations should incorporate green value, life cycle analysis, environmental friendliness principle, energy efficiency and low energy consumption. These indicators are found to be widely discussed in the literature of supply chain and operational studies. Furthermore, with climate change becoming an important issue need to be addressed, manufacturing firms should not neglect energy efficiency and substituting towards low energy consumption. In addition, green value that is part of green features in product starting from design, process and packaging should also become part of environmental friendliness indicator. Other than that, life cycle analysis is critical for supply chain and operations management to assess product, process and achieving environmental objectives. Therefore, life cycle analysis and environmental friendliness principles should be incorporated as well. Environmental friendliness principles include other green practice that is appropriate for the manufacturing industry.

Through standardisation of environmental friendliness indicators, manufacturing firms are able to evaluate its operational performance and able to achieve better environmental objective. Future studies should test the relevancy of environmental friendliness with empirical findings and strengthening the principles of environmental friendliness.

CONCLUSION

Generally, environmental management studies are aplenty in supply chain and operations management literature. Nevertheless, operations management field is lacking in producing copious studies in regard to current environmental management. In operations management cluster, green features are considered as important while lacking in current issues such as low carbon emission, energy management, energy consumption and issues related to safety and security. This study proposed operational indicators of environmental friendliness to help firms to assess its operational performance in meeting environmental objectives such as low carbon operations. Furthermore, this study also develops an interest in management scholars to strengthening the understanding of environmental friendliness. Future studies should delve more on this topic especially on defining the principle of environmental friendliness and testing the relevancy of its indicators with empirical data.

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KEY TERMS AND DEFINITIONS

Environmental Friendliness: Defined as operational performance without harming the environment using less energy consumption, clean energy, has green value and use life cycle assessment to support environmental friendliness principles.

Environmental Management: Firm's management practices reducing environmental degradation.

Low Carbon Performance: Performance of firm in reducing carbon emissions through reducing per output carbon emission, substitute or minimization of carbon-intensive materials and reduction of energy use.

Manufacturing Performance: Performance of manufacturing or operations through cost reduction and efficiency of operations such as flexible production, responsive to customer demand and quality improvements.

Supply Chain Management: Firm's management of product or service, information and financial flow throughout the process of supply chain starting from procurement, product design, production process, distribution channel and network and logistics.

A Review of Future Energy Efficiency Measures and CO₂ Emission Reduction in Maritime Supply Chain

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INTRODUCTION

As the world's largest industry, the maritime supply chain sector is a significant contributor to global CO₂ emissions. Based on the recent report (see Figure 1) by the International Maritime Organization (IMO), the maritime supply chain sector currently accounts for approximately 3% of global CO₂ emissions, projected to double or triple by 2050 (Buhaug et al., 2009). Conversely, it is also projected that 25-70 per cent of CO₂ emission can also be lessened with appropriate strategies through better energy efficiency practice, adoption green technologies and improved logistics system (Johnson & Styhre, 2015). However, the implementation of all current cost-efficient technologies aiming at reducing fuel consumption and curbing emissions have proved to be inadequate to counteract the effects of rapid growth of maritime supply chain sector (Eide, Longva, Hoffmann, Endresen, & Dalsøren, 2011).

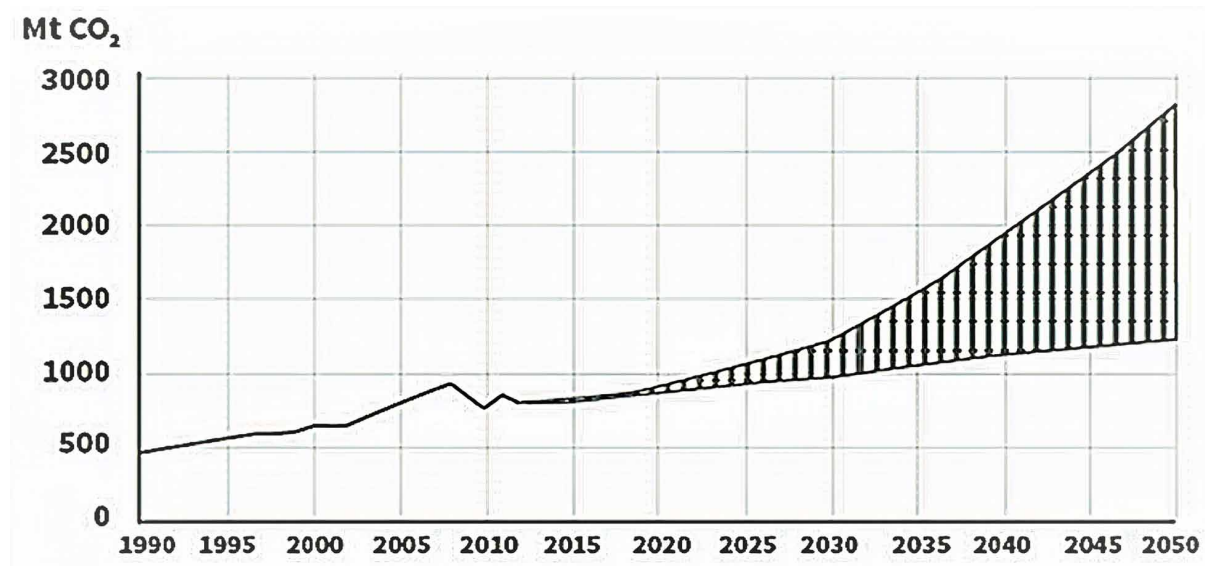
Due to this concern, numerous studies have been taken in the field of substitute power sources and energy-saving measures for shipping operation to reduce CO₂ emission. Nevertheless, the gaps remain between existing knowledge and the execution of energy efficiency measures by maritime supply chain organizations (Styhre & Winnes, 2013). As in other numerous sectors, several measures that would improve fuel efficiency and CO₂ emission in the maritime supply chain have yet to be implemented despite their known cost efficiency. This situation is known as energy efficiency gap in the literature. This situation is generally occurred due to lack of understanding/awareness, low capital, weak policies and slow technology adoption. While Sorell, Mally, Schleich and Scott (2004) underpin this problem through recognition of organizational barriers such as organizational risk, asymmetrical of information, hidden costs, higher capital, split incentives and bounded rationality.

From the legislator viewpoint, these problems call for proactive policy intervention in this sector. IMO as a sole global legislator has been implementing a few chapters in its MARPOL Annex VI in achieving a comprehensive goal to reduce GHG emission in shipping operation (Kader, 2013). Current IMO declarations such as Energy Efficiency Design Index (EEDI), Ship Energy Efficient Management Plan (SEEMP) and Energy Efficiency Operational Indicator (EEOI) are to collect data on energy consumption and emission so that reliable measures can be implemented. IMO also is in the ongoing discussion on the possible implementation of sector-specific market-based measures (MBM) to further curb specific CO₂ reduction within this sector (Hannes Johnson & Andersson, 2016). This annex will

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Figure 1. CO₂ emission projection for maritime transportations

Source: International Maritime Organization (IMO)



eventually become a blueprint for many maritime organizations to abide as it is obligatory to follow suit these regulations in order to fulfil the global requirement for trade in the future. However, as the volume of trade is predicted to rise over the year, total reductions in fuel consumption and CO₂ emissions from the sector are not expected to lower despite these new regulations (Anderson & Bows, 2012).

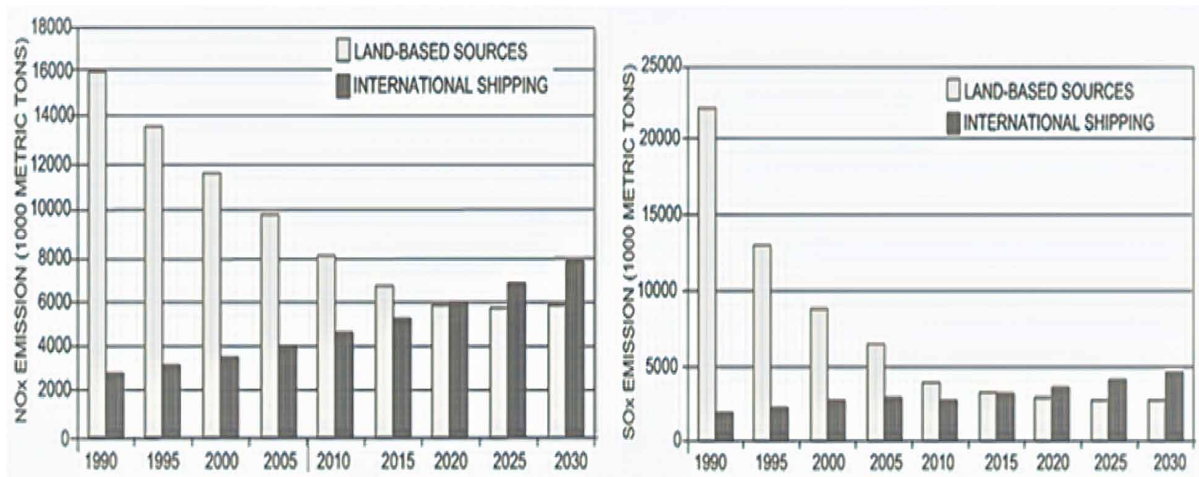
Currently, it is more important to focus on what prevents energy efficiency and emission improvements within the maritime organization and what can be done to overcome the current barriers. Overcoming energy efficiency gaps should be a priority since direct fuel costs are expected to rise in the future. The role of energy efficiency should be considered as a critical success factor for any maritime organization to be profitable and to achieve long-term sustainability. Thus addressing this need, this paper provides an overview of measures that can be considered for future energy efficiency and emission reduction in the maritime supply chain. In addition, the current stage of adoption, barriers, overcoming the barriers and potential research direction is discussed through the remaining of the paper.

BACKGROUND

The Future Potential of Energy Efficiency Measure and CO₂ Emission Reduction

The energy in maritime supply chain can be defined as a source of power necessary to carry out logistics and transportation activities. While maritime transport can be powered by various sources of energy (e.g. fossil fuels, biofuels, nuclear electricity, or alternative energy), fossil fuels are still the most common form of energy source used in this sector (M. F. A. Jasmi & Fernando, 2018). However, as the scarcity of fossil fuels and concern on climate change increased, there is an urgent need for proper technical and managerial measures within maritime supply chain sector. Additionally, as maritime supply chain is an energy-intensive sector, energy costs contribute a large share of total operating costs. This is a substantial

Figure 2. Emissions NO_x and SO_x from the year 1990–2030 (projected number) from land-based sources and international shipping
 Source: Komar and Lalić (2015)



ratio by nature since other industries only constitute around 5% to 20% of energy cost (Thollander & Ottosson, 2010). Even though this sector is considered most efficient mode of commercial transportation compare to other modes of transportation (such as air freight or land trucking), the efficiency of shipping as opposed to land-based transportation has been lately questioned, with respect to nitrogen oxide (NO_x) and sulphur oxide (SO_x) emissions per transportation work (see Figure 2) and also when it comes to energy efficiency (Hjelle, 2010). Addressing these problems several measures of energy efficiency measure and CO₂ emission reduction in maritime supply chain can be considered in the future consisting of:

Greener Ship Design

IMO estimates that greener ship design measures could potentially reduce CO₂ emissions by 10% to 50% per transport work. The current technical ship design measures related to improvement on hull and propeller geometry, hull construction, propulsion machinery, auxiliary machinery and equipment, heat recovery and cargo handling are intensive to ensure efficient usage of energy consumption in shipping operation (Chang, 2012). Newer hull cleaning system and paint technology to reduce resistance are further explored to enhance the general efficiency of the ships. New technologies such as a hybrid system for propulsion system (Dedes, Hudson, & Turnock, 2012), solar technology (Chambliss, 2015), autopilot upgrade and wind power (Nuttall, Newell, Prasad, Veitayaki, & Holland, 2014) have also been proposed for consideration to be implemented in new ships. From policy standpoint, IMO has also outlined the EEDI for adoption to new and latest ships starting from the year 2013 onwards. EEDI functions as a technical measurement indicator with the major objective of encouraging the utilization of efficient energy and less polluting types of equipment as well as the more environmentally engines in designation and production phase. Additionally, the design of greener engine is also being considered for future consideration of cleaner usage of biofuel and alternative energy (Bengtsson, Fridell, & Andersson, 2012).

Cleaner Fuels

There are few alternative fuels currently in various stages of development for commercial implementation. For example liquefied natural gas (LNG) is a potential candidate to replace fossil oil in the fleet due to lower production of SO_x and NO_x and abundance in reserve compare to existing fossil fuel. It is currently in the commercialization stage where IMO has forecasted current fossil fuel will be entirely replaced by distillate oils and LNG by 2020. Biofuel such as methane is also considered since it is a renewable energy resource produced from biomaterial waste from the fermentation process. A new option is the development of synthetic diesel, which is produced from natural gas, biogas, coal or biomass by the Fischer-Tropsch method. However since the cost exceeds the benefit it is only an option based on current technology development (Bengtsson et al., 2012). Other alternative fuel suggested is the usage of dimethyl ether (DME) for diesel engine which is cleaner than current diesel fuel (Fridell, Winnes, & Styhre, 2013).

Managerial Measures

Recently, green managerial practices aim at improving operational efficiency has emerged extensively. The concept of green supply chain management (GSCM) (Caniëls, Cleophas, & Semeijn, 2016), green shipping practice (GSP) (Lai, Lun, Wong, & Cheng, 2011), maritime green supply chain management (MGSCM) (Jasmi & Fernando, 2018) and sustainable maritime supply chain (Lam, 2014) have been discussed in maritime literatures to increase efficiency and decrease environmental impact. All of these concepts aim at achieving three bottom lines of sustainability; to improve economy, environment and social dimension. Among suggested managerial criteria proposed in the literature are (the lists are not exhaustive):

- i. Streamlining IT system using the green information system to improve paperless transaction, reduce waiting time and information sharing and streamlining production schedule, inventory and demand forecasting for increase efficiency.
- ii. Integrative solution through green integration practice where green collaboration among supply chain partners can be enhanced; through close integration and information sharing related to green practices to streamline the process flow.
- iii. Green financial flow where the monetary allocation of green practice can be tracked and allocated accordingly to certain operation measure where efficiency is mostly needed.
- iv. Enhancing company policy and procedure to be aligned with external environmental policy through corporate commitment and managerial support
- v. Enhancing shipping equipment and activities that include reuse, recycling and material recovery to comply with environmental compliance.

Onshore Power Supply

In general, the fuel consumed by idle ships at the port is mostly used to produce electricity in order to run general facilities onboard such as ship system, air conditioning and lighting. This activity is not efficient since the ships still consume considerable quantity of fuel in static condition. Using onshore power supply or port electricity might be an alternative solution to reduce emission released from idle ships (Fridell et al., 2013). The technology is relatively new but several port system equipped with this

innovation, prove to be feasible. However, practical issues concerning with development cost, expert crew dealing with electrical connection and variation of ship voltage have hampered further development. The cost of low bunker fuel (onboard ship's fuel storage or container) usage which is relatively low to produce electricity onboard makes this innovation currently stagnant for now. Nonetheless, with increasing fuel price versus operation cost in the future might cultivate the development of onshore power supply in the years to come.

Operational Measures

Many operational measures have been suggested in maritime literature. The most common method to achieve energy efficiency is through decrease time in port (Hannes Johnson & Styhre, 2015) and slow steaming practice (Corbett, Wang, & Winebrake, 2009). The relationship between speed and time with fuel consumption per unit time is relatively cubical; for this reason, a speed reduction or consistent speed and less time in port can have a significant impact on fuel consumption which reflects in energy efficiency. Fuel consumption monitoring and weather routing are also common methods which are more cost-effective operational measures to increase energy efficiency (Takashima, Mezaoui, & Shoji, 2009). Another significance measure is to improve port efficiency, which can improve turnaround time in port. Shorter time in port can relatively reduce the speed at sea while maintaining the tight transport service time/schedule. A study by Johnson and Styhre (2013) denote that speed at sea for short sea bulk shipping can be reduced substantially by decreasing idle waiting time (due to port close or early arrival) in port system. The potential for increased energy efficiency through this measure is substantial and can add up to 2%-8% of energy saving.

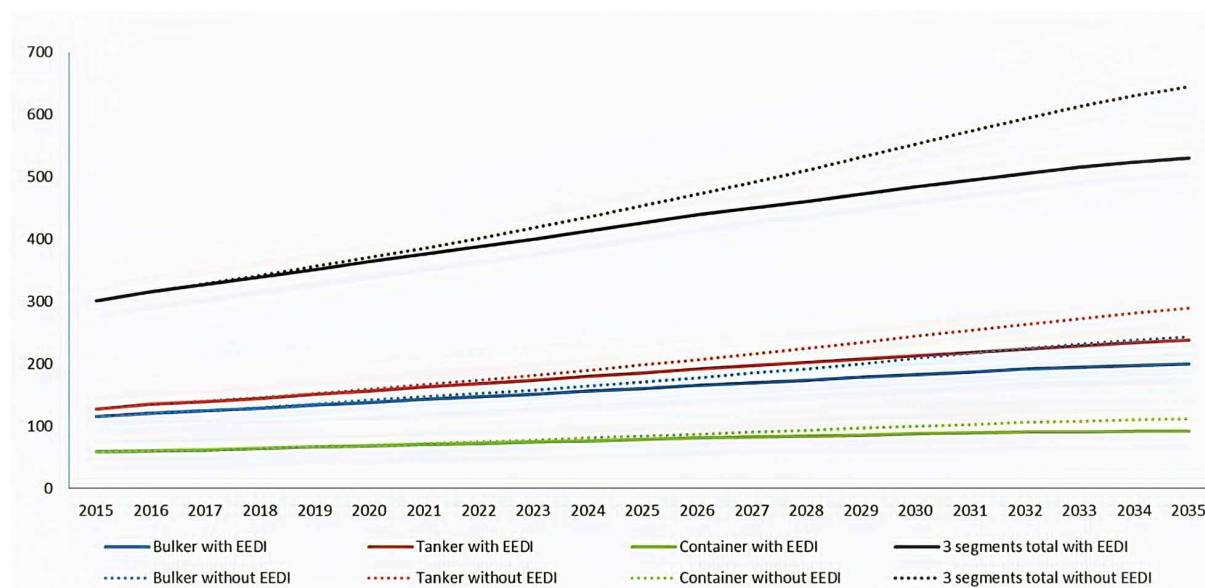
Policy Measures

Environmental sustainability has appeared on the political agenda for decades. The current inclination towards climate change, conservation and environmental sustainability have been extensively discussed by industry players, stakeholders, as well as worldwide political leaders that helped to shape the required policy and incentive measures. International conventions such as the Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) have been established following collaboration between several nations containing provisions for reducing GHG emissions from aviation and shipping operation. Currently, the central agreement of policies and protocols in regards to shipping operation is regulated through involvement from IMO. IMO acts as the major source of more than 60 legal mechanisms that funnel the laws and regulatory development of its member states to develop a comprehensive safety and security dimension at sea as well as facilitate trade among maritime states and keep the marine environment protected. The most critical regulations include the International Convention for the Safety of Life at Sea (SOLAS), International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) as well as International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC) (the lists are not exhaustive).

In recent years, IMO has shifted its focus to new policy options for increasing fuel efficiency and lowering GHG emissions such as EEDI, SEEMP and EEOI. The EEDI is established to put pressure on ship design to become more energy efficient in the future. According to a study by Organisation for Economic Co-operation and Development (OECD) 2017, full compliance with the EEDI regulation will reduce total CO₂ emissions by approximately 115 million tons from bulkers, tankers and container ships in 2035 compared to a scenario where such regulation does not exist and where there is no endogenous

Figure 3. CO₂ emissions with and without EEDI

Source: OECD (2017)



improvement in fuel efficiency (i.e. due to reactions to bunker fuel prices). Given that this reduction represents 38 percent of the 2015 CO₂ emissions from bulkers, tankers and container ships, the EEDI regulations have a significant impact on limiting the increase in shipping sector CO₂ emissions and energy usage under these assumptions (see Figure 3).

Meanwhile, SEEMP establishment aims at improving operational measures for better energy efficiency and an approach to monitoring the performance of ships and fleets over time and forces responsible persons and entities to consider new technologies and practices in order to optimize ship performance

Table 1. SEEMP related measures

Energy Efficiency Measure	Description
Engine tuning and monitoring	Engine operational performance and condition optimization.
Hull condition	Hull operational fouling and damage avoidance.
Propeller condition	Propeller operational fouling and damage avoidance.
Reduced auxiliary power	Reducing the electrical load via machinery operation and power management.
Speed reduction (operation)	Operational slow steaming.
Trim/draft	Trim and draft monitoring and optimisation.
Voyage execution	Reducing port times, waiting times, etc. and increasing the passage time, just in time arrival
Weather routing	Use of weather routing services to avoid rough seas and head currents, to optimize voyage efficiency.
Advanced hull coating	Re-paint using advanced paints.
Propeller upgrade and aft body flow devices	Propeller and after-body retrofit for optimisation. Also, addition of flow improving devices (e.g. duct and fins).

Source: International Maritime Organization (IMO)

(see Table 1 for SEEMP related measures). The Second IMO GHG Study 2009 shows that a 20 percent reduction on a ton-mile basis is possible due mainly to operational measures and would be cost-effective even with the current fuel prices, and the SEEMP will help the shipping industry to achieve this potential.

Finally, EEOI is an operational indicator tool for assessing the ship energy efficiency and CO₂ emission to the environment. Guidelines for the voluntary use of the EEOI ship have been developed to establish a consistent approach for measuring the energy efficiency of ships on each journey or over a certain period of time to assist shipowners and ship operators in assessing their fleet's operational performance. Since the amount of CO₂ emitted by ships is directly related to bunker fuel oil consumption, EEOI can also provide useful information about the fuel efficiency performance and energy usage of a ship. All of these regulations are expected to be implemented on new ships starting from the year 2013 which increase in stringency every five years up until 2030 onwards to further improve energy efficiency measure and CO₂ emission reduction (Rehmatulla, Calleya, & Smith, 2017).

Current Adoption and Major Barriers

According to Rehmatulla et al. (2017), current adoption in general finds lower levels of implementation for the different categories of energy efficiency measures and CO₂ reducing technologies. They noted that certain energy efficiency measures are relatively average across different type of measures. Some measure such as the use of alternative fuel is noted to be lowest in implementation whereas ship design measure is relatively higher in implementation. This uneven spread of implementation suggests inherent barriers are facing this sector to implement specific energy efficiency measures.

In general, institutional barriers are considered the major inherent barrier in the maritime supply chain. The maritime supply chain system is a part of global distribution chain which consists of different players and stakeholders (domestic and global players) from diverse organizations with each player have their own organisational functions, goals and needs. This complex nature of successive multiple phases of the distribution chain adding up to interconnected operation where the reality of this chain goes beyond diverse interests and priorities of involving players in each phase of the maritime supply chain. The different views of each player in this chain may influence the implementation of energy efficiency measures. Due to the complex nature of this sector, it is challenging to develop and implement energy efficiency measures that meet all the player's requirement collectively (Fridell et al., 2013).

According to Johnson and Andersson (2016) from the maritime supply chain market viewpoint, imperfect information or information asymmetries seem to be a significant barrier in this sector. The theoretical underpinning is that since information is naturally underprovided by ordinary market activity, maritime players lack adequate knowledge and basis for taking important economically efficient decisions due to multiple phases of the organizational level. For example, various players can be involved in providing a shipping service, with separated geographically and managerially differences that potentially opening up for many problems related to misinformation, and communication problems related to the adoption of energy efficiency measures. In this context, the slow and low implementation of energy efficiency measures is a natural consequence of information asymmetries.

Another major barrier that influences the implementation of energy efficiency measures concerns transaction costs and the difficulties of allocating appropriate costs and profits among diverse business organizations for an investment that can benefit multiple stakeholders (Kesicki & Strachan, 2011). Furthermore, the existence of additional cost, concerning non-negligible cost associated with the measures, which can mean that capital might be not appropriately allocated to the maritime operation where it is most needed. However, it is forecasted that hike in future fuel prices can become an effective driver of

energy efficiency efforts among maritime supply chain companies (Smith, 2012). This partly explains the recent increased interest in energy efficiency amongst shipping organizations lately.

Overcoming the Barriers

To achieve energy efficiency measure and CO₂ emission reduction agenda, the difficulty of managing the complicated inter-relationship among players (institutional barriers) in maritime supply chain system should be first acknowledged and taken into consideration when tackling with specific measures. In order to successfully achieve this agenda, maritime supply chain players require well-ordered, integrated and efficient administrative action through close collaboration with the global and domestic partner. It can be achieved via the fulfillment of outlined compliance with international standards, supported by relevant institutions and technical know-how expertise. Maritime supply chain organizations and stakeholders must collectively involve in synchronized and coordinated support from the government, policymakers as well as the shore-side entity (such as port facilities, cargo-handling infrastructure and land logistics systems) to ensure transparent and holistic adoption of sustainability measures in its operation. This close collaboration of shore-side players from both industry and governmental entities, for example, could provide proper sustainable provision and evaluation for both maritime operations and environmental protection in order to ensure that the entire maritime supply chain integrity and energy efficiency measures do not become stagnant in progress.

In regards to imperfect information barriers, the qualified, skilled and competent workforce is important to be considered in the maritime supply chain. In the maritime context, the current challenging issue facing this sector is how to draw and maintain adequate people of sufficiently trained and qualified workforce with the right expertise and understanding of “green” concept, motivation, information and skills for sustainable application of developing energy efficiency measures. The challenges of maintaining a well-informed workforce will increase drastically further as rapid global trade and technology advancement continues to develop in the future. With this kind of backdrop, an all-inclusive approach and strategy for the advancement of maritime supply chain operation are therefore indispensable in order to accomplish energy efficiency measure and CO₂ emission reduction.

In addition, all players in the maritime supply chain system are subjected to peripheral and transaction costs. Nevertheless, several of these costs will eventually involve all players. In this sense, if the costs affect specific parts within the maritime supply chain system, inevitably it will also affect the whole maritime supply chain system or just a link in the respective maritime supply chain system. A coherent approach is needed to overcome this problem through comprehensive regulation and policies as well as educating the players by overseeing governmental bodies regarding this predicament issue. Maritime supply chain operations must be cautiously planned and well-managed in an organized, systematic and integrated approach among maritime players to ensure level playing field among them. Besides the contemplations concerning the equilibrium between expenditure (cost) and benefit, it is imperative that value creation which contains a chain of industry players all of whom must allocate and distribute values should be protected. In this sense, if each and every player in the maritime sector fulfil their diverse functions, and work collectively in mutual support of this value chain, the maritime supply chain will not only operate efficiently for the entire stakeholders concerned but also to the general stakeholders as a whole. Addressing the underlying said barriers, a universal and coherent plan suggested in this paper should include the subsequent approaches:

- i. Suitable policies, regulations, conventions, set of laws and plans must be comprehensively set up and research accordingly to support the development of energy efficiency measures in specific compartment that could concentrate on that particular needs and adjust to distinctive developments in specific unique sectors that require certain attention.
- ii. Assisting diverse governmental bodies, agencies, organizations and institutions involved in maritime supply chain activities to focus their attention, information, effort and share their existing knowledge with each another and with other related sectors of the maritime supply chain.
- iii. Constructing efficient, transparent and effective measurement approaches in assessing the energy efficiency measures of maritime supply chain operation.
- iv. Amplifying the existing collaboration and cooperation amongst the maritime supply chain stakeholders including individual players, private enterprises, NGOs, communities as well as governmental bodies involved in maritime sectors. It is also important for these entities to expand the valuable relationship with international maritime agencies to align its operation with global standard and needs.
- v. Financial support by financial sectors or government entities should be properly considered in supporting the evolving nature of the maritime supply chain to permit for long-term efficiency of resources allocation to progress the entire three pillars aspect of sustainability.
- vi. Engaging close collaboration with academic institutions and other researchers and development entities to align the current understanding with new evolving green technologies and new operational practices that will allow the industries to continually progress towards this sustainable and energy efficiency agenda.
- vii. Greater emphasis on monitoring and follow-up of performance should be in place, both internally and externally within the maritime organizations and with respect to external contracts and global standards.

FUTURE RESEARCH DIRECTION

The scope of this article is limited to an overview of future potential energy efficiency measure in maritime supply chain and its organization. It is thus limited in the sense that it does not provide an empirical assessment of discussed energy efficiency measure. Future studies might extend this limitation by providing each of energy efficiency measure an in-depth empirical study to understand the measures further and the measurement can also be extending in other industry as well. The low current adoption in certain specific energy efficiency measures also become an intriguing research question that can be investigated further in future research. Overcoming the barriers is also an interesting direction in future research especially addressing the problem regarding the regional, organizational and geographical context of information asymmetries and institutional barriers in maritime supply chain context.

CONCLUSIONS

Pressure on the maritime supply chain sector to reduce its environmental impacts will increase substantially, and without a doubt, the most cost-efficient route to CO₂ emission reduction will be through increased energy efficiency. Current assessments have shown that several measures when it comes to energy efficiency are the only way to reach emission reductions in the short term while certain energy

efficiency measures may take longer than others. This is expected since the maritime supply chain is a complex system which requires intricate assessment on each link of its value chain to understand the specific potential of energy efficiency measures that can be implemented. On the other note, the diverse possibilities for potential future energy efficiency measures covered in this paper demonstrate how maritime and shipping organizations could move towards greater efficiency of the overall maritime supply chain system. Concurrently, however, there seem to be various barriers that hinder maritime organizations from realizing this potential.

For this reason, greater importance in the planning, coordination, management, execution and monitoring of maritime supply chain operations in this sector must be materialized first before all the energy efficiency measures can be implemented successfully. Further research is thus essential to further understand the role of energy use and efficiency internally in a maritime organization as well as in its relationship with other organizations in this sector. A dynamic integration between all maritime supply chain players must be well cultivated to motivate efficient decision making and effective collaboration among them to provide a concrete platform for energy efficiency measures to function successfully in the future.

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KEY TERMS AND DEFINITIONS

Energy Efficiency: It refers the goal of reducing the amount of energy required to provide products and services. The energy definition in this context can be fossil fuel or electricity.

Energy Efficiency Gap: It refers to the difference cost potential improvement of energy efficiency and the level of energy efficiency actually realized. For example, although cost-effective technologies that can improve energy efficiency are recognized, they are not always implemented due to this ‘energy efficiency gap’.

Maritime Supply Chain: It refers to entire shipping industry consisting of shipping lines, port terminal operators, freight forwarders and land-based logistic system. It is a part of comprehensive worldwide logistics systems of moving cargoes between places.

Sustainability: It refers to the ability of the organization to maintain a certain rate or level especially in term of natural resources or ecological balance. In most literature, sustainability also constitutes the three bottom line concept of sustainable development which emphasizes improving the economy, environment, and social dimension.

Big Data Analytics in Supply Chain Management

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INTRODUCTION

During the last several years there was an amazing progression in the amount of data produced within the supply chain information systems, but also externally. This poses many challenges related to data analysis specifically in terms of know-how, technology, infrastructure, software systems and development methods. The current business climate demands real-time analysis, faster, collaborative and more intelligent decision making.

The current approach to supply chain intelligence has some fundamental challenges when confronted with the scale and characteristics of big data. These include not only data volumes, velocity and variety, but also data veracity and value (Arunachalam, 2018).

The best way to effectively analyze these composite systems is the use of business intelligence (BI). Traditional BI systems face many challenges that include processing of vast data volumes, demand for real-time analytics, enhanced decision making, insight discovery and optimization of supply chain processes. Big Data initiatives promise to answer these challenges by incorporating various methods, tools and services for more agile and flexible analytics and decision making. Nevertheless, potential value of big data in supply chain management (SCM) has not yet been fully realized and requires establishing new BI infrastructures, architectures, models and tools (Marr, 2016).

Supply chain BI system proved to be very useful in extracting information and knowledge from existing enterprise information systems, but in recent years, organizations face new challenges in term of huge data volumes generated through supply chain and externally, variety (different kind of structured and unstructured data), as well as data velocity (batch processing, streaming and real-time data). Most of the existing analytical systems are incapable to cope with these new dynamics (Larson & Chang 2016).

On the other hand, we have seen tremendous advancements in technology like in-memory computing, cloud computing, Internet of Things (IoT), NoSQL databases, distributed computing, machine learning, etc. Big data is a term that underpins a raft of these technologies that have been created in the drive to better analyze and derive meaning from data at a dramatically lower cost and while delivering new insights and products for organizations in the supply chain.

The key challenges for modern supply chain analytical systems include (Wang et al., 2016):

- § Data explosion – supply chains need the right tools to make sense of the overwhelming amount of data generated by a growing set of data internal and external sources.
- § Growing variety of data – most of the new data is unstructured or comes in different types and forms.
- § Data speed – data is being generated at high velocity which makes data processing even more challenging.

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- § Real-time analysis - in today's turbulent business climate the ability to make the right decisions in real-time brings real competitive advantage. Yet many supply chains do not have the infrastructure, tools and applications to make timely and accurate decisions.
- § Achieving simplified deployment and management – despite its promise, big data systems can be complex, costly and difficult to deploy and maintain. Supply chains need more flexible, scalable and cost-effective infrastructure, platforms and services, such as those offered in cloud

In this chapter, challenges and new trends in supply chain big data analytics are discussed and background research of big data initiatives related to SCM is provided. The chapter also describes the main technologies, methods and tools for big data analytics. The methodology and the unified model for supply chain big data analytics which comprises the whole BI lifecycle is presented. Architecture of the model is scalable and layered in such a way to provide necessary agility and adaptivity. The proposed big data model encompasses supply chain process model, data and analytical models, as well as insights delivery. It enables creation of the next-generation cloud-based big data systems that can create strategic value and improve performance of supply chains. An example of supply chain big data solution that illustrates applicability and effectiveness of the model is presented. Finally, future trends, directions and technologies are presented.

BACKGROUND

As the globalized business environment is forcing supply chain networks to adapt to new business models, collaboration, integration and information sharing are becoming even more critical for the ultimate success. Supply chains enterprise systems are experiencing a major structural shift as more organizations rely on a community of partners to perform complex supply chain processes. While supply chains are growing increasingly complex, from linear arrangements to interconnected, multi-echelon, collaborative networks of companies, there is much more information that needs to be stored, processed and analyzed than there was just a few years ago (Tiwari et al., 2018).

Supply chain business intelligence is a collection of activities to understand business situations by performing various types of analysis on the organization data as well as on external data from supply chain partners and other data sources (devices, sensors, social networks, etc.) to help make strategic, tactical, and operational business decisions and take necessary actions for improving supply chain performance. This includes gathering, analyzing, understanding, and managing high volumes of variety data about operation performance, customer and supplier activities, financial performance, production, competition, regulatory compliance, quality controls, device data and Internet (Stefanovic & Milosevic, 2018).

Over the past few decades, the way in which companies need to collate, analyze, report and share their data has changed dramatically. Organizations need to be more adaptive, have increased access to information for decision-making, and effectively deal with a rapidly growing volume of data. Today's business environment demands fast supply chain decisions and reduced time from raw data to insights and actions. Typically, supply chains are capturing enormous data volumes - including vast amounts of unstructured data such as files, images, videos, blogs, clickstreams and geo-spatial data, as well as data coming from various sensors, devices, and social networks (Stefanovic & Milosevic, 2017).

During the past two decades organizations have made large investments in SCM information systems in order to improve their businesses. However, these systems usually provide only transaction-based functionality and mostly maintain operational view of the business. They lack sophisticated analytical

capabilities required to provide an integrated view of the supply chain. On the other hand, organizations that implemented some kind of enterprise business intelligence systems still face many challenges related to data integration, storage and processing, as well as data velocity, volume and variety. Additional issues include lack of predictive intelligence features, mobile analytics and self-service business intelligence capabilities (Harvey, 2017).

Sixty-four percent of supply chain executives consider big data analytics a disruptive and important technology, setting the foundation for long-term change management in their organizations (Renner, 2016). Ninety-seven percent of supply chain executives report having an understanding of how big data analytics can benefit their supply chain. Nonetheless, only 17 percent report having already implemented analytics in one or more supply chain functions (Accenture, 2014).

Another survey shows that 68% of supply chain leaders believe that supply chain analytics are critical to their operations. However, a key ingredient for the success of supply chain analytics is consolidating data from all participants and flows in the system, essentially breaking the boundaries between them. 66% of supply chain leaders say advanced supply chain analytics are critically important to their supply chain operations in the next 2 to 3 years. While 94% of supply chain leaders say that digital transformation will fundamentally change supply chains in 2018, only 44% have a strategy ready (Columbus, 2018).

Running a global supply chain demands intricate planning, sourcing, delivery and measurement. This requires big data strategy and governance, as well as investing in education of supply chain professionals. The general guidelines include (Morley, 2017):

- Starting with business objectives
- Break down the communication silos between different teams
- Define reasonable and achievable goals
- Plan globally, but start with small projects
- Prioritize and streamline analytical reports
- Turn data into concrete decision
- Evaluate and improve

The current approaches to BI have some fundamental challenges when confronted with the scale and characteristics of big data: types of data, enterprise data modeling, data integration, costs, master data management, metadata management, and skills (Chen et al., 2016).

The big data phenomenon, the volume, variety, and velocity of data, has impacted business intelligence and the use of information. New trends such as real-time and predictive analytics and data science have emerged as part of business intelligence (Schoenherr & Speier-Pero, 2015). In its essence, Data Science is simply a new term for Business Intelligence. It is a multi-disciplinary field that uses scientific methods, processes, algorithms and systems to extract knowledge and insights from structured and unstructured data (Frankenfield & Banton, 2019). is the concept that utilizes scientific and software methods, IT infrastructure, processes and software systems in order to gather, process, analyze and deliver useful information, knowledge and insights from various data sources.

Some of the supply chain challenges that data science is helping to solve include (Prokle, 2019):

- Making the supply chain greener to minimize the environmental impact of global sourcing (e.g., shorter distances or consolidated shipments)
- Increasing visibility into the supply chain and response time (e.g., through blockchain)
- Adapting to demographic changes and customer expectations (e.g., free same day deliveries)

- Allowing manufacturers to decrease their product life-cycle times (e.g., through better market insights and smart sourcing) to react to trends and demand more quickly
- Increasing the product portfolio to serve not only the mass market but the entire demand curve (e.g., through mass-customization)

While data science, predictive analytics, and big data have been frequently used buzzwords, rigorous academic investigations into these areas are just emerging. Even though a hot topic, there is not many researches related to big data analytics in SCM. Most of the papers deal with big data potential, possible applications and value propositions.

Fosso Wamba and Akter (2015) provide a literature review of big data analytics for supply chain management. They highlight future research directions where the deployment of big data analytics is likely to transform supply chain management practices. Waller and Fawcett (2013) examine possible applications of big data analytics in SCM and provide examples of research questions from these applications, as well as examples of research questions employing big data that stem from management theories.

Identifying specific ways that big data systems can be leveraged to improve specific supply chain business processes and to automate and enhance performance becomes crucial for ultimate business success. The information and analytics delivered would be used to improve supply planning, vendor negotiations, capacity planning, warehousing and transportation performance, productivity, shop floor performance, materials requirements planning, distribution and customer service.

Organizations can apply big data and BI in the following supply chain areas (Stefanovic, 2014):

- Plan Analytics — balancing supply chain resources with requirements.
- Source Analytics — improving inbound supply chain consolidation and optimization.
- Make Analytics — providing insight into the manufacturing process.
- Deliver Analytics — improving outbound supply efficiency and effectiveness.
- Return Analytics — managing the return of goods effectively and efficiently.

Big Data technologies are opening a range of possibilities for capitalizing on big data in logistics, and the use cases, as well as the benefits, continue to roll in (Feliu, 2019). These efforts can be classified into the following categories: visibility improvement, better form of demand and supply synchronization, optimization of fulfillment channels, building a smart and connected products, increased asset intelligence, and better work safety and productivity (Lopez, 2017).

Logistics companies such as DHL, are using big data analytics for flexible routing and optimization, as well as for capacity planning. Others use data-collecting sensors within vehicles to track the status of every vehicle to provide updates and make optimal decisions. Some airline companies are using big data analytics to improve the bottom line by predicting demand and performing dynamic pricing strategies (Eleks, 2019).

The supply chain economy is a web of multiple industries, and big data analytics has made an impact on most of them. McDaniel (2019) describe practical application of big data analytics in manufacturing (i.e. collecting telemetry data for predictive equipment maintenance, gathering contextual intelligence to eliminate bottlenecks for high throughput, or forecasting demand), consumer goods (i.e. plan for what-if scenarios and answer questions on whether strategies, such as marketing spends, are bringing in expected returns), and agriculture (i.e. combining past and real-time data to enhance operational efficiencies and reduce delivery cycles).

Some of the most important data-driven supply chain management challenges can be summarized as follows (Columbus, 2015):

- Meet rising customer expectations on supply chain management.
- Increase costs efficiency in supply chain management.
- Monitor and manage supply chain compliance & risk.
- Make supply chain traceability and sustainability a priority.
- Remain agile and flexible in volatile times and markets.

Supply chains which implemented certain big data systems have achieved the following benefits (Howard, 2016):

- Improvement in customer service and demand fulfillment.
- Faster and more efficient reaction time to supply chain issues.
- An increase in supply chain efficiency.
- Integration across the supply chain.
- Optimization of inventory and asset productivity.

Leading SCM and ERP solution vendors have incorporated analytical features into their latest information systems. There are many companies offering various software systems, platforms and services

As data analytics becomes critical in supply chain operations and management, supply chain analytics software solutions and tools have become must-have technologies. Many supply chain analytical tools feature improved forecasting and sales and operations planning to give supply chain managers the business intelligence they need to streamline operations, lower costs, and improve customer service. Leading SCM and ERP solution such as SAP, Microsoft, Oracle, and others, have incorporated some analytical features into their latest SCM information systems (Pontius, 2019). However, these analytics solutions usually relay on the own databases and data sources, thus requiring additional systems, services and tools to integrate and process large volumes of data from various departments and organizations across the supply network.

Despite new business requirements and technology innovations, big data methods, models and applications in SCM still need to be researched, studied and developed. In the subsequent sections, the supply chain big data model, software architecture and example of big data analytical system are presented.

BIG DATA AND SUPPLY CHAIN MANAGEMENT

Big data analytics uncovers patterns in a wide variety of data and associates the patterns with business outcomes. Analysts use analytical techniques and tools to detect unusual, interesting, previously unknown, or new patterns in data. Big data is a result of interaction of four dimensions of scale (increasing data volumes, high velocity of data creation, increasing complexity of data types, and extreme time sensitivity of data diminishing its value if not treated at that moment) thereby posing different challenges to manage, not to mention applying analytics techniques to find new insights. Big data does not behave the same as other data. The challenges associated with analytics on big data require a different approach from traditional data analytics processes (Nguyen et al., 2018).

Big data analytics has to do more with ideas, question and value, than with technology. Therefore, the big data analytics methodology is a combination of sequential execution of tasks in certain phases and highly iterative execution steps in certain phases.

The big data analytics process lifecycle is a combination of sequential execution of tasks in certain phases and highly iterative execution steps in certain phases. Because of the scale issue associated with supply chain big data system, an incremental and agile approach is recommended, which include modifying and expanding processes gradually across several activities as opposed to designing a system all at once (Mohanty, 2013).

In this section, an agile, iterative big data analytical process model to deliver supply chain predictive analytics solutions and intelligent applications efficiently is presented. The complete process model should encompass the lifecycle (phases, tasks, and workflows), roles, infrastructure, tools, and artifacts produced.

The proposed model is comprised of the following key components:

- A big data lifecycle.
- A standardized project structure.
- Infrastructure and resources for big data projects.
- Tools and utilities for project execution.

Figure 1 shows a proposed analytical lifecycle that can used to structure and execute various big data analytics projects (Ericson et al., 2017).

The lifecycle outlines the steps, from start to finish, that projects usually follow when they are executed. The process model includes the following stages that analytical projects typically execute, often iteratively:

1. Business understanding
2. Data acquisition and understanding
3. Modeling
4. Deployment
5. Customer acceptance

The lifecycle defines goals, tasks, and documentation artifacts for each stage of the lifecycle. These tasks and artifacts are associated with project roles such as: project manager, solution architect, data scientist, project lead, IT manager, business analyst, DevOps specialist, application developer, tester, etc.

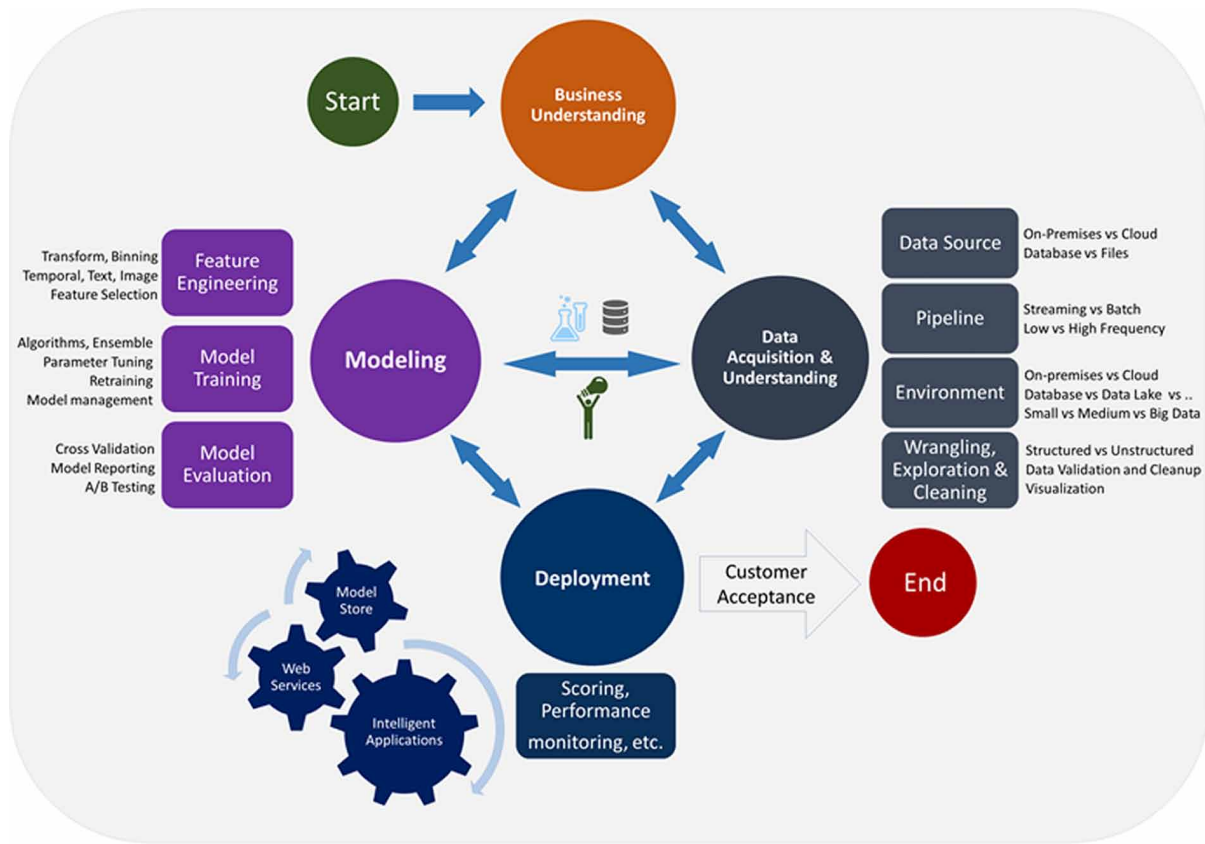
The goal of the business understanding phase is to specify the key variables that are to serve as the model targets and whose related metrics are used determine the success of the project, and to identify the relevant data sources that the supply chain has access to or needs to obtain.

The second phase includes the three main tasks:

- Data ingestion from various supply chain data sources into the target analytic environment.
- Data exploration in order to determine if the data quality is adequate to answer the question.
- Solution architecture development of the data pipeline that refreshes and scores the data regularly.

The modeling phase addresses the following tasks:

Figure 1. Big Data Analytic Lifecycle



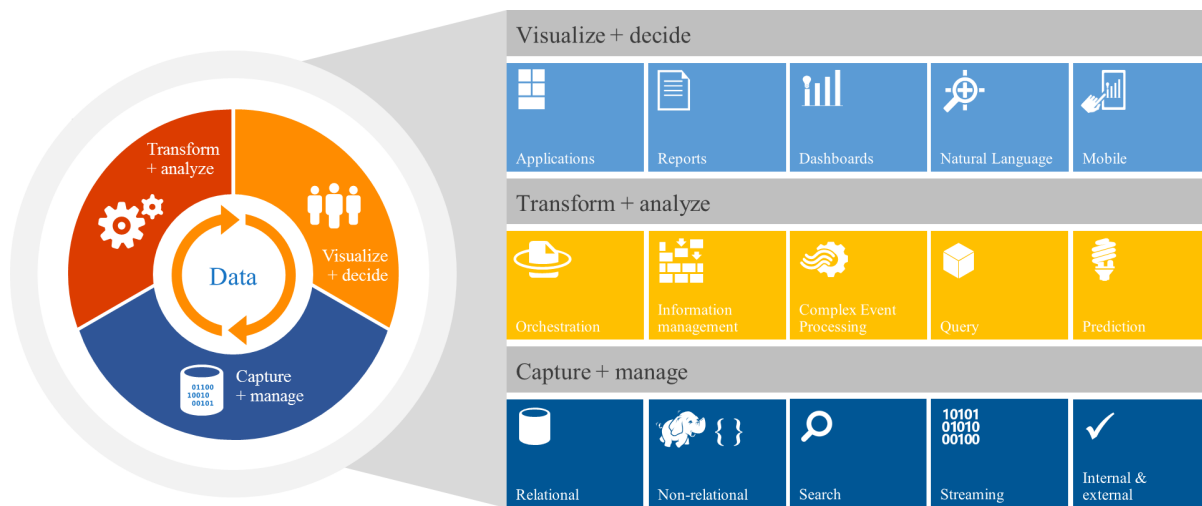
- Feature engineering - Create data features from the raw data to facilitate model training.
- Model training - Find the model that answers the question most accurately by comparing their success metrics.
- Model evaluation - Determine if the model is suitable for production.

Deployment phase refers to deploying the models with a data pipeline to a production or production-like environment for final user acceptance and application usage. The final phase includes system validation (confirming that the deployed model and pipeline meet the customer's needs) and project delivery (hand the project off to the entity that's going to run the system in production).

The model also includes the standardized project structure so that projects share a common directory structure and use templates for project documents. This makes it easy for the team members to find information about their projects. All code and documents are stored in a version control system to enable more effective and efficient team collaboration. Tracking tasks and features in an agile project tracking system allows closer tracking of the code for individual features. The standardized structure for all projects helps build institutional knowledge across the supply chain.

The proposed big data process model also provides recommendations for managing shared analytics and storage infrastructure such as: cloud file systems for storing datasets, databases, big data (Hadoop or Spark) clusters, machine learning service, etc. Tools provided to implement the big data process and lifecycle help lower the barriers to and increase the consistency of their adoption. They are used to pro-

Figure 2. Supply chain analytical lifecycle model



vision the shared resources, manage them, and allow each team member to connect to those resources securely. Tools also helps automate some of the common tasks in the data science lifecycle such as data exploration and baseline modeling.

The real users of the analytics outcomes are business users, but they often do not understand the complex mathematical formulae, statistical analysis models, etc. Therefore, it is extremely important to equip the business users with easy-to-understand and highly intuitive tools through which they will understand what actions are to be performed.

The proposed model and the lifecycle offer several advantages over existing supply chain analytical systems. They take into account the specifics of the big data analysis and provide unified framework for designing, developing, and deploying big data analytical solutions. The model can be applied to various analytical projects, regardless of technology and platforms. This enables faster development and implementation with high level of agility comparing to existing approaches.

SOLUTIONS AND RECOMMENDATIONS

In order to overcome main challenges of modern analytics and deficiencies of existing BI supply systems we propose a comprehensive multi-layered supply chain big data BI model that utilizes cloud-based big data services and tools for data extraction, transformation and loading (ETL), analysis, and reporting. Figure 2 shows the architecture with layers and services.

The proposed big data model unifies processes, methodologies and tools into a single business solution. The model has been developed in such a way to seamlessly integrate within overall BI and collaboration framework (Stefanovic et al., 2011). It is process-centric, metrics-based and modular. It introduces the new supply network and data modeling approaches, as well as layered application architecture which enables creation of composite BI systems.

The data integration layer supports various data types (relational, unstructured, streaming, OLAP, etc.) via cloud ETL services. The data management layer is based on the Hadoop engine but with additional services which provide more flexible data models and querying. The analytical layer hosts various ana-

lytical models and schemas. These can be exploration, data mining, or performance monitoring models. The final insights layer provides insights to all users such as self-service BI, data search, collaboration and performance monitoring. The central component of this layer is specialized supply chain BI portal as the unifying component that provides integrated analytical information and services, and also fosters collaborative decision making and planning (Stefanovic & Stefanovic, 2011).

This approach utilizes various cloud data management services such as ETL jobs for data extraction, cleansing and import, as well as event hubs that acts as a scalable data streaming platform capable of ingesting large amounts of high-velocity data from sensors and IoT devices throughout supply chain.

Additionally, the supply chain-wide data catalog was created in the cloud. It is fully managed cloud service that enables users to discover, understand, and consume data sources. The data catalog includes a crowdsourcing model of metadata and annotations, and it allows all supply chain participants to contribute their knowledge to build a various data models which can be integrated into specific applications and services.

In order to provide more flexibility, two big data stores are designed: supply chain enterprise multi-dimensional data warehouse and special in-memory tabular model for processing large amount of data. Combined with specific cloud analysis services, it is possible to design different analytical models. For example, stream analytical services can be used to set up real-time analytic computations on data streaming from devices, sensors, e-commerce sites, social media, information systems, infrastructure systems, etc. Another example is cloud machine learning service that enables supply chain participants to easily build, deploy, and share predictive analytics solutions (i.e. forecasting sales or inventory data) (Stefanovic & Stefanovic, 2015).

Finally, information derived from such analytical models need to be delivered to decision makers in timely and user-friendly way. For this purpose, a special web portal is used. It acts as a single point of data analysis, collaborative decision making.

In order to demonstrate our approach, we have designed a supply chain BI solution for analysis of supplier quality within the supply chain. Data from different sources (relational database, files, and web feeds) is integrated via cloud ETL job into the in-memory tabular data store.

Various analytical reports are designed using different technologies and services. All these BI artifacts (reports, charts, maps, etc.) are then integrated in the web dashboards as shown in Figure 3.

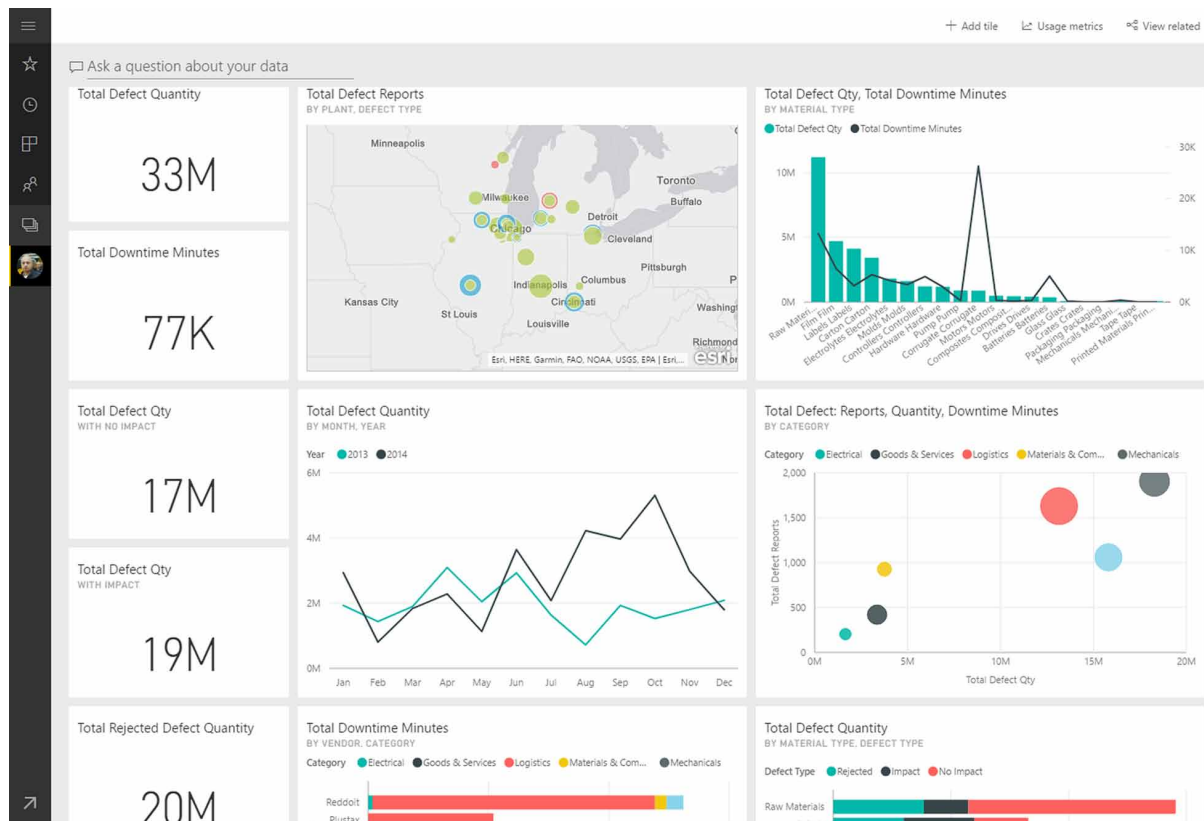
Supplier quality analysis is a typical supply chain task. Two primary metrics in this analysis are: total number of defects and the total downtime that these defects caused. This sample has two main objectives:

- Understand who the best and worst supply chain suppliers are, with respect to quality.
- Identify which plants do a better job finding and rejecting defects, to minimize downtime.

Each of the analytical segments on the dashboard can be further investigated by using various drill-down reports. For example, if user wants to analyze how plants deal with defective materials and the downtime, by clicking on the map segment, it opens supplier analysis dashboard that can be used for deeper analysis and filtering in order to derive meaningful knowledge about supplier management processes and take corrective actions.

The presented solution demonstrates the effectiveness and applicability of the proposed big data analytical model and the lifecycle. It encompasses the complete analytical lifecycle, from data capture and transformation, to storage, processing and visualization. This innovative approach enables better supply chain integration and coordination, as well as more informed decision making based on the advanced analytical services based on machine learning and visualization.

Figure 3. Supplier quality dashboard page



FUTURE RESEARCH DIRECTIONS

Supply chain management has been a highly researched area during the past twenty years, and it was seen as the key approach and enabler for organizational success and sustainability. Today's increased globalization, market pressures, uncertainty, shorter product lifecycles, tough competition and technological advancement make SCM critical in the years to come. Efficient decision making based on produced information and knowledge derived from vast supply chain data sources is the key for successful supply chain management (Petty, 2019).

The impact of advanced analytics on supply chain is significant. Big data analytics is increasingly being deployed in real time or near-real time in various supply chain areas, from planning, sourcing and making, to delivery and return. The growth of data analytics has been particularly dramatic. In 2018 alone, big data adoption increased to 59% from 17% in 2015 (Keary, 2019).

The research show that supply chain leaders are using advanced analytics and artificial intelligence (AI) to augment and automate supply chain decision making. Within advanced supply chain companies, defined as those using two or more of the three advanced analytics techniques — predictive analytics, prescriptive analytics and artificial intelligence — 96% of respondents use predictive analytics, 85% use prescriptive analytics and 64% use AI (Van der Meulen, 2018).

Big data will certainly continue to play a crucial role in supply chain analytics and SCM in overall. Besides advancements directly related to big data systems, it is expected that big data will be combined

with other technologies such as IoT, blockchain, augmented reality, cloud computing and many others. The main big data trends and research directions will be related to (Elliot, 2019):

- Cloud analytics
- Internet of Things (IoT)
- Predictive analytics
- Augmented analytics
- Artificial Intelligence
- Quantum Computing
- Digital assistants and chatbots
- Visualization and user experience
- Mobile analytics

CONCLUSION

During the last several years there was an amazing progression in the amount of data produced within the supply chain information systems, but also externally. This poses many challenges related to data analysis specifically in terms of technology, infrastructure, software systems and development methods. The current business climate demands real-time analysis, faster, collaborative and more intelligent decision making.

The current approach to supply chain intelligence has some fundamental challenges when confronted with the scale and characteristics of big data. These include not only data volumes, velocity and variety, but also data veracity and value. One of the key aspects of leveraging big data is to also understand where it can be used, when it can be used, and how it can be used - how the value drivers of big data are aligned to supply chain strategic objectives.

Big data is starting to make inroads into logistics and supply chain management – large steps have certainly been taken over the past several years – but there is still a long way to go. Opportunities to create efficiency and savings through smart use of data are evident and concerted effort is being put into finding them. Big data and advanced analytics are being integrated successfully as logistics management solutions such as: optimization tools, demand forecasting, integrated business planning, supplier collaboration and risks analytics.

The proposed layered supply chain big data model and architecture allows construction of the next-generation loosely-coupled analytical systems that combine different services, data sources, analytical models and reporting artifacts into a unified analytical. This will enable collaborative, efficient, responsive, and adaptive supply chains.

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KEY TERMS AND DEFINITIONS

BI Portal: A specialized web portal that provide a range of analytical services and which enables collaborative decision-making.

Big Data: The evolving term that describes a large volume of structured, semi-structured and unstructured data that has the potential to be mined for information and used in machine learning projects and other advanced analytics applications.

Business Intelligence: A set of processes, technologies and tools comprising data warehousing, On-Line Analytical Processing, and information delivery in order to turn data into information and information into knowledge.

Cloud Analytics: Cloud analytics is a type of cloud service model where data analysis and related services are performed on a public or private cloud.

Data Science: The concept that utilizes scientific and software methods, IT infrastructure, processes, and software systems in order to gather, process, analyze and deliver useful information, knowledge and insights from various data sources.

Machine Learning (Data Mining): Set of knowledge discovery techniques for intelligent data analysis in order to find hidden patterns and associations, devise rules and make predictions.

Supply Chain: Dynamic, interconnected, and collaborative group of companies working jointly on planning, management and execution of cross-company business processes spanning from the first-tier suppliers to the end-customers.

Supply Chain Intelligence: Process of integrating and presenting supply chain information in order to provide collaborative planning, monitoring, measurement, analysis and management of the supply network.

Critical Success Factors of Analytics and Digital Technologies Adoption in Supply Chain

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INTRODUCTION

The digital economy has brought into focus the importance of Supply chain as a competitive advantage. (Li et al, 2006). Competition has evolved from firm vs firm to supply chain vs supply chain (Ketchen & Hult, 2007). This has encouraged firm to adopt analytics to improve supply chain performance. Impact of analytics, on supply chain performance, is an important topic of research (Kohavi et al. 2002).

The supply chain is a bidirectional flow of information products and money between the initial suppliers and final customers through different firms. Supply chain management includes planning, implementing and controlling this flow. Management scholars and practitioners' agree that analytics has the potential of working on all areas of supply chain management to provide insights thereby improving supply chain performance. As demand and supply volatility has increased, the need for data and analytics has grown. A holistic analytics strategy may be the answer to many of the pains ailing the supply chain today (Cecere, 2016).

At a firm level, it is of interest to the Chief Executive Officer and Chief Supply Chain Officer, supported by the Chief Information Officer to explore what are the strategies to improve effectiveness of analytics in the supply chain. Research need to explore the effect of analytics on individual firm performance, an important factor that all firms are concerned about (Maskey et al. 2015). Harrington and Gooley (2017) opined that it is important to demonstrate the business benefits of analytics in supply chain initiatives to firms' leadership.

Acceptance and use of technology by an individual or a firm is one of the most mature stream of information system research (Benbasat & Barki, 2005; Venkatesh et al., 2007; Venkatesh et al., 2012). Better means for predicting and explaining information system acceptance and use have great practical value (Davis, 1989). Identifying the facilitators to improve adoption of analytics in supply chain, using validated framework of acceptance and use of information technology, has both practical and theoretical value.

The Research questions are:

- What are the facilitating factors for adoption of analytics in supply chain?
- What are the perceived benefits of use of analytics on supply chain?

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BACKGROUND: LITERATURE SURVEY

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The existing research frameworks were perused for their applicability in this research and have been presented.

Technology Adoption model: Various theoretical models of Technology adoption have been proposed by researchers (Fishbein & Ajzen, 1975; Bandura, 1986; Compeau, 1999; Davis, 1989; Ajzen, 1991; Moore & Benbasat, 1991; Venkatesh & Davis, 2000) that specifies factors which influence technology adoption. The constructs of Technology adoption have been specified as performance expectancy i.e. perceived benefits on adopting the technology, effort expectancy or ease of use of adopting the technology, *social influence* to adopt or not adopt the technology, facilitating conditions, which positively or negatively influence adoption and behavioral intention to adopt the technology (Venkatesh et al., 2003).

SCOR model: SCOR model provides a systematic approach to identifying, evaluating and monitoring supply chain performance, covering the four core supply chain processes of Plan, Source, Make and Deliver (Jamehshooran et al, 2015; Stephens, 2001). In Plan, data is analysed to forecast the market trends for the products and services (Azvine et al, 2005). In Source, agent based information systems are studied that include evaluation, search, selection and price negotiation (Lee et al, 2009; Trkman et al, 2007). In Make, factors that facilitate production to be within specification and on time are perused (Ranjan, 2008). In Deliver, analytics used in logistics management to reach products on time are investigated (Reyes, 2005). Trkman et al, (2010) used the SCOR model to study Supply chain performance and introduced Process Orientation and Information Systems as moderators.

Literature survey on use of Analytics and Big Data in supply chain- Hahn & Packowski (2015) described four types of use cases of analytics in supply chain (i) monitor and navigate (ii) sense and respond (iii) predict and act (iv) plan and optimize. Business analytics may help in increasing organization efficiency, using different analytical methods to forecast market trends, reduce the operating cost and increase the profits by using mature supply chain systems (Hoole, 2005; Hedgebeth, 2007). Analytics may produce breakthrough insights that can help supply chains reduce costs and risks whilst improving operational agility and service quality (Deloitte & MHI, 2014).

Fawcett & Wallet (2013) found an increase in Big data in Supply Chain. Garmaki et al (2016) found that Big data analytics is being used to create actionable insights for sustained competitive advantage. There is increased demand of Volume of data from Sales (details of price, quantity, time of day, date), Consumer (more details of purchasing behaviour, browsing history, frequency, value, timing), Inventory (perpetual inventory at more locations with more details e.g. style/color/size), Location and time (sensor data to detect location in stores/distribution center / transit). They also found that the Velocity of data is increasing from monthly / weekly to hourly, from consumer card usage to click history. The Variety of data is also increasing, from firms' sale to competitors sales, international sales, consumers identification to eye tracking, emotion detection, sentiment based on tweets and likes, inventory in warehouses to that with online retailer, location of product to who is moving it, nearby locations, path being taken etc.

Studies on the benefits of analytics on Supply chain- As Kwan (1999) found that information technologies allow firms to quickly and accurately share demand data, sales projections and production schedules, which provides adopting firms greater flexibility and responsiveness in the face of a constantly changing environment. Luu et al. (2017), in the Annual Forrester Data Analytics survey, found that digitising the supply chain enables firms to integrate, embed intelligence and visualise all supply chain processes from supplier to customer. This opens the door to live inventory management that provides true transparency on inventory flows. Manufacturing costs are reduced as detailed planning and scheduling enables agility within the supply chain and optimises the efficient use of capacity. Gstettner et al (2016) referred a

study by 'The Boston Consulting Group' that shows that the leaders in digital supply chain management are enjoying increase in product availability of up to 10% points, more than 25% faster response time to changes in market demand, and 30% better realization of working-capital reductions than the laggards. They have 40% to 110% higher operating margins and 17% to 64% fewer cash conversion days. They have reported that analytics is helping help managers to dynamically calculate optimal inventory allocations and forecast demand more accurately. Depending on the analytics of customer clicks on the website in a country or region, firms are adjusting inventories even though customers have not yet placed orders, holding more stock in the right locations, thereby decreasing the lead time promised to customers and increase their willingness to buy. Harrington and Gooley (2017), in their research, reported the perceived benefits from applications of supply chain analytics are customer service, profitability, visibility to cost-to-serve, inventory management, risk and resiliency management, demand planning and end-to-end supply chain collaboration.

Studies on adoption of analytics in supply chain- Various studies (Irani, 2010; Roach et al 1987; Sharif & Irani, 2006) have argued that Information systems (IS) investments have not resulted in business value. Studies in IS and business value have concluded that the results may be mediated by a number of intermediate variables (Mooney et al, 1996). Researchers have also proposed that multi-dimensional perspective of business value need to be studied to understand the impact of IS capabilities (Bharadwaj, 2000; Bhatt & Grover, 2005; Santhanam & Hartono, 2003).

Study by Schoenherr and Speier-Pero (2015) has highlighted factors which act as barriers to adoption of supply chain like inability to identify most suitable data, security concerns, lack of top management support, unclear business case or value, cost of currently available solutions, employees are inexperienced (need for training), current applications unable to meet business needs etc.

Harrington and Gooley (2017) similarly reported major impediments as lack of integration of data warehousing initiatives, need to invest in software and hardware, analytical tools' level of difficulty for users, acquisition of talent and expertise, difficulty of using analytical tools, management commitment and support, uncertainty about return on investment or value.

Patterson et al. (2003) found that firms subjected to greater pressure from supply chain partners would be more likely to adopt supply chain technology. Further firms with a more favourable transaction climate with supply chain members will be more likely to adopt supply chain technology.

Greater environmental uncertainty would lead to greater technology adoption as uncertainty creates the need for more accurate information in order to respond as environmental conditions necessitate (Ahmad and Schroeder, 2001). Firms facing higher environmental uncertainty will be more likely to adopt supply chain technology.

To have a broader and more multidimensional view of impact of Analytics on Supply chain performance, related management and technology initiatives were also studied.

Digital Technologies IoT through use of Big Data and analytics has led to supply chain innovations (Li & Li, 2017), servitization (Fichman et al 2014) and Multimodal delivery (Ganesan et al, 2016). Additive Manufacturing is disrupting the Supply chain models by a dramatic reduction in transportation volumes and bringing manufacturing closer to the customer (Chen, 2016; Mohr & Khan, 2015). Amazon has filed a patent for a mobile 3-D-printing delivery truck that would make it possible to print out a customer's order from a data file sent to the nearest vehicle. This innovation would let the company get items to shoppers much more quickly and reduce its warehouse space. Autonomous vehicles or drone technology is a supply chain design inflection point (Fawcett & Waller, 2014). Block Chain is a ledger based technology with decentralized data design and data recording, which improves transaction execution and transaction validation capabilities in supply chain (Korpela et al, 2017; Kshetri, 2018).

Information System (IS) Capability Previous studies (Lin, 2007; Lu & Ramamurthy, 2011; Chen et al, 2014) have brought out a positive relationship between IS capability and firms performance. Wamba et al. (2016) and Kim et al. (2012) in their research have further refined IS capability and concluded that Business Data Analytics infrastructure capability, management capability and personnel capability have an impact on Supply chain performance.

Extended supply chain: With the advent of unstructured data, firms need to redesign business processes to be able to extract actionable insights from unstructured data (Jha et al, 2016). The inclusion of cross-functional business processes may be needed to exploit the advantages of analytics based supply chain planning. The extended supply chain also involves collaboration with external supply chain partners.

Supply chain visibility across the extended supply chain is a core issue involving interaction of people, processes, technologies and information flow (Hearney, 2013).

Kiron et al (2013) reported that, i) respondents who agree that analytics is helping their firms innovate are much more likely to say they collaborate with partners and suppliers through use of analytics (ii) are reaching beyond their own data to feed their analytics process. Studies have highlighted the importance of achieving a high level of inter and intra organizational processes and information systems (Wamba & Akter, 2015). With collaborative business processes and the seamless integration of processes of different firms, dynamic and flexible collaborations can be created in order to improve performance (Liu et al, 2009).

Perusal of literature also gave the perspective of the Gaps in literature. Feki et al (2016) concluded that the research challenge is determining the theories that can be mobilized and developing metrics to measure supply chain performance in big data and analytics settings. Schoenherr & Speier-Pero (2015) found that there is a research gap and need of more formal investigation into adoption and infusion of analytics.

This research tries to address this research gap by mobilizing the construct “Facilitators” and “Performance expectancy” of Unified model of Adoption and Use of Technology (UTAUT) to study critical success factors adoption of analytics in supply chain. Further, it uses the SCOR model, widely used by the practitioners of supply chain, to develop metrics, which align “performance expectancy” of analytics to the key parameters of supply chain.

RESEARCH FRAMEWORK

Data collection was done by a questionnaire. The questionnaire was pre tested by a panel of experts, before it was administered to respondents across manufacturing, infrastructure, consumer goods, e-commerce and third party logistics industries in face to face interviews.

Profile of the Respondents: The feedback from fourteen Chief Executive officers, thirty-five Chief Supply chain officers and eighteen Chief Information officers from firms of various sizes across India, was compiled.

The measurement models for constructs “Facilitating Factors” and “Performance Expectancy” have been subjected to confirmatory factor analysis with data from the questionnaire survey. Structural equation modeling package AMOS 18.0 has been used for this purpose. The standardized regression weights of the measurement items with the corresponding construct has been evaluated along with the critical ratio. The critical ratio of over 1.96 and the standardized regression weight of over 0.3 is considered acceptable. Based on this criterion, measurement items were dropped from each of the constructs due to poor loading.

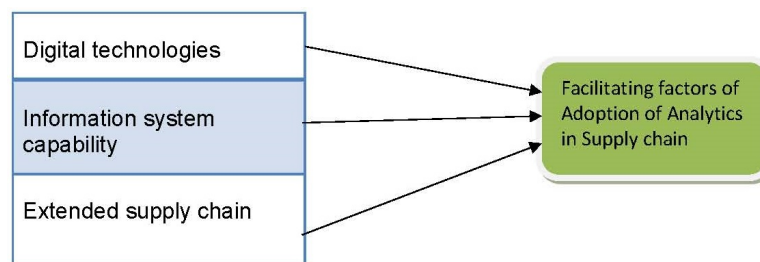
The revised measurement models for constructs were again subject to confirmatory analysis. The acceptance criterion was that the chi square value of the measurement model should be between 1 to 3 and the p value greater than 0.05. It was recommended that standardized regression weight will be over 0.3 and the corresponding critical ratio over 1.96 for the measurement items.

The composite reliability and variance extracted for each measurement model has been computed separately. The construct reliability values are above the threshold of 0.70 (Nunnally, 1978) and the convergent validity (Average variance extracted) is higher than 0.50 which is the accepted value (Hair et al, 1998). This analysis has been done on the revised measurement models that have been accepted by confirmatory analysis. The interpretation of the revised measurement models have been also taken up for discussion next.

RESULTS AND DISCUSSIONS

Facilitating factors: This construct discusses the factors which facilitate adoption.

Figure 1. Measurement Model of Facilitating factors of adoption of Analytics in supply chain



In the context of adoption of analytics in supply chain, the measurement parameters and related hypothesis are defined as follows:

H1: Digital technologies have a positive influence on adoption of Analytics. The findings of the study support this hypothesis.

Digital technologies, which facilitate the adoption of analytics in the Supply chain, are *Additive manufacturing* (3 D printing) which is enabling businesses to station local manufacturing centres closer to strategic markets. This along with insights from analytics is making supply chains become agile and able to cope with faster product design and production cycles.

Oettmeier & Hofmann (2016) found that adoption of Additive manufacturing in customized products is helping analytics to speed up complaint processing, increase material utilization and reducing order lead time. They also found that Additive manufacturing is improving quality management and influencing vendor management.

Another Digital technology, *Internet of Things* (IoT) information is being used to generate analytics across the value chain and reducing manual intervention, improving visibility and decision making. Objects moving through the value chain are producing unprecedented supply chain visibility. Stationary objects connected over the Internet of Things are monitoring the surrounding environment, reporting conditions, altering their state depending on predefined parameters, enabling firms to come closer to the customer.

Li & Li (2017) reported that adoption of IoT along with analytics is leading to sourcing innovation by optimizing inventory levels and by building trust between the firm and the vendor. They also reported that IoT is helping analytics to bring innovation in logistics by improving information transparency of transportation.

Drones and vehicle automation are disrupting the supply chain by enabling automation in the world of supply chain logistics and materials handling. The scope is enormous from Self driving trucks and cargo ships, loading / unloading of parcels, last mile delivery drones as being tested by UPS and Amazon.

Block Chain can disrupt supply chain by improving traceability, increasing trust and speed up transaction through smart contracts (Fransisco & Swanson, 2018; Pruitt, 2017).

H 2: Information system capability influences adoption of Analytics. The findings of the study support this hypothesis

Jha et al (2016) concluded that Big Data analytics requires business processes to change and it must align with the firms IS infrastructure to support the business initiatives. New ways of doing data analytics and business intelligence depend on information system capability. Firms need to focus on this now than later to gain competitive advantage in the market place. Raguseo (2018) found that lack of Information System and infrastructure support is a strong barrier to adoption of analytics in supply chain.

H 3: Extended supply chain has a positive impact on adoption of Analytics. The findings of the study support this hypothesis.

Research findings strongly support these. Respondents opined that analytics can be, over time, copied by rivals eroding the competitive advantage. To sustain the competitive advantage of analytics adoption, realignment of business processes is being undertaken. Firms reengineering their Supply chains to Extended supply chain agree that analytics is helping their firms innovate. The supply chain visibility is helping firms to collaborate with logistic partners and vendors through the use of analytics. However firms also agree that internal integration is a prerequisite for extended supply chain.

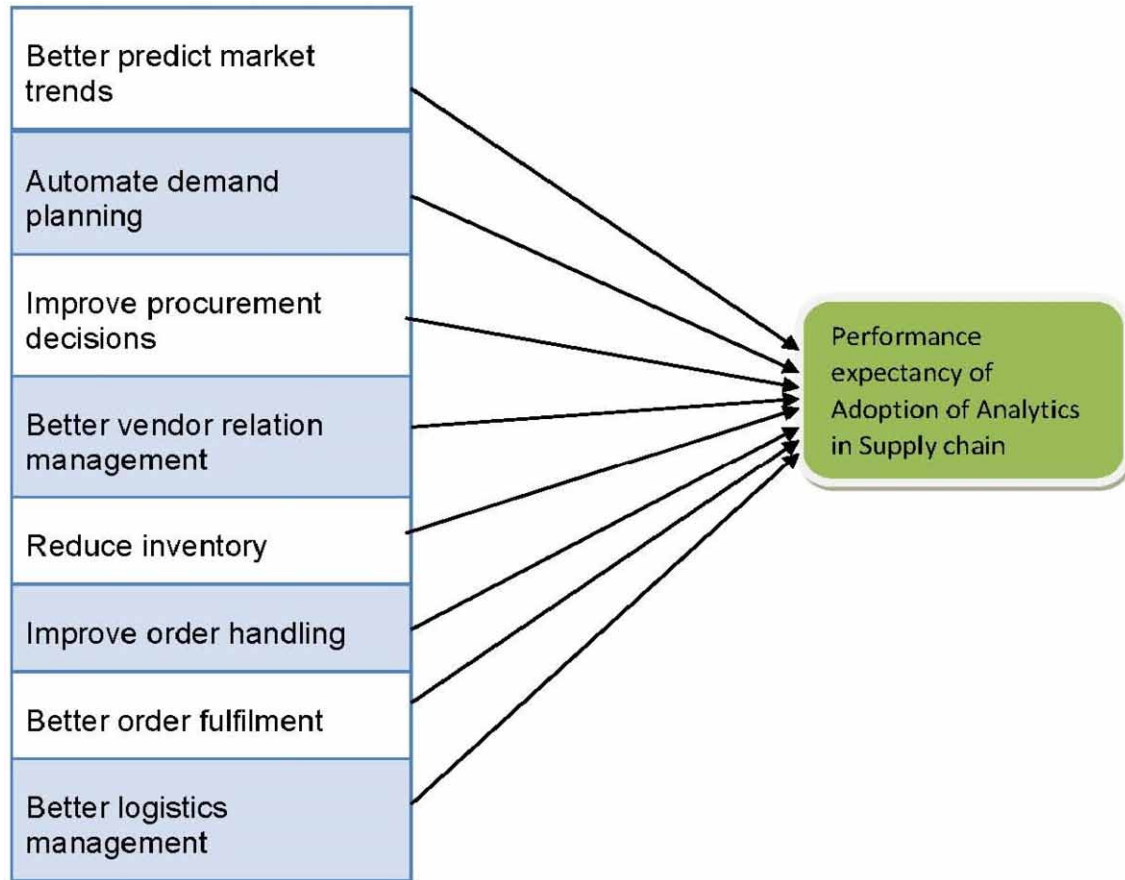
This is supported by Rozados & Tjahjono (2014), who states that an extended supply chain is a multi-echelon system that connects organisations, allowing collaboration and integration. Sanders (2014) supported by stating that the exchange and sharing of data across the extended supply chain has provided transparency and enabled coordinated cross-enterprise efforts.

“Perceived Benefits” refers to the expected benefits of adoption and use of technology.

The measurement items of the construct “Perceived Benefits” of Analytics and the related hypothesis in Supply chain is presented in a Tabular form.

Overall there is a strong correlation between performance expectancy and intention to adopt analytics. This is in line with study of Jamehshooran et al (2015), which proved that Analytics in Plan, Source, Make and Delivery has positive and significant impact on performance. Chen et al (2016) found a strong relation between expected benefits and adoption of analytics in supply chain. Aronow & Johnson (2016) has reported Gartner research that states 29% of companies have achieved a high return on investment (ROI) from putting data analytics programs in place, while only 4% said they have not achieved an ROI from their analytics investment. The data also shows that the ROI from data analytics investments consistently increases in correlation with maturity level. For example, of the high-maturity companies that deployed data analytics, 50% noted improved product quality as a benefit, as compared to only 24% of low-maturity organizations. Accenture (2015) reported that Big data and analytics is having an impact on organizations’ reaction time to supply chain issues (41%), increased supply chain efficiency of 10% or greater (36%), and greater integration across the supply chain (36%).

Figure 2. Measurement Model of Perceived Benefits of adoption of Analytics in supply chain



CONCLUSION

The results of the discussion contributes to a systematic review of impact of analytics on supply chain performance. The use of a Framework developed on the universally accepted SCOR Model has given an opportunity to do a structured inquiry on perceived benefits of analytics in various aspects of supply chain. This may provide actionable insights to practitioners on perceived impact of analytics in various functions of Supply chain.

The study of the impact of facilitating factors, i.e. Digital Technologies, Extended supply chain and IS capability on supply chain performance, reemphasises that analytics in isolation will not have its intended benefits, if these facilitating conditions are absent.

The perceived impact of the adoption of analytics on the supply chain performance has come out very strongly and emphatically in the research. It is crucial that firms have the facilitating factors (i.e. Digital technologies Extended supply chain and IS capability) to reap the full potential of analytics in supply chain performance.

This is of particular importance in a developing country like India, where Information System infrastructure and availability of trained personnel across all the supply chain partners is a challenge. It is important that the Industry leaders and Industry trade bodies take particular attention to improve the whole supply chain and have innovative solutions wherever needed. Saldhana et al (2015) pointed that

Table 1. Measurement model of perceived benefits of adoption of analytics in supply chain

Measurement items- Hypothesis	Key Conclusions	Previous results
Analytics will improve planning by better predicting market trends - <i>Supported</i>	Firms are adopting predictive analytics for planning Supply chain practitioners use analytics for contingency planning	DeAngelis (2017), Hanesbrands uses analytics to sense supply chain issues in time.
Analytics will improve planning by automating demand planning - <i>Supported</i>	Firms monitor demand upto the stock keeping unit level, at point of sale and during promotional events, track lost sales.	Leveling & Otto (2014) - analytics is resulting in automatic ordering if demand is recognized.
Analytics will impact Sourcing by improving procurement decisions- <i>Supported</i>	Adoption of Analytics has led to decrease in Total cost of ownership and more effective supplier negotiation	Innamarto et al (2017) - analytics support better sourcing decisions. Rozados & Tjahjono (2014) - analytics is providing visibility on aggregated procurement patterns.
Analytics will improve Sourcing by leading to better vendor relation management - <i>Supported</i>	Firms are using analytics for annual vendor scorecard and product sourcing process. This has reduced the 'Request for Quote' process and at the same time allow real-time benchmarking.	Panchmatia (2015) - analytics gives information on firms spending pattern and return on investment. Ahlawat & Martinez (2016)- analytics helps to monitor quality
Analytics will improve Make by reducing inventory - <i>Supported</i>	Analytics has led to finished Inventory optimizations (Inventory carrying cost optimization, decreasing bullwhip effect, customized fulfilment level based on customer segmentation).	Hoffman (2017) - relation between adoption of analytics and reduction of bullwhip effect.
Analytics will improve Make by improving order handling- <i>Supported</i>	Analytics is helping in processing data available through sensors and digital machines in shop floors, production lines and factories to improve order handling.	Zhong, Huang, and Lan (2014) - analytics support shop floor logistics planning and scheduling. Zhong, Xu, Chen, & Huang, 2017; Zhong et al., 2015 - Analytics is supporting in building intelligent shop floor logistics system Rozados & Tjahjono (2014) analytics has led to better inventory sensing capability and material handling and packaging.
Analytics will improve Delivery by better order fulfilment - <i>Supported</i>	Analytics in supply chain has improved network planning and optimization	Aronow & Johnson (2016) 26% of the respondents say that better customer service is a driver of adoption of analytics. Sanders (2014)- analytics has optimized supply chain segments and made it focussed to meet customer demands
Analytics will improve Delivery by better logistics management- <i>Supported</i>	Analytics may facilitate hyper-scale, real-time improving logistics efficiency and utilization Analytics can help in prior shipment using lower cost transportation Analytics has improved traceability of products.	Bubner et al (2014)- analytics could speed up delivery times of goods and increase the utilization ratio of distribution capacities. Spiegel et al (2013) - predictive analytics can help to ship goods prior to the customers' order to reduce delivery time

Source: Developed for this Research

in India language differences, low accessibility of internet, purely transactional relationship with channel, lack of IS expertise of logistics partners, lack of information sharing with suppliers are constraints in supply chain. The extended supply chain needs to provide benefits to the entire supply chain, rather than be internally-focused and transaction-oriented. In transaction oriented, firms acts solely for its own benefit, regardless of the potential detriment or constraints to the rest of the supply network (Rice & Hoppe, 2001).

FUTURE SCOPE OF THE STUDY

The research helped firm up the measurement items of the constructs “Facilitators” and “Performance expectancy”. Additionally similar study needs to be done to identify the measurement items of the other constructs “Effort expectancy” and “Social influence”. Further, the final model need to be statistically validated using Structural Equation modelling. This will lead to operationalizing UTAUT to study adoption issues of analytics in supply chain and may be used to predict adoption of analytics in supply chain, across industries, countries and firms size. This is an important subject of management research.

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KEY TERMS AND DEFINITIONS

Analytics in Supply Chain: Analytics can be defined as tools and techniques that are dedicated to harnessing external and internal data to improve supply chain efficiency.

Big Data: Refers to the 3Vs (i.e., Volume, Velocity, Variety) of data which is captured for actionable insights.

Business Process Reengineering (BPR): Involves the analysis and redesign of firms' processes and workflows to achieve sustainable improvements in quality of response and cost competitiveness.

Digital Technologies: Relevant to supply chain are Additive manufacturing (3D Printing), Internet of things (Machine to machine communication between devices that belong to different systems, including public infrastructure), Drone technology for logistics and Block Chain for transactions.

Extended Supply Chain: Is the BPR initiative, which assists in maximizing the impact of analytics in supply chain. Extended supply chain proposes a close integration with other lines of business units that are key in the supply chain such as product development, manufacturing, sales, and operations.

SCOR Model: Is the framework used for analysis and insights of Supply chain performance. It is used in this research for measuring the impact of Business analytics in supply chain.

Unified Model of Adoption and Use of Technology (UTAUT): It is a consolidated model to study Technology adoption, proposed by Venkatesh et al. (2003).

Blockchain for Supply Chain Management: Opportunities, Technologies, and Applications

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INTRODUCTION

Over the past decades, digital technologies empowered more efficient, effective and connected supply chains. Many organizations have invested a significant amount of resources in various supply chain management (SCM) in order to improve performance and profitability. However, as supply chain complexity continues to increase, organizations face new challenges of maintaining visibility into origin, authenticity, and asset handling as they cross organizational boundaries (Stefanovic, 2015). The existing SCM information systems and apps usually cannot provide required visibility, traceability, automation, provenance, and efficiency.

Blockchain technology is considered to be a game-changer for decentralizing infrastructure and building a trust layer for business logic. It is envisioned to be a technology that could drive us into the next industrial revolution, with new paradigms for doing business in supply chain, transportation, manufacturing, finance and many other industries (Vorabutra, 2016).

It has a potential impact on most documentation processes, but it adds value through the ability to track purchase orders, assign and verify certifications, link physical goods to IoT (Internet of Things)-enabled devices, such as digital tax, barcodes, and serial numbers, and sharing such information with suppliers, vendors, and other supply chain partners (Robinson, 2019).

Blockchain is a transparent and verifiable system that will change the way supply chain partners exchange value and assets, manage contracts, and share data. The technology is a shared, secure ledger of transactions distributed among a network of computers, rather than resting with a single provider. Blockchain can be used as a common data layer to enable a new class of SCM applications. Thus, business processes and data can be shared across multiple organizations, which eliminates waste, reduces the risk of fraud, and creates new revenue streams.

Blockchain-based supply chain solutions are changing the way industries do business by offering end-to-end decentralized processes via the distributed and digital public ledger (Miaoulis, 2019).

Blockchain within the supply chain provides supply chain participants with a decentralized ledger that can store an entire history of transactions across a shared database — an ideal solution for multi-tier collaboration within the context of a dynamic and digital supply chain ecosystem (Doubleday, 2019).

Certain supply chains are already using the blockchain technology, and literature suggests blockchain could soon become a universal “supply chain operating system” (Spend Matters, 2015). Blockchain technology could improve the following supply chain tasks:

- Recording the quantity and transfer of assets - like pallets, trailers, containers, etc. - as they move between supply chain nodes (Gonzalez, 2016)

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- Tracking purchase orders, change orders, receipts, shipment notifications, or other trade-related documents
- Assigning or verifying certifications or certain properties of physical products; for example, determining if a food product is organic or fair trade (Herzberg, 2015)
- Linking physical goods to serial numbers, bar codes, digital tags like RFID, etc.
- Sharing information about manufacturing process, assembly, delivery, and maintenance of products with suppliers and vendors

Supply chain organizations must can achieve significant benefits from blockchain in core areas of supply chain operations (Francis, 2018):

- Removing paperwork - by using blockchain to create a tamper-proof “master ledgers” between trading parties
- Creating “smart contracts” - that check when new records are written, ensure there are no out of balance conditions, and remove the existence of ‘bad’ invoices
- Having a single system of record - replicated across all partners to a transaction, which enables the impartial enforcement of contract terms

With the power to bring transparency and accountability to even the most complex supply chains, blockchain is poised to transform the way suppliers, retailers, and consumers interact with one another and their goods. Blockchain has the potential to replace complicated, error prone processes such as look-back auditing with streamlined smart contracts. As the technology grows and matures, it will be used to open new doors for cross-organizational collaboration and enable new business models along the supply chain (Microsoft, 2018).

Supply chain blockchain is taking ground at a rapid pace. Most of the key technological components needed to create robust supply chain blockchain networks are available or in a mature development stage. However, radical change will truly start to take shape through the integration of blockchain with other innovative technologies like AI and IoE (XChain2, 2018).

In this chapter, we discuss the various opportunities blockchain provides for SCM, as well as the main technologies including infrastructure and services. The main applications and benefits of blockchain for SCM are described including smart contracts, payments, transaction recording, dispute resolution, environmental monitoring, and security. We also introduce the multi-layered and cloud-based hybrid blockchain model that combines various data, integration, blockchain, and security services.

BACKGROUND

Supply chains are definitely critical for the overall success of today’s organizations. Supply chain management includes integrated planning as well as the execution of different processes within the supply chain such as planning, sourcing, making, delivering, end returning. These processes include material, information and financial flows (Stefanovic & Stefanovic, 2013).

Supply chains are currently managed on centralized software platforms, and the chain activities rely on human paper-and-pen processes to ensure certified products are delivered as intended to final consumers. The current supply chain management system as it exists today is outdated and unable to

keep up with growing interconnectedness that the global industry presently demands. Some of the main challenges that existing supply chain systems face are related to (Miaoulis, 2019):

- **Speed:** The speed of the current supply chain is very slow due to the presence of intermediary heavy authentication processes, doing business across time zones, and logistics management inadequacies. Transacting across time zones is a slow process that requires third-party financial services that are expensive and multi-day.
- **Counterfeiting and Fraud:** Counterfeiting not only damages organization's reputations, but it can also potentially endanger lives (i.e., frauds in pharmaceutical, food or electronic supply chains). Fraud is so widespread because global supply chains are not able to know for sure the volume of every item stored in every location.
- **Costs:** Frauds, slow processes, and intermediaries all add to costs for everyone in the supply chain. Consumers end up paying for these added expenses and companies take their fair share out of their revenue.
- **Trust:** Centralized supply chains require that all players trust that the others are operating honestly and will be on schedule. Without automation and better technological infrastructure, all processes hinge on trust or costly third-party verification.
- **Reliability and Data Security:** Data analytics help to improve supply chain management, when data is inaccurate this data is less likely to be useful and work towards a more robust chain. Additionally, insecure customer data leaves consumers vulnerable to identity theft.

Managing today's supply chains—all the links to creating and distributing goods—is extraordinarily complex. There are many challenges with the existing supply chain organization and technologies that are related to transactions efficiency, transparency, traceability, trust, and security. One of the studies found that 408 organizations from 64 countries were facing consistent supply chain visibility challenges (RiskMethods, 2019):

- 69% do not have full visibility into their supply chains
- 65% experienced at least one supply chain disruption
- 41% still rely on spreadsheets to keep track of supply chain disruptions

There is a significant amount of locked in value in SCM, largely stemming from the fragmented and competitive nature of the logistics industry. Hence, there is an increased interest in how blockchains might transform the supply chain and logistics industry (Marr, 2018).

Blockchain is a transparent and verifiable system that will change the way organizations think about exchanging value and assets, enforcing contracts, and sharing data. The technology is a shared, secure ledger of transactions distributed among a network of systems, rather than resting with a single centralized provider. Supply chain organizations are using blockchain as a common data layer to enable a new class of applications. Now, business processes and data can be shared across multiple organizations, which eliminates waste, reduces the risk of fraud, and creates new revenue streams (Microsoft, 2019a).

The three properties of the blockchain technology that is going to help disrupt the supply chain management system are (Mitra, 2019):

- **Decentralization:** What it essentially means is that any data that is stored inside the blockchain is not owned by one centralized entity but shared by everyone who is part of that blockchain's network.
- **Immutable:** Immutability basically means non-tamperable. Any data put inside the blockchain cannot be tampered with.
- **Transparency:** Every single operation that will ever take place in the supply chain will be recorded in the blockchain for authorized parties to see.

Blockchain is a top 10 strategic technology trend in 2018 according to Gartner. By 2030, it is predicted it will provide \$3.1tr of added value to businesses worldwide (Pettey, 2017). It is likely to affect key supply chain management objectives such as cost, quality, speed, dependability, risk reduction, sustainability and flexibility (Kshetri, 2018). Blockchain can make tracking items and transactions in the supply chain radically faster and simpler when used in conjunction with IoT technology, cutting administrative and logistics timelines in shipping by an estimated 85% (Deloitte, 2017). Where the movement of goods involves dozens of individuals and organizations communicating with each other, blockchain can dramatically simplify record keeping (Lehmacher, 2017). Blockchain is more than a pure electronic data interchange (EDI) – it is the backbone of digital supply chains, offering distinct advantages over today's conventional supply chain IT infrastructure and analytics capabilities (Lierow et al., 2017).

Blockchain is scalable, thus any number of supply chain members may be seamlessly integrated into the blockchain without losing data consistency. Blockchain is independent of adjacent and legacy systems, making implementation quick. Every participant along the chain holds a complete copy of the data. But, by defining specific access rights, participants can ensure that confidential corporate information is kept private. While the blockchain record possesses a high degree of integrity, organizations will need to ensure that they are vigilant to cyber-security threats given that entries on the ledger are distributed immediately and are then permanent (Lin & Liao, 2017).

For blockchain to be deployed successfully across the supply chain the following prerequisites are needed (InsightBrief, 2018):

- Joint standards (covering terminology, development, security and more).
- The technical ability to handle large transaction volumes must be enhanced.
- Smooth and easy interface with legacy systems.
- Broad stakeholder buy-in.

True blockchain-led transformation of business and supply chain is still in progress and in its early stages. It is a hot topic among academic researchers, industry experts and enterprise software vendors. Even though there are certain research projects related to blockchain technologies and SCM, available software platforms, services and apps, as well as successful real-world implementations, presently academic and managerial adoption of blockchain technologies is quite limited (Swanson & Francisco, 2018).

Peterson et al. (2018) explore benefits, challenges and opportunities of blockchain applications in SCM. Other studies report blockchain applications in pharmaceutical (Bocek et al., 2017), food (Caro et al., 2018), and healthcare (Clauson, 2018) supply chains.

For blockchain to add true value to the supply chain, it will generally require extensive use of IoT, AI (Artificial Intelligence), cloud technologies and analytics (Stefanovic, 2014). Furthermore, every stage of the supply chain must be digitized and integrated, presenting a logistical challenge at the launch phase (De Meijer, 2018).

Even though surveys show that supply chain organizations have quite positive stand about blockchain technology and possible benefits, they still have a strong reserve against concrete implementations. The benefits over existing IT solutions must be elaborated more carefully and use cases must be further explored (Hackius & Petersen, 2017). This requires an additional research and studies about concrete blockchain applications in supply chain processes, as well as adequate software systems, platforms, services and apps capable to support decentralized, distributed and heterogenous SCM software systems, all with necessary scalability, flexibility, security and compliance.

In the following chapters, the main blockchain SCM use cases and benefits, system architectures, concrete solutions, and future research directions and trends are described.

BLOCKCHAIN APPLICATIONS IN SUPPLY CHAIN MANAGEMENT

Blockchain promises real long-term potential for the global transformation of economies and industries that, over time, will lead to the era of the “programmable economy” (Prentice et al., 2015).

A practical approach to blockchain development and implementation demands a clear understanding of the business opportunity, the capabilities and limitations of blockchain technology, a trust architecture, and the necessary IT to implement the technology (Furlonger, 2017). Blockchain’s key attributes and potential benefits are:

- Improved cash flow
- Lower transaction costs
- Asset provenance
- Native asset creation
- New trust models

In general, blockchain technologies can be utilized at three levels (Piscini et al., 2017):

1. Storage of digital records – blockchain can be used to store digital identities of supply chain organizations, assets, documents, events, transactions, and essentially everything that can be represented digitally.
2. Exchange of digital assets – blockchain can execute P2P (peer-to-peer) transactions without trusted intermediaries, thus reducing clearing and settlement, human work, and related costs
3. Creation and execution of smart contracts – they are kind of digital codes which enable automated execution of specified actions based on contractual conditions as validated by all the supply chain participants.

To assess the value of blockchain technologies for the supply chain domain, the three main areas where it could add value can be observed (Alicke et al., 2017):

- Replacing slow, manual processes. Although supply chains can currently handle large, complex data sets, many of their processes, especially those in the lower supply tiers, are slow and rely entirely on paper.
- Strengthening traceability. Increasing regulatory and consumer demand for provenance information is already driving change.

- Reducing supply-chain IT costs. This often means lower data storage, transaction, integration, exchange and analytical costs.

Blockchain can definitely improve the following supply chain processes (Mitra, 2019):

- Recording the quantity of the products and its transfer through different participants.
- Tracking all the purchase orders, change orders, receipts, trade-related details, etc.
- Verifying the validity of the certification of the products. For example, this can be used to track whether a particular item meets certain quality standards or not.
- It can link various physical items to serial numbers, barcodes, and tags like RFID etc.
- Helps in the sharing all the information about the manufacturing process, assembly, delivery, and maintenance of products with the different participants in the supply chain.

Additional benefits of blockchain in the supply chain for visibility include (Robinson, 2019):

- The creation of smart contracts to hold vendors and suppliers accountable, maintaining adherence to duties and responsibilities defined within service level agreements (SLAs).
- Integrated payment solutions, reducing the time between ordering and payment processing, ensuring the proper, timely movement of products. Payment processing also has major ramifications for avoiding violations of international and domestic trade agreement, preventing illicit payments from countries and entities that are sanctioned from doing business with other parts of the world.
- Ability to create public and private blockchains, protecting proprietary, if not private, information from unauthorized parties.
- Recording all activities throughout the supply chain, including the quantity and transfer of assets, regardless of the motive transit. This will grow more important as new technologies, including unmanned, autonomous trucks, drones, and even Amazon's proposed floating fulfillment center, emerge.
- Better customer service levels and far-reaching scalability, resulting from the ability to provide more information regarding a product's manufacturer, origin, transfer, and use.

Regardless of the application, blockchain offers shippers the following advantages (Vorabutra, 2016):

- Enhanced Transparency. Documenting a product's journey across the supply chain reveals its true origin and touchpoints, which increases trust and helps eliminate the bias found in today's opaque supply chains. Manufacturers can also reduce recalls by sharing logs with OEMs (Original Equipment Manufacturers) and regulators (Gonzalez, 2016).
- Greater Scalability. Virtually any number of participants, accessing from any number of touchpoints, is possible (Chester, 2016).
- Better Security. A shared, indelible ledger with codified rules could potentially eliminate the audits required by internal systems and processes (Spend Matters, 2015).
- Increased Innovation. Opportunities abound to create new, specialized uses for the technology as a result of the decentralized architecture.

Blockchain can add a great deal of value when combined with IoT devices, tracking real-world events and uploading the information to the chain. Applications include (InsightBrief, 2018):

- Automating payments on completion of delivery
- Detecting temperature changes and voiding products that have been adversely affected
- Recording security logs for items in transit

If applied correctly, blockchain technology can assure provenance tracking and traceability across the supply chain. This, in turn, will lead to fewer counterfeiters and ensured safety in the processes. Blockchain in the supply chain will also allow manufacturers, transporters, and end-users to collect data, study trends, and apply predictive monitoring process for better product experience (Pratap, 2018).

Besides many proven and promising advantages and benefits, application and utilization of blockchain technologies is still at its nascent stage and have some challenges (Queiroz & Fosso Wamba, 2019). The main challenges include (Lawton, 2019):

- Higher computational overhead
- Managing decentralized systems
- Data complexity
- Buy-in with multiple parties
- Readiness of participants
- Integration with existing ERP (Enterprise Resource Planning) systems
- Application development complexity

Supply chain managers, as well as IT managers need to be aware of these challenges and to take the right preparations and actions to successfully carry out blockchain project.

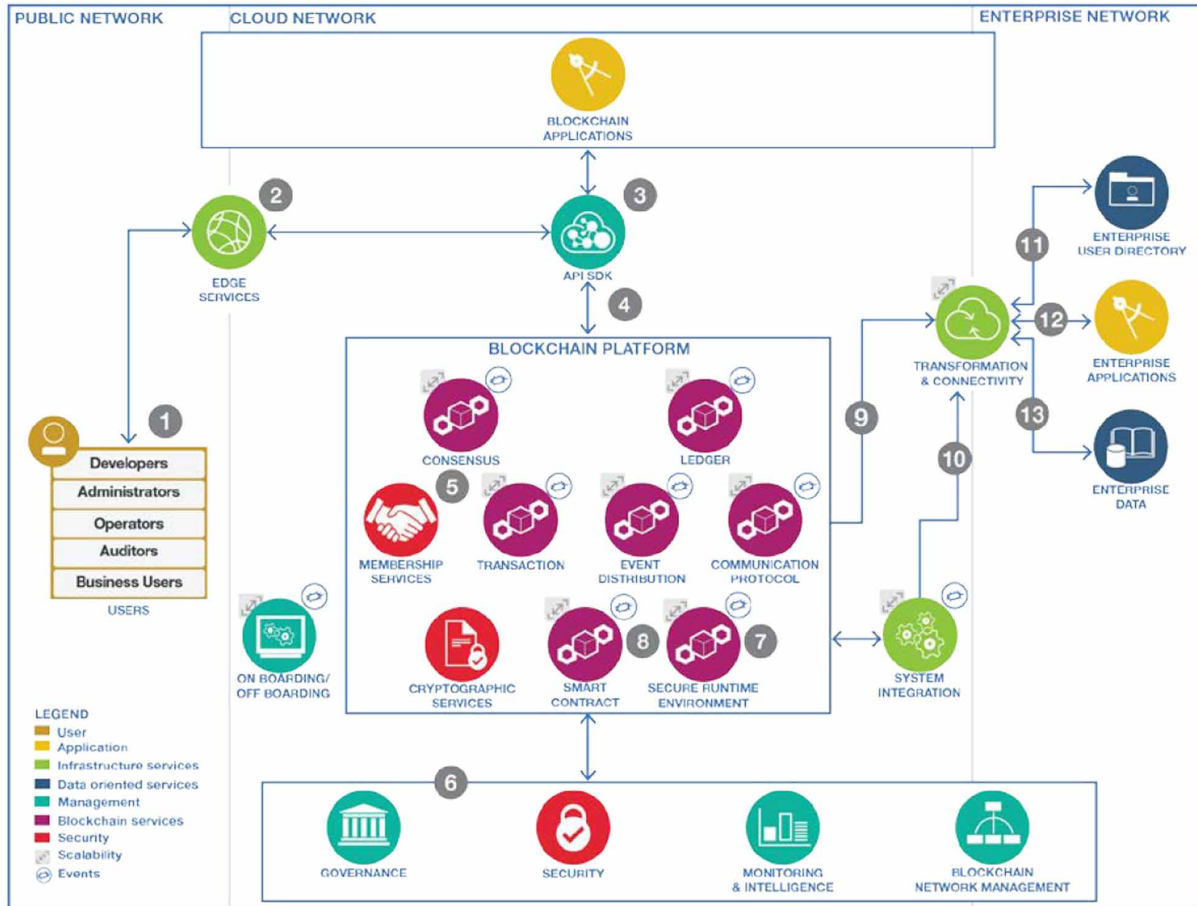
SOLUTIONS AND RECOMMENDATIONS

In this section, cloud-based blockchain reference architecture for supply networks is presented. Furthermore, architectures of the two characteristic supply chain use cases are described. They are based on the blockchain-as-a-service (BaaS) cloud platform that is used to create and deploy blockchain applications, and to share business processes and data among supply chain organizations.

Successful supply chain blockchain implementations support multi-level confidentiality and privacy which is achieved through multichannel or subchain communication, multiple sub-ledgers, and multiple stakeholders for transaction visibility based on a need-to-know-basis. There are several characteristics that apply to blockchain systems that affect their architecture and implementation: cryptography, immutability, provenance, decentralized computing infrastructure, distributed transaction-processing platform, decentralized database, shared and distributed accounting ledger, software development platform, cloud computing, peer-to-peer network, and digital wallet (OMG, 2017).

Figure 1 shows the SCM blockchain reference architecture with typical capabilities needed for a node (organization) or the supply chain participating in the blockchain system. The reference architecture is expressed across three networks – public, cloud, and enterprise. The technical implementations of blockchains vary depending on the type of blockchain that is chosen. They can use different methods to establish the network topology, manage participation, execute smart contracts, and manage growth.

Figure 1. Blockchain reference architecture capabilities and runtime flow



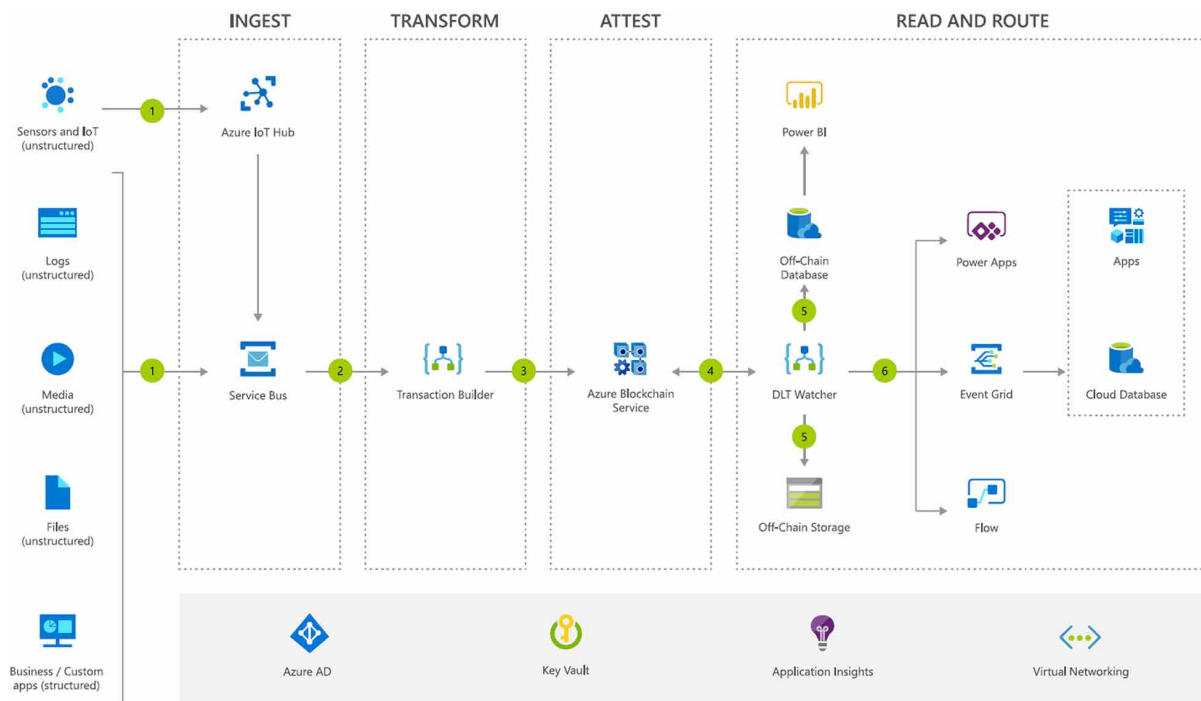
1. A blockchain user accesses the blockchain platform to perform a transaction. Business users are likely to access the blockchain network through blockchain applications running on the cloud network. Other users may access the blockchain network from within the environment for administrative and operational purposes.
2. Upon receiving the request to access the blockchain network, edge services route the request to the security gateway.
3. Business users may access the application using a browser client that passes the request to the blockchain platform.
4. The request passes through the API SDK to the blockchain platform for authentication, authorization and execution.
5. Blockchain membership services, which provides security, privacy and protection for blockchain users, authenticates the user and authorizes the action requested by the user based on their role.
6. Security services enable the blockchain membership services to establish the user's identity and provide authentication, authorization and integration capabilities.
7. A secure environment is spawned to execute server-side blockchain business logic.
8. Based on various triggers, smart contract business logic enforces contract terms between the supply chain participants.

9. The validation of the smart contract may necessitate access to enterprise data. The request goes through the transformation and connectivity service which transforms the data and ensures secure and reliable delivery.
10. In addition, external events may trigger a blockchain transaction such as the creation of business documents (i.e. by customs or a bank) through their legacy systems.
11. Before any processing is performed by the enterprise application, the blockchain service instance may authenticate the user via the enterprise user directory.
12. The enterprise application may leverage data used by the client app as well as logs and context data for analytics. If the client application updates the data then the enterprise application may process those changes.
13. Enterprise Data is the data store for the Enterprise Application.

Blockchain Workflow Application

Businesses use blockchain to digitize workflows they share with other organizations, such as moving physical assets across supply chains. The anatomy of blockchain apps is similar across supply chain use cases. Here, Azure Blockchain Service as the foundational managed blockchain network is used, and a consortium application that can ingest signals from relevant user interfaces and communicate ledger data to consuming apps across the consortium is built (Microsoft, 2019b).

Figure 2. Blockchain workflow application architecture

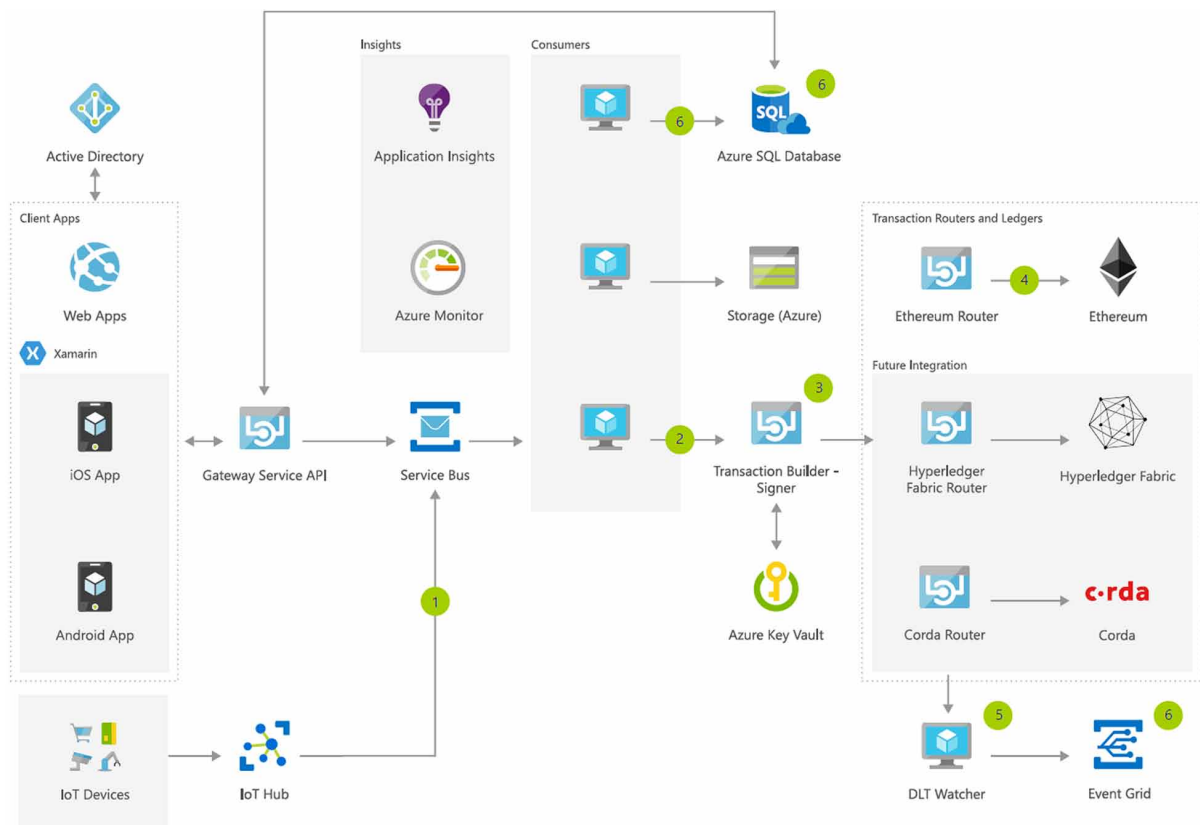


1. Relevant apps, devices, and data sources send events or data to a message broker (Azure Service Bus).
2. The distributed ledger technology (DLT) consumer Logic App fetches the data from the Service Bus and sends to transaction builder which builds and signs the transaction.
3. The signed transaction gets routed to Azure Blockchain Service (fully managed Ethereum consortium network) via a ledger-specific Logic App connector.
4. The DLT watcher Logic App gets confirmation of the transaction commitment to the blockchain and sends the confirmed blockchain transactions to off-chain databases and storage.
5. Information is analyzed and visualized using tools such as Power BI by connecting to off-chain database
6. Message broker sends ledger data to consuming business process applications.

Tracking and Tracing Throughout Supply Chain

A common blockchain pattern is IoT-enabled monitoring of an asset as it moves along a multi-echelon supply chain. A great example of this pattern is the refrigerated transportation of perishable goods like food or pharmaceuticals where certain compliance rules must be met throughout the duration of the transportation process. In this scenario, an initiating company (such as a retailer) specifies contractual conditions, such as a required humidity and temperature range, that the custodians on the supply chain must adhere to. At any point, if the device takes a temperature or humidity measurement that is out of range, the smart contract state will be updated to indicate that it is out of compliance, recording a transaction on the blockchain and triggering remediating events downstream (Microsoft, 2019c).

Figure 3. Architecture of blockchain IoT tracking system



1. IoT devices communicate with IoT Hub. IoT Hub as a route configured that will send specific messages to a Service Bus associated with that route. The message is still in the native format for the device and needs to be translated to the format used by Azure Blockchain Workbench. An Azure Logic App performs that transformation. It is triggered when a new message is added to the Service Bus associated with the IoT hub, it then transforms the message and delivers it to the Service Bus used to deliver messages to Azure Blockchain workbench. The first service bus effectively serves as an “Outbox” for IoT Hub and the second one serves as an “Inbox” for Azure Blockchain Workbench.
2. DLT Consumer fetches the data from the message broker (Service Bus) and sends data to Transaction Builder - Signer.
3. Transaction Builder builds and signs the transaction.
4. The signed transaction gets routed to the Blockchain (Private Ethereum Consortium Network).
5. DLT Watcher gets confirmation of the transaction commitment to the Blockchain and sends the confirmation to the message broker (Service Bus).
6. DB consumers send confirmed blockchain transactions to off-chain databases (Azure SQL Database).
7. Information analyzed and visualized using tools such as Power BI by connecting to off-chain database (Azure SQL Database).
8. Events from the ledger are delivered to Event Grid and Service Bus for use by downstream consumers. Examples of “downstream consumers” include logic apps, functions or other code that is designed to take actions on the events. For example, an Azure Function could receive an event and then place that in a datastore such as SQL Server.

FUTURE RESEARCH DIRECTIONS

Supply chain management has been one of the top five organizational initiatives and highly researched topic within academia for last two decades and it is expected to continue so. Blockchain is seen as a disruptive technology with high potential to improve supply chain operations. Incorporating blockchain into supply chains has the potential to transform everything from warehousing and delivery to order tracking and payment (Exegistics 2019).

Blockchain is aligned to potentially fulfill critical and long-standing challenges presented across dynamic and complex global supply chains that traditionally have held centralized governance models. Current capabilities offered by blockchain solutions for supply chain include a loose portfolio of technologies and processes that spans middleware, database, verification, security, analytics, and contractual and identity management concepts. Blockchain is also increasingly being offered as a service or development option across supply chain solutions that target closely aligned objectives such as automation, traceability and security. A critical aspect of blockchain technology today is the unregulated, ungoverned verification of successful transactions, as well as immutability. These capabilities currently fund much of blockchain development for supply chain (Petty, 2019).

This chapter introduces some new SCM blockchain architecture patterns, and the concrete solutions for workflow automation and tracking and traceability. Further research that will be carried out includes integration of blockchain data with cloud analytical systems and machine learning services in order to provide better insights and business decisions.

Blockchain in the future will revolutionize business processes in many supply chain industries, but its adoption requires time and efforts. Nevertheless, in the near future, it is expected that governments

will finally accept blockchain benefits and begin to use it for improving financial and public services. Though some blockchain startups will fail, people will get more experience and knowledge on how to use this technology. Blockchain will stimulate people to acquire new skills, while traditional business will have to completely reconsider their processes (Gogan, 2018).

Many IoT companies are considering the implementation of blockchain technology in their solutions. The reason for this is that blockchain technology can provide a secure and scalable framework for communication between IoT devices.

The market potential for blockchain is immense. In a recent survey by PwC of 600 executives, 84% of organization are already involved in some way with blockchain technology (PWC, 2019).

International Data Corporation (IDC) forecasts worldwide spending on blockchain will reach \$11.7 billion by 2022, with the United State leading the way accounting for 36% of the investment, followed by Western Europe, China and Asia Pacific (Goepfert & Shirer, 2018). Gartner predicts that blockchain's business value-add will grow to more than \$3.1 trillion by 2030 and that 10-20% of the global infrastructure will be running on blockchain technology by 2030 (Gartner, 2017).

CONCLUSION

Today's modern global distributed supply chain is incredibly complex, with blockchain having the potential to transform how business is done. With its distributed digital ledger, blockchain has many potential applications in the supply chains for any type of transaction, contract, tracking item, payment and more.

Blockchain technology has the potential to significantly boost the global economy. By accelerating the flow of information in the supply chain, increasing efficiency and enabling the faster turnaround of goods, blockchain could drive trillions of dollars of trade over the next decade.

In this chapter, the main challenges, benefits and use cases of blockchain supply chain systems are identified and discussed. The blockchain reference architectures along with typical supply chain scenarios are presented. They can be used as a blueprints or patterns of how to design and deploy scalable, flexible, and secure cloud-based blockchain system integrated with other enterprise IT services and systems.

The presented SCM blockchain scenarios provide cloud-based architectures for typical supply chain processes. By utilizing the blockchain-as-a-service platform, it is possible to create, deploy, manage and automate blockchain networks more efficiently and with greater level of scalability and security.

Application of blockchain holds promises to increase visibility, renew viability, reduce inconsistency, increase payment processing accuracy, and eliminate compliance problems. Even though the technology is still new, its potential cannot be ignored, and supply chain executives, managers and IT experts need to know how to best utilize blockchain technologies in order to improve supply chain processes and cut costs.

In the near future, blockchain has the power to replace complicated, error prone supply chain processes with streamlined smart contracts. As the technology grows and matures, it will be used to open new doors for cross-organizational collaboration and enable new business models along the supply chain.

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KEY TERMS AND DEFINITIONS

Blockchain: Blockchain is a type of public/private, immutable and distributed ledger for maintaining a permanent and tamper-proof record of transactional data.

Blockchain as a Service (BaaS): It is an offering that allows customers to leverage cloud-based solutions to build, host and use their own blockchain apps, smart contracts and functions on the blockchain while the cloud-based service provider manages all the necessary tasks and activities to keep the infrastructure agile and operational.

Distributed Ledger: It is a database that is consensually shared and synchronized across multiple sites, organizations or geographies.

Ethereum: It is an open source, distributed software platform and cryptocurrency built on the blockchain technology that enables creation of smart contracts.

Hyperledger: Hyperledger is an umbrella project, which offers the necessary framework, standards, guidelines, and tools, to build open source blockchains and related applications for use across various industries.

Mining: In the context of blockchain technology, mining is the process of using computer resources for adding transactions to the large distributed public ledger of existing transactions.

Node: It is a copy of the ledger operated by a participant of the blockchain network, which enables establishing trust in the network, as well as cryptographic and transaction clearing.

Smart Contract: Smart contracts are self-executing contracts with the terms of the agreement between business parties being directly written into lines of code and hosted in the blockchain.

Supply Chain: The evolving term that describes a large volume of structured, semi-structured and unstructured data that has the potential to be mined for information and used in machine learning projects and other advanced analytics applications.

Supply Chain Management (SCM): The management of the flow of goods, services, financials and information across the interconnected business network of companies.

Adoption of Blockchain Technology to Improve Integrity of Halal Supply Chain Management

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INTRODUCTION – “EVOLUTION OF BLOCKCHAIN TECHNOLOGY”

Blockchain technology was invented by Satoshi Nakamoto along with a few others which still remains a mystery (Kersten, Blecker, Ringle, Hackius, & Petersen, 2017). This technology can help company protect assets, initiate transactions and maintain records between parties in verified chronological events without being hacked or tampered. Blockchain has the potential to change any nation into a cashless entity. A verifiable distributed ledger that records transactions are one of the major concepts of blockchain phenomena (Iansiti, Lakhani, & Mohamed, 2017).

The Blockchain is a chain of orphaned divergent blocks to bring equilibrium inside any digital system (Biais, Bisiere, Bouvard, & Casamatta, 2018). Much focus is now being paid to electronic agreements. Public blockchains applications are constructed into a full digital framework for converting acts and registries. Many governments, personal and economic sector industries are now exploring the possibilities of smart contracts depending on blockchain (Bocek & Stiller, 2018). The success and failure of a key party to handle inter-agency business transactions are no longer necessary. In companies that request safe economic operations, Blockchains are now beginning to affect business management procedures (Mendling et al., 2018).

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Blockchain Based Smart Contracts

Smart contracts based on Blockchain offer a decentralized consensus and conduct algorithms that cannot be readily altered. The manner in which any organization functions is entirely reorganized by incredible quintessence and helps create and build better platforms for records and databases with advanced features (Cong & He, 2018). The installation of blockchain-based tracking improves supply chain provenance. The ability to trace and trace the vanity amount of any products can be seen. Counterfeiting and manipulation in global supply chains have now become very simple (Kim & Laskowski, 2018).

Blockchain's backbone with respect to any smart contracts financial transactions is cryptocurrencies. Pseudonymous payments can be made online using cryptocurrency. They can be used to exchange currencies through a smart contract but somehow exhibit few drawbacks regarding throughput and latency (Eyal et al., 2016). Cryptocurrencies are decentralized currencies which can be used to design and develop a smart property over an internet platform without human interventions. Self-administrating regulations if established could deploy law-abiding self-executing smart contracts. Government and multinational corporates could find it difficult to regulate activities through old means. Hence, there is great need to still refine and fine-tune this cryptocurrency technology (Wright & De Filippi, 2015). Social world can be mediated by decentralized technologies that has the capability to completely transform bureaucratic government models (Reijers & Coeckelbergh, 2018). Cryptocurrency is an irreversible virtual currency that has become more flexible, private and less amenable when compared to other transaction procedures (Böhme, Christin, Edelman, & Moore, 2015).

Background of Study - Halal Supply Chain Management

Conventional supply chain management (SCM) focusses on the integration of the business process from the original suppliers that provide products, services, and information until it reaches the end-user. According to Halal Industry Development Corporation (HDC), Halal SCM, on the other hand, makes the conventional SCM becoming more meaningful by addressing the details of supply chain management which has to comply with the Islamic law (Syariah Law) by addressing few details as follows:

- Does not contain any parts or products of non-halal animals or animal products that are not slaughtered under Islamic law,
- Does not contain any material that Najs according to Sharia law,
- Safe and harmless
- Not prepared, processed or manufactured using equipment contaminated with Najs matter (dirt or impurities) in accordance with Sharia law,
- The food or ingredients used do not contain any portion or derivative of human beings which is not permitted by Shariah law, and
- And during preparation, processing, packaging, storage or transportation, meals are physically separated from other foods that do not qualify as aforementioned or any other matter that has been designated as Najs by Shari 'ah Law (Halal Industry Development Corporation - Halalan Toyayiban).

The word halal comes from Arabic words which are halla, yahillu, hillan, wahalalan which mean allowed or permitted according to Islamic Law. It covers the entire processes from the method of preparation (including the equipment), processing, storage, packaging and environmental areas that must be free

from Najs and comply with hygiene practices (Soon, Chandia, & Regenstein, 2017). While conventional supply chain focusses on maximizing profitability, reducing costs and meeting consumer demand, the halal supply chain main objective is to protect the integrity of halal food to ensure that Muslim consumers eat only halal and toyyib. This is important as Islam ensures its people to eat only acceptable, nutritious, healthy and quality foods.

The Halal SCM integrity has become an important issue and the biggest challenge that need to be tackled in the Halal industry. Halal food integrity can only be protected by ensuring that there is no direct contact between halal products and non-halal products across the supply chain. In addressing the growing demand for Halal food from around the world, the need for a comprehensive and well-managed integrity supply chain management approach has to be emphasized. This is to ensure the availability of halal food products in the market is entirely based on integrity concept and practices (Abd Rahman, Singhry, Hanafiah, & Abdul, 2017; Roslan Mohd Nor, Latif, Nazari Ismail, & Nazri Mohd Nor, 2016; Soon et al., 2017).

Halal Supply Chain Issues

A stronger scheme must be created continually to track and trace Halal products in any stage of the supply chain. Some of the Halal producers are not complying with the regulations established by the Halal bodies and are therefore acting as loophole for communication transparency in a negative way within the supply chain network (Zailani, Arrifin, Wahid, Othman, & Fernando, 2010). In order to satisfy the demands of Muslims, Halal supply chain and logistics norms play a dominant role. Not every Halal manufacturer is including Halal methods in their entire supply chain. The adoption rate for Halal in the supply chain is also too low among many foreign manufacturers. A separate body of Halal supply chain providers needs to be established to help overcome competitive pressure, lack of awareness and stringent governmental regulations (Ngah, Zainuddin, & Thurasamy, 2014).

Supply chain of Halal products needs to meet specific objectives and goals with respect to Halal standards and policies set by the government agencies which primarily differ from traditional supply chain practices right from the design of the supply chain network to business processes for logistics control (Tieman, van der Vorst, & Che Ghazali, 2012). Therefore, consumer's purchase intention not only depends on Halal slaughtering but also on storage and packaging methods (Adura et al., 2015; Tieman, 2011). Halal consumer market directly depends on Halal storage and packaging standards implemented by Halal supply chain service providers to provide higher assurance to the customers and increase integrity and help design robust and flexible requirements (Bahrudin, Illyas, & Desa, 2011). Nowadays, some customers tend to ask even what type of feed was given to slaughtered animals (Omar & Jaafar, 2011).

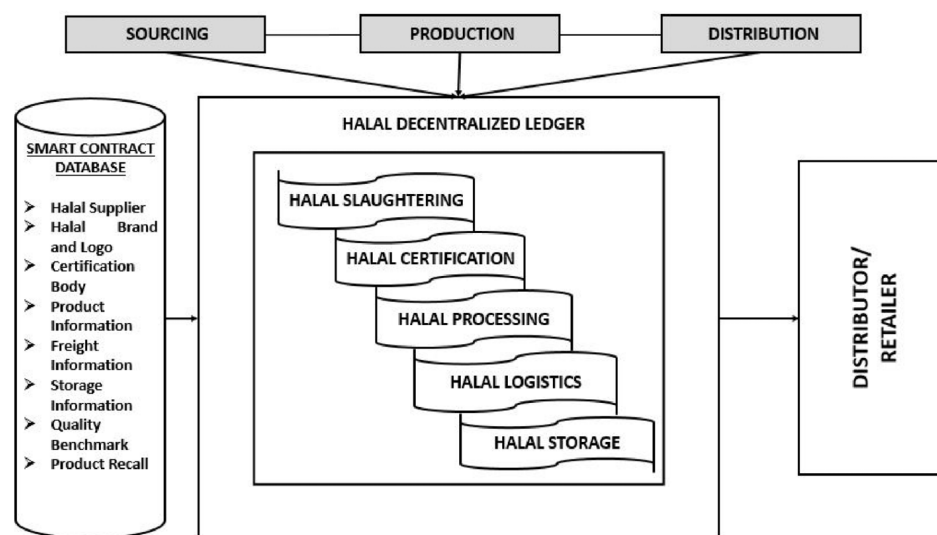
Halal containerization and coding is another major challenge. Some sections of the supply chain of Halal are still susceptible to cool / ambient and bulk/unit contamination. Some Muslim and non-Muslim countries ' business demands also differ, which have to be monitored constantly to guarantee regulated operations and to decrease vulnerabilities (Tieman & Ghazali, 2014). A specialized transport and retention of Halal are needed for cold-chain products such as meat and fish which are imports from other nations or distinct parts of the same nation and must be specifically devoted to a transport port and airport system with Halal standards. Efforts should be made for the eradication of Halal ambient products from the adulteration of Non-Halal products (Tieman & van Nistelrooy, 2014). In attempt to obtain Halal consistency without cross-contamination from raw material to finished goods, presentable data on Halal status should be created available to the public (Soon et al., 2017).

Future Scope for Blockchain-based Halal Supply Chain Smart Contracts

High-end supply chain technology related software is booming with the help IT in manufacturing sectors to enhance supply chain security that is assisted by blockchain technology. This concept's major advantage is to help us to trace every item's origin. It saves IoT (Internet of Things) linked devices from cyber-attacks. It is very apt in handling complex workflows in supply chain and logistics (Kshetri, 2017). The blockchain technology acts as a foundation for distributed ledgers and an innovative platform for establishing businesses. Transaction of any goods and services can be made possible by the help of inherited transparency and traceability characteristics of blockchain software.

Key product information is collected, managed and stored in a smart contract that operates with a decentralized distributed ledger. This process can be repeated throughout the life cycle of the product creating a shared and secured record combining all the specific information of the product. A product normally passes through many actors like producers and manufacturers, suppliers and distributors and retailers and finally end customers. A unique digital profile can be generated to each and every product in the supply chain network to preserve its identity at any given level. A Barcode, RFID or QR code shall be used to attach a product to the network along with all of its information. A unique cryptographic spotter helps to connect a physical product to its virtual identity on the network. Owners of every echelon of the supply chain will possess their own digital profile that portrays the location, product description, certifications and association of other products linking the player profile and the product profile. Every stage of the contract can be privacy protected (Abeyratne & Monfared, 2016). The blockchain features allow consumers to monitor each high-value object from the origin. And all private data would be driven into strings that can prevent some privacy issues (Xu et al., 2019). Hyperconnected logistical ideas ensure that the supply chain of products is accessible, more effective and environmentalism. Increasingly, Blockchain and IoT techniques are considered as key enablers of progress in this field (Betti, Khoury, Hallé, & Montreuil, 2019).

Figure 1. Conceptual framework



A lot of paperwork is done when containers carrying goods are shipped globally also incurring a lot of money and time. Documents and files, in particular the high-profile goods, are susceptible to falsification and cheating. The food chain where foodborne outbreaks are caused by counterfeit products is one of the worst impacted. Through source monitoring systems which can be efficiently processed through blockchain technology, the identification of the products should, therefore, be monitored and identified at all stage of the supply chain. All information is collected and collected in an affordable and immutable form (Kersten et al., 2017). Blockchain technology has a prospective impact on supply chain management (Chang, Chen, & Lu, 2019). Drug supply chains can be made secure with a Hyper-ledger fabric based on blockchains (Jamil, Hang, Kim, & Kim, 2019). Blockchains have the capability to create a disruptive global sustainable supply chain (Saber, Kouhizadeh, Sarkis, & Shen, 2019). However, the heavy costs of developing this technology require thorough consideration and an awareness of its advantages and results (Kumar, Liu, & Shan, 2019).

Blockchain Based Halal Supply Chain – A Conceptual Framework

The above Blockchain-based Halal framework (Figure 1) is designed and proposed based on the various Halal requirements that need to be fulfilled to meet customer satisfaction in Halal Food supply chain in a Halal context. Time-Consuming and tiring constraints and requirements can be made easy by imparting them into a distributed decentralized ledger as shown in the figure above. The main aim is to interconnect all the constraints together and retrieve Halal data and information at any point of the business process and financial transactions. The Halal certifications and governmental norms are made online to reduce a huge amount of time. Maintaining security and integrity of Halal manufacturing, storage and transportation can be made easy by adopting blockchain-based Halal Supply chain.

An asymmetric encryption mathematical modules which need a matching key to decrypt the blockchain cannot be falsified at any point in the procedure. With the decryption technique, the buyer can track the vendor and the route of delivery. His real source, certification, or process cannot be hidden by anyone or changed. When used in the Halal supply chain, this technology can demonstrate unthinkable benefits, especially for the Halal food industry as stronger traceability is required throughout the value chain enabling more robust trading is feasible.

LIMITATIONS

A blockchain is faster for economic operations, but more sophistication is needed for products like inventory quality check, registrations, certifications, documents, and taxes. But there are real-time issues to overcome traditional supply chain transactional features. Sometimes the miners could pose a threat in hacking transactional processes like over-invoicing, changing document quality and content, certification, contracts and protocols, supplier preferences and logistics details. Quality audits with human interventions are also a major issue which can prove disastrous if not done properly especially in pharmaceuticals and perishable food chains (Apte & Petrovsky, 2016).

CONCLUSION

Scholars argue that this technology can bring reliable, robust and speedy financial transactions without changing hands of any physical goods. Blockchain-powered platforms can take care of business process of stock market, insurance and taxation, land-registry and medical records. Several ways are being explored and experimented to apply this technology to suffice the requirements for secure and safe physical transportation of goods. This technology has a great potential to revolutionize the existing system and make it a transparent and secure one (Iansiti et al., 2017; Spend Matters Team, 2015). With a high-end supply chain technology the primary advantage of tracing the origin of each element is identified. It avoids cyber-attacks of linked devices IoT (Internet of Things). It can be used to manage complex supply chain and logistics workflows (Kshetri, 2017).

Halal supply chains are susceptible in view of the credence quality attributes, and to preserve the integrity of halal in the entire supply chain, the suspicion must be avoided, food standards are to be monitored to tackle the Muslim consumers who are sensitive to Halal standards (Tieman & Darun, 2017). Brand holders are facing many difficulties with regard to the development of complete halal supply chains and the governance of halal issues. To this purpose, major Halal Certification Bodies (HCBs) put up a panel of discussions on the prospective position of halal blockchain technology. The problems of Halal can be split into three main fields: contamination, failure to comply and perception. Higher flaws are expected to happen in Non-Muslim countries and can be handled with effective communication, whereby the term 'halal supply chain' is encoded in freight documents, on freight labels and within the ICT system (Tieman, Darun, Fernando, & Ngah, 2019).

FURTHER RESEARCH DIRECTIONS

Pros of this technology can be used in production and supply chain business for the implementation of financial, social and legal processes. Blockchain presents special features such as longevity, easiness, immutability and process sincerity. The future study can include the features of blockchain technology and the enablers of adoption. It is also worth to consider the security aspect in blockchain technology. Unlike distributed systems, the risk of error is totally prevented. Any individual node in a supply chain shall be retained with the same copy, which is practically unchanged and needs other nodes to be validated. Very soon, the supply chain will be fully controlled by decentralized systems, bridging the division between organizations and countries and building a revolutionary worldwide chain. Blockchain technology has a much broader range in the Halal supply chain because of its tiring accreditation and reliability obligations. Countries like Malaysia, Saudi Arabia are considered to be the Halal hubs of the world. It would be a great revolutionary change in the Halal business if the Halal Global Supply chain is integrated and connected together by sophisticated high-end blockchain platforms.

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Role of Smart Contracts in Halal Supply Chain Management

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INTRODUCTION

The technologies and its advancement have brought many solutions to various complex aspects of our life. Blockchain technology is a new revolution in the era of technology that called the Fourth Industrial Revolution (Tieman and Darun 2017). The basic idea behind this technology is that, its “an open, distributed ledger that stores transactions between two parties on distributed servers located in different places around the world and this make it more secure and trustable (Iansiti and Lakhani 2017, Tapscott and Tapscott 2017). The blockchain system has the ability to improve traceability and the transparency of the supply chain operations (Tieman et al., 2019). Hence, Blockchain technology had provided solutions and had enormous values in streamlining agreements, transactions and industry workflows inside and among the organizations. For instance, varied number of industries such as energy sector, robotics systems industries, finance, medical, insurance and supply chain can potentially apply this technology and provide solutions to overcome challenges and being greater benefits to all these sectors (Burger, Kuhlmann et al. 2016, Engerati 2017) (Gatteschi, Lamberti et al. 2018).

In the energy sector, Blockchain technologies has confirmed its great potentials to enhance the existing processes and practices in this field. Blockchain technologies can offer a great benefits to this industry in various ways such as: reduce costs, enhance energy security and foster sustainability (Andoni, Robu et al. 2019). Similarly, Blockchain technologies shows its potentials and promises in the robotic systems industries. (Ferrer 2018, Lopes and Alexandre 2018, Afanasyev, Kolotov et al. 2019, Lopes, Alexandre et al. 2019) emphasized the benefits and outcomes of the integration of Blockchain and robotic systems

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whereby it will offer an essential capabilities to enable the operation of robotic swam systems, rise the efficiency between agents.

Other field and sectors such as business sector, Blockchain technologies has offered numerous types of applications to facilitate the operations and business processes. (Andoni, Robu et al. 2019) summarized those applications as a use cases by Blockchain technologies in the business field. Billing, Sales and marketing, Trading and market, Automations, Smart grid applications, and Grid Management are among the potential applications in the field of business offered by Blockchain technologies (Grewal-Carr V 2016, Arsenjev, Baskakov et al. 2019)

On the other hand, with the invention of smart contracts within the Blockchain technology, the overall Supply Chain Management (SCM) will become more efficient as well as the transaction and traceability will be better in the supply chain process (Catallini 2017, Law 2017). To elaborate this, Blockchain offers capabilities such as tamper data saved in Blockchain, providing a single source of the truth, and smart contracts that automatically execute agreement terms. In combination, these capabilities promote the supply chain traceability, trust and veracity that are vital to the industry's future competitiveness (Casey and Vigna 2018) .

Likewise, Tieman and Darun (2017) argued that Halal Supply Chains Management (HSCM) are susceptible and due that becomes more difficult to design, manage and optimize. As a result, a combination of Blockchain technology and smart contracts that help in transparency is needed to ensure trust, reputation and originality of Halal supply chains products. Thus, this study aims to provide a comprehensive review on the role, benefits, and promises of utilizing the smart contracts in the domains of SCM, and HSCM.

Moreover, to the best of our awareness, till date, there has been no review study specifically focused on the implementation impact of the smart contract on the SCM and HSCM. Hence, this chapter will add new value to the intended researchers and practitioners by providing a clear view and critical discussion on smart contracts in term of its roles and benefits to the HSCM.

This paper is organized into the two main sections: Section 2 (Background) elaborates the smart contracts with SCM along with providing a detailed discussion on the roles, benefits, and promises of utilizing the smart contracts in SCM domain. Section 3 discusses further the application of smart contracts in HSCM with presenting its roles, benefits, and promises. Section 4 concludes this study.

BACKGROUND

Benefits and Promises of Smart Contracts with Supply Chains Management

Smart contracts are not a word to do with artificial intelligence but it's a term used to define an automated computer program that is capable of facilitating, executing and enforcing an agreement without interference of third party. The idea back to the mid-90s when scholar Nik Szabo has introduced this term explaining its uses and potentials (Botsman 2017). Hence, since the required technological infrastructure was not existed, Nik Szabo innovation was not recognized. But and due to the advent of Blockchain and crypto protocols, many things are changing and smart contracts starts its revolution.

In our global society, traditional contracts require a middle man for enforcement such as bank, lawyer, ebay and etc. On the other hand, smart contracts are segments of code that build upon Blockchain technology to verify or enforce the performance of contracts. Moreover, smart contracts have many advantages over traditional contracts. Simple computer programs to replace enforcers, easy to understand, immutable, transparent, accurate, verification, visibility, lower costs, self-execution, clarity of

Table 1. Current usage fields of smart contracts

Fields	How smart contracts being used
Management	Smart contracts improves security, communication and efficiency through the transparent, accurate, and automated system of Blockchain technology. .
Government	An obvious example in how smart contracts being used in government is the vital role that smart contracts play in securing the voting system.
Automobile	Smart contracts can be a boon for the automobile industry. They could help in detecting the culprit of a crash. This could also help the automobile insurance companies to charge the rates on the bases of the conditions under which the customer operates their automobiles.
Supply chain	In paper-based systems of supply chains, the forms go through many processes for approval. This increases the susceptibility to fraud and loss. This common and sensitive issue has long been countered by the use of Blockchain technology. The use of smart contracts in Blockchain offers tremendous security and accessibility to all the associated parties. This automates tasks as well as payment. The transparency offered by incorporating Blockchain in the supply chain also helps in building trusts between the involved parties.
Real Estate	By using smart contracts, all the additional cost to be paid to the third party and others will be cut off and this lead to increase the revenues. Because, by using smart contracts, the payment is only through bitcoin and encode the contract on the ledger. As a result, this will benefit the real estate agent.
Healthcare	It makes the healthcare management simpler such as regulation compliance, administering drugs, regulating the healthcare supplies and testing results.(Griggs, Ossipova et al. 2018)
Transportation	Making the flight more saver and to avoid flight data confliction, storing the flight data and uses of smart analysis can achieve this goal.
Banking	It assists the clients in sharing and exchange money and properties. It also bring more transparency, trusts and efficiency in the working process.

Source: Zfort Group (2018)

agreement terms, fraud protection and connectivity are among the advantages of smart contract over traditional one (Cottrill 2017).

Furthermore, as mentioned earlier, smart contract is a new technological storm that being used in various fields and industries. Table 1 shows some examples of current fields used by smart contracts.

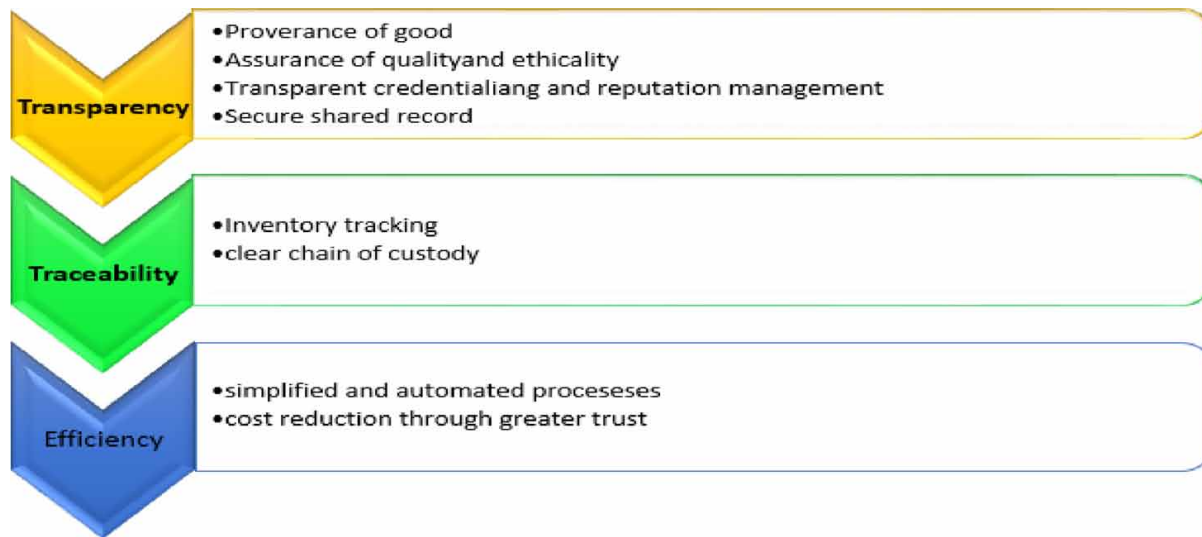
ISSUES

According to John et al., (2017), “*smart contracts represent a next step in the progression of blockchains from a financial transaction protocol to an all-purpose utility*,”. Noticeably, smart contracts have affected businesses whether directly or indirectly. This can be seen in many smart contracts applications such as insurance products, copyright protection, company recordkeeping and smarter voting as well as in supply chain management. Peter Harris, co-founder and research principal at Chain Business Insights stated that “ Numerous firms realized the capabilities of smart contracts to the supply chains field”. Similarly, in supply chains management, smart contracts can provides many benefits and promises to this particular field. Figure 1 presents the summary of the smart contracts benefits provided to the supply chains management.

Figure 1 illustrates the benefits of smart contracts to supply chains management in terms of transparency, traceability and efficiency. These three major benefits are discussed further in the following points:

Figure 1. Smart contracts benefits to supply chains management

Source: (Law 2017).



Transparency

Smart contracts can play an important role in building trust and confidence among the manufacturers and the consumers. The ability to save all the goods' information such as origins, date, location and quality on the Blockchain will result to improve transparency of SCM. Therefore, when these information are available, secured and can't be changed, the products can be easily proved and as a result, manufacturers and consumers can be more confident and assured about the originality and legitimacy of the products. Likewise, HSCM can benefited a lot of this technology in terms of transparency.

Traceability

Tieman and Darun (2017) stated that one of the challenges facing Halal supply chain management is the traceability or the ability of verifying the location and the product. Therefore, traceability can be a second benefit of smart contracts for SCM. The benefit can be represented by allowing the inventory to be checked and tracked along the way of the SCM processes. With advent technology such as IoT, real-time systems and connected devices, smart contracts can enhance the traceability even more in SCM. The sensors embedded on those devices will help to provide the necessary data such as location m, environmental condition which will be bases for supply chain mangers for taking faster decisions.

Efficiency

One of the smart contract features is that it's generally faster and convenient which help the processes efficiently. The efficiency of smart contracts can be represented by two main aspects: process and cost (Law 2017). The ease of use make the process of smart contract faster and available at any time comparing to traditional contracts in supply chain management. The second aspect that how supply chain management can be facilitated through efficiency is through cost reduction. As we know that typical

supply chain process required many physical documents and middlemen to handle all these processes, smart contracts can shorten these and reduce the cost.

FUTURE RESEARCH DIRECTIONS

To claim that product is a Halal product, a number of structured stages in HSC are needed and have to be tracked accordingly. The first stage is slaughterhouses and processing plants. In this stage, the materials are shipped to production/manufacturing place where a Halal certificate is issued and transported to the storage facility. The second stage is to distribute and transport to retailers/wholesalers. This stage need to be tracked by barcoding technology which is expensive to deploy (Supply Chain, 2018). As a result, when the items are delivered, there is no ways to track back product origins. Thus, any failures occurs in any of these processing parts, product is no longer classified as Halal. Above all, the current traceability system, for instance, in Malaysia, is manual and has no real-time tracking as well as its not widely trusted (Supply Chain, 2018).

BENEFITS AND PROMISES OF SMART CONTRACTS WITH HALAL SUPPLY CHAINS MANAGEMENT

Halal concept has become a popular and increasingly grabbed the attention of many Muslims and non-Muslims countries. The wide distribution of Halal food around the world, the increase in demands, rising population of the Halal food consumers and the huge revenues are among the reasons behind the popularity of this concept (Omar and Jaafar 2011). Therefore, the Halal supply chain is very sensitive matter towards Muslim consumers which make it more sophisticated and required special attention.

In other word, Halal supply chain is very complex that needs more commitment and rigor of the trading partners in terms of product isolation practices. Sometimes, the failure of these practices lead to the diminish of the consumer trust. To avoid all the above mentioned consequences and obtained the consumers trust and confidence, smart contracts in Blockchain technology is the promise solutions to Halal traceability issues and overcome many drawbacks. The reason behind that is, smart contracts using Blockchain technology can engender trust as the bases of this technology is designed with immutable tamper-proof database. Likewise, it can remove third parties to verify sources of products.

CONCLUSION

The aim of this chapter was to investigate the roles, benefits and promises of smart contracts on Halal supply chains management. The smart contracts applications on Blockchain technology are going to be used widely while the traditional contracts are nearing its end. The features that smart contracts possesses and because of the complexity and sensitivity of the Halal supply chains management processes, smart contracts can be a useful solution. Among the promises and benefits that smart contracts can affords to Halal supply chain management are: increase the trust among manufacturers and consumers, security and ease of use, reduce the payment for lawyers and eliminate middlemen. Finally, smart contracts is a new promises applications of Blockchain technology that will change the business world and bring it to a new business model.

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KEY TERMS AND DEFINITIONS

Blockchain: A list of records namely blocks, that are tied with cryptography.

Blockchain Technologies: Technologies that stored everything of value and prevent corruptions in many aspects of daily work and transactions.

Halal: Word originated from Arabic language that describe any food, deal with others based on Islamic law.

Halal Supply Chain Management: Sha'riah compliance of management of goods and services movement which transform raw materials into final products and distribute it to the end users.

Smart Contracts: Blockchain-based technology that make many parties to deal electronically based on prior sets of rules and agreements.

Wasta Effects on Supply Chain Relationships in the Middle East Region

14

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INTRODUCTION

Globalization and new rules of competition have forced many firms to revisit their relationship-building strategies for achieving a competitive position over their rivals in the global marketplace (Cannon, Doney, Mullen, & Petersen, 2010; Rita & Krapfel, 2015; Wiengarten, Fynes, Pagell, & de Búrca, 2011). The globalization of markets requires individual firms to build mutual trust and long-lasting business relationships with firms from different countries, each with its own unique and distinguishable culture (Hofstede, 1980). The accelerating expansion of supply chains beyond national boundaries coupled with the rise in product recalls in the global supply chain have encouraged management scholars to examine the effects of culture on trustworthy supply chain relationships (Carter et al., 2015; Choi & Wacker, 2011; Halldórsson et al., 2015; Hunt & Davis, 2012; Miles & Snow, 2007; Steven et al., 2014). Overall, prior supply chain relationships research has theorized cultural effects on supply chain relationships and trust as having a mediating or moderating effect on the long-term stability of a supply chain relationship (see Chandra & Kumar, 2001; Peters & Hogensen, 1999).

Although the extant research has made substantial contributions to knowledge, the research on cultural effects on long-term supply chain relationships is still patchy. A common concern relates to existing conceptualization and empirical scrutiny of cultural effects on supply chain that has largely relied on Western-driven cultural frameworks (e.g., Hofstede's cross-cultural paradigm) with a focus on highly advanced Anglo-American (e.g. USA, UK, Germany) and several other developed and emerging economies (e.g. Japan, South Korea, China, Singapore). Whereas the homogeneity of cultural frameworks in the context of developed Western economies is assumed to function as fundamental universal assumptions concerning national culture and supply chains, recent research has viewed such generalizations as unhelpful in explaining cultural orientations in the context of (non-Western) developing economies such as the Arab Middle East region (see Cannon et al., 2010; Graca, Barry & Doney, 2015; Soni & Kodali, 2011; Soltani et al., 2018). In this respect, Meyer (2006) has argued that "Asian management research should be able to make major contributions, for instance by explaining context-specific variables and effects, and by drawing on traditional Asian thought in developing new theories" (p. 119).

The research presented in this chapter is a quantitative study of the impact of Arab Middle East cultural values on long-term supply chain relationships in Jordan. The aim is to examine the impact of *Wasta* (الواسطة) network on the long-term supply chain relationship as well as the moderating effect of

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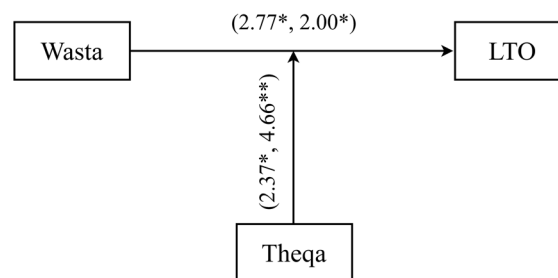
theqa(trustثقة)in this relationship in the Jordanian manufacturing sector. Jordan is an ideal locus for such research because, not only does it share almost the same cultural norms and attitudes with other countries in the region, but it has also been recognized as the most globalized country in the region (Abu Tahun, 2012). Focusing on privatization, it has adopted an open economy strategy to attract foreign investment. Globalization, low purchasing power in the Jordanian manufacturing sector coupled with limited natural resources have made Jordan an interesting research site for studying the effects of culture on supply chain relationships (see Noor, 2014).

The chapter starts with a review of the literature pertinent to national culture and supply chain relationships. It will then discuss the proposed research framework and development of research hypotheses. Next, it will describe the adopted research methodology followed by a presentation of the research findings. The chapter concludes with a discussion of research implications.

CONCEPTUAL FRAMEWORK AND HYPOTHESES DEVELOPMENT

As Figure 1 shows, the proposed research framework suggests that national cultural norms (i.e. *wasta*) have effects on the long-term supply chain relationships and that trust moderates the effects of national culture on supply chain relationships. In addition, trust could also have a direct effect on long-term supply chain relationships.

Figure 1. Conceptual framework



NATIONAL CULTURE AND SUPPLY CHAIN RELATIONSHIPS

A great deal of research has been undertaken to determine just what culture is and how various national cultures differ. Space does not permit a full review of this literature here. It must suffice to say that culture is best reflected in Hofstede and Hofstede's (2005) definition: "the collective programming of the mind that distinguishes the members of one group or category of people from others" (p. 4). In addition, while "cultural dimensions" have no limited list, the extant literature has identified a number of dimensions (Hall & Hall, 1990; Hofstede, 1980; Morden, 1999; Trompennars & Hampden-Turner, 1997; Schwartz, 1999).

Although the role of national culture has been investigated in various human behaviours such as consumer behavior, marketing, and human resources, operations and supply chain management has relatively little research on culture. For example, Hope and Mühlemann (2001) stated that production and operations management (POM) researchers have been relatively slow in examining the inter-relationships between POM practices and culture. Pagell, Katz, and Sheu, (2005) examined the influence of national culture

on operational decision-making. While their study found that national culture explains some variance related to the decisions with regard to the number of suppliers, extending the relationships, outsourcing percentage, the level of export, and the time horizon of forecasting, it did not show how and why culture is a factor influencing Operations Management (OM) decisions. Metters, Zhao, Bendoly, Jiang, and Young's (2010) studied national cultural effects on OM decision making, indicating that culture plays a role in a range of OM decisions in Asia such as location, shift scheduling, revenue management, and total quality management (TQM). Kull and Wacker (2010) examined whether cultural values in Asian (China, Korea and Taiwan) and non-Asian countries moderated TQM practices and evaluated how effective they were in improving quality performance. They found that implementing TQM practice is accomplishable, but such practice assumes specific cultural values in certain Asian cultures. Power, Schoenherr, and Samson (2010) concluded that the Western individualistic and industrialized countries invest more in structural resources such as physical and capital assets, and collectivist emerging Asian economies invest more in infrastructure assets such as team-based improvement programs. Wiengarten et al. (2011) reported that cultural dimensions influence investments in OM practices and operational performance. Graca et al. (2015) examined the impact of relationship capital and exchange climate on performance satisfaction between Brazilian buyers and USA suppliers and find that individualism moderates the relationship between trust and exchange climate (i.e. communication and conflict resolution). Metters (2008) studied the impact of national culture on off-shoring services in airline companies and argues that managers should modify their operational practices in light of the local culture. In a similar vein, Hope (2004) reports that national culture influences successful best practices among hotels in St. Lucia. Altogether, these bodies of literature suggest that national culture has important implications for the nature and scope of long-term supply chain relationships (see also Runyan, Sternquist, and Chung, 2010; Cannon et al., 2010)

In light of globalization and the emergence of a global marketplace, recent studies of operations and supply chain management has shifted the focus from Western settings to non-Western organizational and cultural contexts. For example, Fang and Kriz (2000) offered evidence from the Chinese culture by arguing that industrial marketing and purchasing (IMP) paradigm is not a universal paradigm. Instead, it needs to be modified to incorporate all cultures. Lee, Pae, and Wong (2001) developed a *guanxi* (i.e. personal relationship) model and examined its influence on relationship performance in Hong Kong and mainland China. In the same vein, Chung, Sternquist, and Chen (2006) studied Japanese retailer buyers' relationships with their suppliers and find that long-term orientation is an antecedent of trust and dependence, not an outcome. Jia and Lamming (2013) argue that cultural adaptation eliminates the negative impact of cultural differences on cross-cultural supply chain relationships between Western buyers and Chinese suppliers. Wiegel and Bamford (2015) found that *guanxi* plays an important role in buyer-supplier relationships in SMEs in China both as an organizational source and as a strategic tool to achieve organizational goals in approaching new and existing customers and suppliers.

The preceding review of the extant literature suggests that most of previous cross-border operations and supply chain management studies have focused on Western and developed countries and that Hofstede's cross-cultural paradigm has often been used as a theoretical lens for the evaluation of cultural effects on operations and supply chain decision making. Hence, few studies have tried to integrate various aspects of non-Western cultural norms to reach a better understanding of organisational decision making. More specifically, emerging Arab Middle East nations have been overlooked in past cross-cultural operations and supply chain management research (Soni & Kadoli, 2011). Consequently, there has been call for more research into the role of cultural values in buyer-supplier relationships in the Arab Middle East region – largely owing to the distinct religious culture and geo-strategic importance of the Middle East

to the global economy (Cannon et al., 2010; Doney et al., 1998; Friman, Gärling, Millett, Mattsson, & Johnston, 2002; Graca et al., 2015). As Fang (2010) observes, “The Hofstede paradigm with its focus on cultural differences can hardly capture today’s new cross-cultural management environment characterized by change and paradox in borderless and wireless cultural learning, knowledge transfer, and synchronized information sharing” (p. 155). Fang (2010) takes the argument further by asserting that:

in the twenty-first century, management faces new challenges because people in the twenty-first century are increasingly no longer bipolarized and isolated creatures but of multicultural identities and multi-cultural minds” and that scholars from developing economies such as Asia “need to learn from the West but at the same time need to have self-confidence and courage in using indigenous knowledge to make contributions to theory building with global relevance. (p. 155).

In light of the critiques of Hofstede’s (and several others) cross-cultural paradigms which have their roots in the West, coupled with their inability to capture the richness of distinct cultural traditions of non-Western societies (Javidan, House, Dorfman, Hanges & De Luque, 2006; Liao, Soltani, & Petrovici, 2010), this study uses the Arab Middle East cultural values as a theoretical lens to study national cultural effects on supply chain relationships. More specifically, the aim of this study is two-fold: (a) to explore the impact of Arab Middle Eastern cultural values (i.e., *Wasta*) on building long-term supply chain relationships, and (b) to examine the moderating effect of *theqa* (trust) on the relationship between *wasta* and long-term supply chain relationships from the perspectives of both buying and supplying firms.

Long-Term Buyer-Supplier Relationship

Long-term business relationships allow firms to move beyond short-term benefits and improve financial and non-financial performance of all members of the entire supply chain. Lambert, Emmelhainz, and Gardner define (1996) long-term relationship between supply chain partners as “business relationships based on mutual trust, openness, shared risk and shared rewards that yield a competitive advantage, resulting in business performance greater than would be achieved by the firms individually” (p. 2). The literature on long-term buyer-supplier relationships includes several constructs, including relationship continuity (Jena et al., 2011), commitment (Grayson & Ambler, 1999), and long-term orientation (Cannon et al., 2010). While these constructs differ, each enhances the relationship between buying and supplying firms. Given the paramount importance of the role of long-term relationship in fulfilling the goals of the all supply chain parties, the current study adopts Lambert et al. (1996) definition of long-term supply chain relationship and uses items largely adapted from Cannon et al.’s (2010) study of buyer-supplier relationships in international markets

Wasta and Long-Term Buyer-Supplier Relationship

Wasta or *Wasata* (وَاسِطَة) is an Arabic word which refers to using one’s connections and/or influence to cement a business deal and grow long-term business relationships. El-Said and Harrigan (2009) view *Wasta* as “to employ a middle man, a broker, ago-between or an intermediary (usually a person of high social status and accepted rank) to achieve one’s end” (p. 1238). Alwerthan, Swanson, and Rogge (2017) defined it as “broad set of practices in which an individual is expected to extend favors to family, friends and people from their tribe” (p. 1). *Wasta* overlaps in meaning with nepotism in English and *guanxi* in Chinese, amounting to the use of personal connections to gain something or getting something through

favoritism rather than merit. *Wasta* is a way of life in the MENA region and frequently practiced by both local and international businesses who use their connections as *wasta*. In the absence of a “no-nepotism” policy, *Wastahas* always been a mechanism for developing strong, productive, and enduring relationships in Arab countries, and its importance has only become more pronounced with the widespread ubiquity of cultural diversity and the desire for the establishment of a long-term harmonious business relationship. Loewe et al. (2008) studied the business climate and investment activities in Jordan, finding that 86% of the interviewees perceived *wastato* be of paramount importance in all kinds of interactions, and some 56% of the respondents admitted that they used their various means of personal connections to reach their goals.

Cunningham and Sarayrah (1993), Tlaiss and Kauser (2011) and Hooker (2008) noted that *wasta* was an important determinant of business decision making. Solberg (2002) observed that *wastain* its multitudes of forms (e.g., family relationships, social networks) accelerates the process of handling a document through an organization by accessing decision-makers inside the organization. Similarly, Barnett, Yandle, and Naufal (2011) viewed *wasta* as a tool that plays a part in facilitating the flow of business in Middle Eastern countries wherein a partner has a family member or a close friend with a high power status and is able to help speed up business transactions and support projects. Overall, the existing research highlights the paramount importance of *wasta* as an intrinsic part of the MENA culture and a morally accepted business practice that serves as the beginning and sets the tone for a successful long-term business relationship (see Aljbour & Hanson, 2015; Berger et al., 2015). In fact, recent research identified *wasta* as the cornerstone in a social organization and serves as a basis for the continuation of a business relationship in the future (Brandstaetter, Bamber, & Weir, 2016; Weir, David, Nabil Sultan, & Van De Bunt, 2016). Recent evidence has shown that using *wasta* through politico-business networks is important since it enables access to current information that is crucial for the success of SMEs. The concept of *wastah* has also been mentioned in relation to financial resources and suppliers. Findings revealed that strong relationships with suppliers enable firms to get financial resources in the form of trade credits (Sefiani, Davies, Bown, & Kite, 2018). Despite the prevalence of *wasta* across the Arab World as an intrinsic part of the culture and a way of conducting business, it has also been cited as one of the main obstacles to good governance and economic development in the MENA countries. While *wasta* or favoritism has recently received growing attention in the Asian cultural studies, very little research focused on the use of *wasta* and its effects on business climate in MENA countries (Hutchings & Weir, 2006). Therefore, it is hypothesized that:

H1a: *Wastais* positively related to long-term buyer-supplier relationships in the Jordanian manufacturing sector.

Moderating Effect of Theqa (Trust)

Theqa is equivalent to “trust” in the Western context. Trust has been extensively studied in the literature, which has demonstrated trust as a critical factor for developing successful long-term relationships. Several model studies have posited trust as a mediating variable (e.g., Chandra & Kumar 2001; Ferro et al., 2016; Morgan & Hunt, 1994; Nyaga et al., 2010; Peters & Hogensen, 1999). Furthermore, researchers have distinguished between in-group and external trust (Huff & Kelly, 2003). In the Middle East, people are very trusting and empathetic towards their in-group members and subordinate personal goals to achieve the group goal (Elahee, Kirby, & Nasif 2002; Power et al., 2010). Moreover, there is a great level of integration between members, which enhances the building of trust via a transfer process (i.e., *wasta*) (Doney et al., 1998). Solberg (2002) found that the purchasing process in Arab countries followed the

Western model, except that developing trust between exchange parties takes longer, which was evident in the slow decision processes within Arabic organizations. Doney and Cannon (1997) identified five processes of building trust, noting the transfer process as one of these whereby a third party facilitates the initial meetings (i.e., *ta'arof*) and conversations between parties (Javidan & Dastmalchian, 2003) and helps to transfer *theqa* (i.e., trust) from the *wasta* as a “proof source” to another party to build a friendly environment. Therefore, *wasta* (i.e., *waseet*) works as a mechanism to transfer *theqa* and friendship between exchange parties. *Waseet* is a helpful component in facilitating the joining of a party in *wasta*-closed circles, which provides access to advantages and builds business relationships (Loewe et al., 2008; Tlaiss & Kauser, 2011). Therefore, it is hypothesized that:

H1b: Theqa moderates the positive relationship between *wasta* and buyer-supplier relationships in the Jordanian manufacturing sector.

Research Context

The Middle East and North Africa (MENA) region generally and the Arab Middle East region in particular offer great opportunities for international business and foreign investment on several fronts. The young population, averaging 25 years old, less than any other region, presents a great opportunity both as a market and a source of labor. Renewable energy has become an important opportunity for investment in non-oil trade in the MENA region. With 60% of the oil and 45% of the gas reserves in the world, the resource-rich countries in the region still represent great assets for many countries. Overall, the MENA region offers a significant market in terms of tourism, manufacturing, services, and agribusiness (O'Sullivan, Rey & Mendez, 2011). While companies around the world have recognized the long-term economic potential in the region and are willing to invest outside the oil and gas sector, cultural issues have been cited as having a major impact on their decisions to operate in the region (Economist Intelligence Unit, 2011). The region is becoming a home base for many multinational corporations (MNCs) that are dominant players and control a significant market share in almost all region countries in different sectors (Soltani & Wilkinson, 2011). Local companies could benefit from the MNCs and act as active partners of the supply chain for these MNCs. Multinational corporations bring new technology into the market that can help local companies become innovators rather than imitators. This in turn shapes managerial thinking and practice and assist local business partners to catch up with international standards (Zahra, 2011). Altogether, the MENA non-oil export potential, its potential to be a profitable emerging consumers market for international firms, and the need for local business partners to establish a trustworthy long-lasting business relationships have motivated the current study.

Research Design

Sampling and Data Collection

Data for this study emerged from questionnaires distributed across two samples: buying firms and supplier firms. The questionnaires were translated and back-translated using standard procedure (Ralston et al., 2012). Questionnaires were administered in Arabic as this was the country's and the respondent's language. To ensure that a wide range of industries were included in the response base, the Amman Chamber of Industry (ACI) database was used to select the buyer firms. Then the buyers were asked to provide the researchers with the supplier contact details. Due to the challenges in random sampling and respondent access in the Middle East, we employed a drop-off and pick-up method commonly used in

this region (Ralston et al., 2012). This technique resulted in a high response rate compared to previous results in the literature (e.g., Cannon et al., 2010; Chung et al., 2006; Jena et al., 2011). Overall, a total number of 652 completed questionnaires from both buying ($n = 350$) and supplying firms ($n = 302$) were collected within a five-month time period (January to May 2013).

Measurement

To measure the respondents' perspective, researchers adopted survey measurement items from past studies where appropriate. Each survey contained items representing three constructs. The constructs were *wasta* (Al-Ali, 2008; Coyne&Collins, 2009), *theqa* (Cannon et al., 2010; Doney & Cannon, 1997; Jean et al., 2010), and long-term orientation relationship (Cannon et al., 2010). All measures used a five point Likert scale (where 1= "strongly disagree" and 5= "strongly agree").

Sample analysis

The majority of respondents (34.3% for buyers and 39.40% of suppliers) were general or sales managers. While 50% of respondents in the buying sample had a business relationship up to five years with their suppliers, 37.7% of suppliers had 6 to 11 years of business relationship with their buyers. Table 1 provides a summary of descriptive analysis of the sample organizations in terms of length of business operations, size and market share.

Table 1. Descriptive analysis of the sample organizations

Category	Buyers	Suppliers
Company's age (0-11) years	58%	52%
Number of employees (1-300) employees	90.9%	86.4%
Market share (0%-10%)	40%	38.4%

Analysis procedure and results

The Statistical Package for the Social Sciences 20 (SPSS) program was used to test the hypothesized model. The completed questionnaires were used to test the construct's reliability and validity as well as the research hypotheses.

Assessment of validity and reliability

To assess the validity and reliability of scale measures, we conducted principle component analysis (PCA) and Cronbach's alpha statistic. For the total sample, the scale reliabilities (Cronbach's α) for the dimensions exceeded the recommended value of 0.70 (see appendix) (Jena et al., 2011). To assess the validity of scale, a number of steps were taken as follows. First, we reviewed the literature pertinent to research phenomena and gained feedback from academics during the course of pilot study. Second, we performed an exploratory factor analysis (EFA) to explore the validation of the construct using varimax rotation (Wiengarten et al., 2011). Principle component analysis (PCA) resulted in dropping 10 items

from the buyer's survey and 11 items from the supplier's survey—largely due to low factor loading (<0.40) or cross loading. The retained measures had high factor loading, and all Kaiser-Meyer-Okin (KMO) values for all constructs exceeded the recommended value of 0.60 (Gray & Kinnear 2012). Bartlett's Test of Sphericity reached statistical significant ($p < 0.05$).

Hypothesis Testing

Multiple regression analysis was used to test the research hypotheses. Prior to testing the hypotheses, the data were tested for linearity and multi-co-linearity (Wiengarten et al., 2011). Since none of the cultural dimensions were highly correlated, the likelihood of multi-co-linearity was low (Wiengarten et al., 2011). Moreover, the variance inflation factors (VIFs) were calculated to detect any possible threats. Results indicated that VIFs were all less than 2 (i.e. less than the commonly used threshold of 10)—an indication that multi-co-linearity was not a concern (Field, 2005; Wiengarten et al., 2011). As Table 2 seeks to suggest, the results provide support for the hypotheses meaning that both hypotheses were significant at 0.05 and 0.01 levels from buyers and suppliers perspectives, accordingly.

Table 2. Wasta regression analysis (H1a and H1b)

Independent variable	Dependent variable LTO			
	Buyers Model		Suppliers Model	
	β	t-test	B	t-test
<i>Wasta</i>	0.147	2.770**	0.089	2.00*
<i>Theqa</i>	0.682	17.288**	0.741	19.120**
<i>WastaXTheqa</i>	0.096	2.370*	0.176	4.666**
R ²	0.483		0.584	

* $P < 0.05$, ** $P < 0.01$

DISCUSSION AND FUTURE RESEARCH DIRECTIONS

The role of cultural values in business relationships is a field of growing potential and importance due to several reasons namely, (i) the trend for increasing international trade across national boundaries and (ii) the shift in the global economic balance of power from homogeneous Western industrialized nations to the developing and emerging markets across Southeast Asia and the MENA region driven by unique religious cultural norms and traditions. The current study contributes to this debate through analyzing the cultural effects on long-term supply chain relationships in the Jordanian manufacturing sector.

In accordance with previous research (e.g. Cannon et al., 2010; Hope & Mühlemann, 2001; Metters, 2008; Pagell et al., 2005; Wiengarten et al., 2011), the results of the current study provide support for cultural effects on supply chain relationships from the perspective of buying and supplying firms. Both perspectives support *wasta* as a widespread cultural norm in the Middle East region. *Wasta* works as a loyalty system for the in-group members. It also facilitates the paperwork for the in-group members with the government. In the Middle East business environment, business partners (buyer or supplier) prefer to keep working relationships with their business counterparts (supplier or buyer) organization who has *wasta*. Solberge (2002) views *wasta* as an influential factor in handling the paperwork by giving access to the decision-makers inside the organization. *Wasta* in the MENA region is connected to a

person with high reputation, status, or power between the in-group and out-group people. Because of this high reputation, the exchange partners have the *thaqat* (trust) in the *wasta* person and a person from the *wasta*'s side. Therefore, the exchange partner accepts the business process and contract terms with the partner after negotiation because both of them respect the *wasta* and work closely to save face. This is consistent with Doney and Cannon's (1997) study of the process of building trust which is transferred through a proof source. The findings have also close affinity with the results of cultural studies in other developing economies (e.g. China) in a sense that personal connection has been reported to influence the nature, scope and length of business relationships (see Lee et al., 2001).

The results of the current study suggest a need to revisit and integrate theories of culture into buyer-supplier relationship research. In contrast to previous Western-dominated cross-cultural studies of long-term business relationships, the current study contributes to the debate on conceptualization of supply chain relationships with a focus on distinctive religious culture of the Arab middle East region (see Cannon et al., 2010; Jia & Lamming, 2013; Matters et al., 2010; Metters 2008; Pagell et al., 2005; Power et al., 2010;).

The findings can assist the management of regional and multinational firms operating in the MENA region to better understand context-sensitive and culture-specific issues that are deemed essential in optimizing supply chain relationships. The successful implementation of supply chain strategy in the long-term hinges on the ability of exchange partners to develop and maintain trusting relationships as well as a willingness to accept cultural differences and embrace and promote cultural awareness. International managers should recognize that Arab Middle East nations (in particular Gulf Cooperation Council or GCC countries) have recently undergone a number of structural changes in a bid to spur capital influx and stimulate their oil-reliant economies. Ease of setting up and doing business, improving procedures to access credit locally, reducing bureaucratic interruptions, and launching processes to improve transparency are examples of recent mechanisms by the GCC countries for integrating into the global economy and making the Arab countries the preferred investment destination in the region. To reap the benefits of globalization and penetrate this largely untapped market of the Arab Middle East economies, international managers from both individualist and collectivist cultures should make concerted efforts to minimize the cultural differences with their MENA-based business partners. Managers from individualist Western cultures as well as from collectivist, Muslim minority, Eastern countries (e.g., China, India, Southeast Asia) need to appreciate the extent to which Islamic doctrine and thinking (religious culture) are intertwined and permeate all levels of society (Vogel, 2002, cited in Lagace, 2002). In essence, our findings instruct international managers interested in long-term business relationships in the Arab world to recognize and assimilate the peculiar cultural traits of the Arab world. As Mahajan (2013) succinctly put it, "Companies that gloss over the interplay between culture and religion ignore a critical factor for success in the region". In a similar vein, Hays (2002) observed that "Executives who understand the basic tenets of the Islamic religion as it relates to commerce will have an easier time abroad".

In international businesses, the MENA region's strategic location positions it as a global hub, a candidate for becoming the most important developing economy for global opportunities. These opportunities to invest in different sectors in the MENA region still need a suitable entry method on the part of international businesses. International firms need to find a local partner and hire local staff. This requires foreign businesses to concentrate on understanding the unique cultural norms of the region and minimize the cultural differences for fostering global integration. Effective and feasible solutions to cultural differences in international business relationships require policy makers to take proactive steps to further boost foreign investment in the region. Policymakers need to focus on reforms that help their countries catch up with their peers on issues such as investor-friendly and free trade policies, establishment of

new free zones, and state-of-the-art infrastructure (Abbas, 2018). The Arab Middle East governments need to play the linking role among the parties involved in business relationships. They need to focus on strengthening the relationship between the parties to ensure business continuity through effective buyer-supplier relations policies.

CONCLUSION

The aim of the study was to explore the implications of Arab Middle East cultural values (i.e., *wasta* and *theqa*) for long-term buyer-supplier relationships and the manners in which *theqa* interplay between *wasta* and supply chain relationship. Unlike a majority of previous similar research that adopted Hofstede cultural paradigm as their theoretical lens, the current study examines the buyer-supplier relationships through the unique cultural values of the Arab Middle East region. Using survey data gathered from both buying and supplying firms operating in the Jordanian manufacturing sector, this study shows a general consensus that long-term buyer-supplier relationship is significantly affected by the religious cultural norms of the Arab world and that the moderating effect of *theqa* appears to vary between buying and supplying firms.

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KEY TERMS AND DEFINITIONS

Guanxi: Is personal connection in Chinese culture.

National Culture: A set of norms, values, attitudes, and behaviors.

Supply Chain Relationships: On-going relationships between two firms with, at a minimum, a commitment from each party to engage in long-term business projects.

Theqa: Is equivalent to “trust” in the Western context.

Wasta: Is a social behavior based on whom one knows or networks.

Section 15

Organizational Management and Communications

Types and Challenges of Expatriation

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INTRODUCTION

Based on the Latin etymological root (*expatria*, outside of the mother land), expatriation comprises all individuals residing temporarily or permanently in a country other than the one in which they were born (González & Oliveira, 2011). However, the management literature clearly differentiates terms as expatriate and immigrant, in which the former is associated with individual sent abroad by the firms they work for, and the latter with individuals that left their countries, normally for socio-economic conditions (González & Oliveira, 2011).

The thriving economic globalization process has led to a clear increase in the number of migrants, expatriates and mobile employees, which has led the academic community to focusing on the expatriation phenomenon, especially in the process of adaptation of those expatriates to the countries of destination (Black & Mendenhall, 1991; González & Oliveira, 2011; Shaffer, Harrison, & Gilley, 1999; Wang, 2002).

Expatriation has been studied based on the interest of many multinationals in sending their managers/executives abroad, since qualified and skilled expatriates are major intangible assets to their companies when it comes to compete in the global market. (Black & Mendenhall, 1991; Shaffer, Harrison, & Gilley, 1999; Wang, 2002; Bonache, Brewster, Suutari, & Cerdin, 2018; Tahir, 2018). However, expatriation has also been studied from the point of view of small and medium-sized enterprises, although with less intensity (Ribau, Moreira, & Raposo, 2018). From the managerial point of view, the expatriate lives temporarily in a foreign country. Expatriation is the act of transferring an executive, eventually his/her family and children, to another subsidiary of the company, located in a different country and culture (Bonache et al., 2018).

When internationalizing a company, expatriation works as a way to solve the problems of lack of professionals with technical and managerial skills. Expatriates are also of added value to the company in the implementation of new projects.

When one experiences times of crisis, the tendency is to seek a better life in another country, yet expatriates tend to do it in ways different from what the ordinary migrants do. They are more adventurous, fearless, and willing to take more risks, bearing in mind that expatriation is seen initially as a temporary experience, something enriching and less like a necessity. Expatriates' performance is a multidimensional

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construction that encompasses the dimensions of cross-cultural adaptation and requires success of the international mandate, i.e. achieving the goals proposed, managing local employees, leading the foreign affiliate, scanning the economic environment and appropriately dealing with important international counterparts.

With the globalization process, expatriation has been growing and tends to be seen as an important step in the development of an international professional career. As a worldwide phenomenon, expatriation is guided by a constantly dynamic working relationship between employer and employee (Jokinen, Brewster, & Suutari, 2008).

Although there is extant research on expatriates, it addresses career-based and business-based expatriation as *“business expatriates, defined as, legally working individuals who reside temporarily in a country of which they are not a citizen in order to accomplish a career-related goal, being relocated abroad either by an organization, by self-initiation or directly employed within the host-country”* (Selmer et al., 2018, p. 136).

The expatriation process ends with repatriation and means that the international assignee returns to his/her home country with family members with whom he/she had expatriated in first place. Regarding this final phase of expatriation, that can be alone a very complicated process, there are already many studies trying not only to understand its complexity but also seeking improved strategies to solve difficulties that the repatriates may face (Chiang, Van Esch, Birtch, & Shaffer, 2018).

In this chapter expatriation is scrutinized in depth in its several dimensions, due to the complexity of the concept and bearing in mind the singularity of the different terms and concepts. This chapter also addresses the impact they might have in the economy and other variables such as gender, social class, or country of origin. This chapter focuses on differentiating five major realities: migration; assigned expatriates (AEs); self-initiated expatriates (SIEs); lifestyle expatriates; and expatpreneurs. The former focuses on survival, whereas the latter are more related to personal realization. Clearly, the expatpreneurs concept combines expatriation with entrepreneurship.

This chapter is divided in six different sections. After this introduction, that comprises the first section, the research method is laid down in the second section. The literature review is presented in section three and covers several types of expatriation. The discussion and conclusions are addressed in section four. Finally, section five presents the future research direction.

RESEARCH METHOD

In order to prepare this chapter a research was carried out in the SCOPUS database. Eight articles were analyzed taking into account differences in approaches of the expatriates. The objective was not to analyze in depth the articles, nor the variables / constructs that compose them, but to explore the most important different perspectives embracing the terms covering expatriation. As such, as referred to in the introduction section it was decided to embrace the analysis of five peculiar but complementary approaches: migration; assigned expatriates (AEs); self-initiated expatriates (SIEs); lifestyle expatriates; and expatpreneurs.

Expats profiles are presented and explained according to the reasons of their expatriation and behaviors taken abroad. The main reasons that motivate leaving the country of origin determine the enrolment in the new country with positive interaction and sharing of common interests, stimulating cooperation and good performance, as well as diminishing situations of bias and stress. The inverse also happens.

In order to analyze the findings regarding expats, the eight articles were analyzed, their information compiled and crossed-over, and subsequently their differences discussed.

LITERATURE REVIEW

The concept of expatriation encompasses other associated concepts, taking into account the role of the expatriate. Although there are several typologies associated to expatriation (Guttormsen, 2018), one can claim that there are two large expatriate groups (Selmer et al., 2017): self-initiated expatriates (SIE) and company assigned expatriates (AEs). AEs are expatriated through the organizations they represent and for which they will perform a particular function outside their country of origin. According to Selmer et al. (2012, p.1286), SIEs *“initiate and usually finance their own expatriation and are not transferred by organizations; they relocate to a country of their choice to pursue cultural, personal, and career development experiences, often with no definite time frame in mind.”* As referred by Selmer et al. (2017) and Tharenou (2013), the introduction of SIE research was very important in understanding the different roles of expatriates, which includes those who go abroad primarily for the perceived value of international work experience, and those who seek a long-term personal and professional development. Selmer and Luring (2012) analyze the work outcomes and the reasons for expatriation by SIEs. This study is based on a category proposed by Richardson and McKenna (2002), where they categorize people for the reasons that lead them to leave the country by themselves and not by a company. This typology is divided into four categories: the Refugee; the Mercenary; the Explorer; and the Architect.

The refugee is normally associated to people that leave the country because they want to escape their routine. The refugee is simply motivated by changes related to her/his life. Secondly, the mercenary is a person who is motivated by financial incentives, i.e. for opportunities to make more money than in his/her home country. Thirdly, the explorers are people who expatriate by the sense of adventure and the curiosity to know new places and cultures. Finally, the architects are individuals looking to develop their careers seeking better career opportunities (Richardson & McKenna, 2002; Selmer & Luring, 2012).

To ascertain the relationship between these categories and work outcomes, Selmer and Luring (2012) divided the results in three variants: work performance, work effectiveness and job satisfaction – and applied a questionnaire to academics in 34 universities in Nordic countries and in the Netherlands. The results of this study showed that all individuals, regardless of the category, perceived their performance as valid and considered themselves to be effective in their work, which they were satisfied with. According to the reasons for expatriation, the Explorers and Architects had a higher score, which infers that Explorers have a better job satisfaction and that Architects look for a higher job performance and superior effectiveness (Selmer & Luring, 2012).

Although there are many more studies on AEs than about SIEs, Jokinen, Brewster, and Suutari (2008), under the premise that SIEs are a significant number when compared with the number of AEs, intended to contribute to greater information about SIEs. So, the authors conducted a study in order to compare the performance of the two groups, considering three variables relevant to the analysis of the employment status as an individual and as an expatriate: knowing-how, knowing-why, and knowing-whom. Taking into account those variables, they drew up the questionnaire, which was directed only to Finns on a range from minimal qualifications up to masters' level in economics and management. The sample consists of 222 surveys considered valid for analysis.

The knowing-how sets essentially the skills and knowledge of the work performed. Jokinen et al. (2008) consider that work experiences on an international level reinforce the knowledge already acquired

in the country of origin and allow the acquisition of new skills that stimulate the confidence of the individuals, since in an international environment the expatriates felt a greater demand on themselves. The results obtained with the questionnaire are in line with these assumptions, since there is no great difference between the two groups. However, those results do not reveal an increase in the business knowledge as originally expected.

When discussing the knowing-why variable, i.e. the reasons for the performance of the various tasks that are related to self-confidence and motivation towards a particular career path, both groups had positive and very similar results. These skills are seen as essential for a good performance of the individual in her/his tasks. About the international work experience, individuals believe to be stimulating their skills, increasing their self-confidence and their value as professionals, being seen as a future investment. The knowing-whom is connected to social and professional relationships, both inside and outside the company, i.e., to the individuals network of contacts. With international experience, there is an expansion of this network, especially for expatriates through companies with which they are related, with a multiplicity of types of more or less formal relations. This premise was also clear in this study, in which it is noted that, although most claim their social skills increased, there are differences between SIEs and AEs in the connoisseurship of the organization, being naturally lower for the SIEs. By definition, as SIEs have no previous connections with the company where they are working for, they are expected to experience lower mobility.

In terms of career progression, AEs show higher values than SIE, which can be justified by the fact that the expatriation of the AEs is due to promotions in their careers, while the SIEs start their expatriation on a significantly lower level when compared with AEs. In this group, and for the variables analyzed, public sector workers showed significantly lower values of development when compared with those who performed functions in the private sector. Thus, the main conclusions of the study are clear: the performance of a professional activity outside of the country of origin improves the general professional skills of the individual, for both groups of expatriates. The individuals are not dependent on the employer as they and can autonomously create their experiences and be successful within them (Jokinen et al., 2008).

Related with the concept of expatriates, it is the concept of expatpreneurs as “*being defined as an individual temporarily living abroad who initiates an international new venture (self-employment) opportunity in the host country*” (Selmer, McNulty, Luring, & Vance, 2017, p. 137). This notion of expatpreneurs evolved recently to be considered a subtype of expatriates on its own (SIEs), although this simplification could impoverish both the debate on the subject and on the general knowledge of this specific subtype. The growing importance given to entrepreneurship as the engine of local economic development cannot be ignored as well as the growing immigrant and entrepreneur population, substantially more efficient than the resident population in terms of success at undertaking new businesses. As such, it becomes relevant to analyze with greater attention this subtype.

Without disregarding migratory fluxes and economic and institutional general circumstances, Selmer et al. (2017) present several important individual factors in the analysis of this subtype of expatriates, educational level, gender, marital status, position, time in current job in host location, time the expatriate and time in host location.

The authors also distinguish expatpreneurs from expatriates who leave their country seeking better living conditions. As such expatpreneurs tend to move to a new country and there establish themselves as citizens. Expatpreneurs define themselves as expats on their own account because they only intend to stay temporarily in the host country since they invest in their career and feel free to take up any better proposal. They are portrayed as people gifted with the capability to recognize the potential of the host country and are particularly keen on taking risks. On the other hand, the capability to be involved in

social and relational engagement with people in the host country emphasizes this phenomenon. Expatpreneurs may have initially started their path as AEs or SIEs but when facing new opportunities and possibilities in terms of network contacts, they embrace a new challenge. They are also characterized as having better market assessment skills, which allows them to embrace advantageous opportunities in the host country (Selmer et al., 2017).

To find the key factors that could define the differences between expatpreneurs and the other self-initiated expatriates, Selmer et al. (2017) sent a survey to several expatriates living on China, Hong Kong, and Singapore. Based on 268 answers SIEs and 57 from expatpreneurs, the results showed that, when compared to SIEs, expatpreneurs were older, had longer experience as expatriates and had higher corporate positions, which highlights the importance of time and experience for individuals to self-develop and self-employ themselves. Aware of these differences, it became clear the need to differentiate the multiple expatriates' profiles, not only to understand but also to better apply the several procedures when hiring and managing expatriates with clear consequences for corporate human resources management policies (Selmer et al., 2017).

Following a different perspective, Vance et al. (2016) analyze the shared and unshared features among SIEs distinguishing expatriates and migrants in specific scenarios, in the European Union. It is important to refer to the visible goal to have a different citizenship and its relation with migration, especially in the European Union, where there are incentives for the freedom of movement of European citizens in European space. Expatriation tends to be seen as more temporary compared to migration, as expatriation is normally sought after by those seeking personal and professional development who want to achieve specific goals and adventure in a certain period of time of their lives. Specifically, the SIEs seek for international professional experience and the development of leadership competences. As a result, the organizations they are part of tend to be more positive and the host countries benefit largely from the knowledge and know how transfer, providing a sustainable growth and development of the economy where SIEs are settled. This phenomenon tends to increase stimulated by the current technological advances, by a more globalized world, by the free movement of people and goods and by the encouragement of foreign direct investment (Vance et al., 2016).

Eisenberg et al. (2015) presents the case of Poland, an Eastern European country with a specific social, economic, and political reality that only recently became a member of the European Union. They analyze the case of expatriates in Poland. Eisenberg et al. (2015) starts by highlighting the fact that as an Eastern European country, with all its defining traits, its integration on the EU led to an inevitable change in the national economy, which is now considered a market-based economy. Considering the Polish economic framework and its differences to the EU economy, it became a necessity to change and adapt the management style of Polish managers. Since the Polish management leadership style was very autocratic, the Western Europe expatriates were fundamental to Poland to adjust and be successful before this new social, economic and political reality. Eisenberg et al. (2015) analyze how Western expatriates have taken part of the changing paradigm at the economic scenario and how this was perceived by the Polish workers (Eisenberg et al., 2015).

To understand the effects of these expatriates in Poland, a survey was applied to a sample of Polish workers led by Western European expatriates. Some interviews were afterwards carried out to a sample of these expatriates. The results show that the Western Europe leaders were perceived as more honest, more able to motivate and inspire, more capable to communicate, relate and more tolerant, when compared to the general Polish leaders, who were described as more authoritarian, evasive, egocentric, and more oriented to administrative labor. The respondents also perceive the Western leadership and management style as being three times more efficient, although the adjustment takes time and the gen-

eral Polish workers still felt they work better with Polish leaders, with its authoritarian performance, which is typical from countries that were under the soviet influence. The ones with working experience with foreigner leaders felt more open and prepared to work with them. The foreign managers were encouraged to adapt their leadership style, actions, and decisions to the host country as a way to prevent cultural crash, however without disregarding the necessary and desired change. Analyzing the role of expatriates in Poland, one can argue that their work was crucial to bring Poland closer to the European Union. Nowadays it is possible to see a balance between the Polish leadership profile and the Western leadership style as more people oriented. The merge of those different leadership approaches leads to more global and open organizations, which is very important in the current globalized world.

Expatriation is a complex phenomenon that not always reaches the intended goals. Therefore, many companies may face some problems with their expatriate employees, as some of them quit their jobs, while other underperform, way below from original expectations, and in some cases they are recalled back home or resign, which in fact also signifies losses of Million Dollars to the firms for each unsuccessful expatriation. Thereby, the selection procedure and preparation must be carefully considered as well as the adjustment process, which must be also seen as multidimensional concept involving several variables (Tahir, 2018). Considering these situations, Nunes, Felix, and Prates (2017) analyzed how cross-cultural adaptation and cultural intelligence could promote a positive expatriate performance. For that they analyzed a sample of 217 expatriates from different nationalities living in Brazil.

Based on the contact theory, Nunes et al. (2017) argue that the closer the interpersonal relationships of the individuals, the greater will be their level of happiness. Although the proximity of personal relationships is more typical of individuals with similar characteristics, one can infer that this factor has relevance among expatriates and interferes in their performance, since their level of happiness is directly proportional to the level of general performance of the individual, as well as their self-evaluation. Positive interactions and sharing of interests encourage cooperation and good performance and decrease situations of prejudice and stress. The reverse is also valid: negative experiences regarding personal relationships negatively affect the cognitive performance of the individual. For interactions to be successful, it is necessary for the individual to self-regulate and adapt his/her emotional intelligence. In this regard, and taking into consideration the universe of expatriates, the interpersonal relationships that expatriates develop in the host country influence their degree and ability to adapt to the requirements of the new culture.

In this sense, cross-cultural adaptation is seen as an important antecedent in the performance of the expatriates' tasks and presupposes a positive impact in the quality of the integration of the expatriate in their host country and, consequently, in the performance of the task performed (Agha-Alikhani, 2018). This concept is associated with cultural intelligence, a multidimensional construct that links cognitive, meta-cognitive, motivational and behavioral dimensions, i.e. the ability of the individual to interact satisfactorily in different cultural contexts. Cultural intelligence is understood as a capability to successfully adapt to non-familiar cultures and to be successful in situations characterized by cultural diversity. As such, it is expected from an individual with a high level of cultural intelligence to have a better capability to relate with different cultures, while cross-cultural adaptation is the degree of comfort towards situations of greater or lesser degree of difficulty with which the individual is confronted in the host country. Cross-cultural adaptation can be divided in general, labor, and interactive adaptation (Nunes et. al., 2017).

Although the research results show a correlation between cultural intelligence and cross-cultural adaptation, no correlation was found between cultural intelligence and the expatriates' performance, but the correlation between cross-cultural adaptation and the expatriates' performance was found to be significant. As such, it is possible to infer that individuals with high cultural intelligence do not neces-

sarily have a satisfactory performance. This will only happen if the cultural intelligence leads to a better cross-cultural adaptation, which will effectively contribute to a better performance.

Relating to the concept of expatpreneurs, Stone and Stubbs (2007) studied the relation between “lifestyle migration” and entrepreneurship in rural areas of France and Spain. They begin by explaining entrepreneurship associated with migration aiming to study the connection between lifestyle migration, entrepreneurship, and the specificity of the location in order to put forward a conceptual framework relating these three concepts. However, this study focuses on the self-employed, within entrepreneurship.

Stone and Stubbs (2007) conducted a field study about entrepreneurship within the expatriates’ community in four rural locations in France and Spain. To do this, they did interviews, combining with open and closed questions, as well as observation techniques to gather information about processes, attitudes, and interactions. The results indicate that almost all the interviewees chose the residential and migration location based on the climate and scenery, having often been visited there in previous vacations. Few of the interviewees migrated with ideas and business plans to begin their start-ups. Furthermore, even a smaller number of the interviewees stated that they would go to the chosen location because it was a good opportunity for a business (Stone & Stubbs, 2007).

Different levels of qualifications and education were found between the two countries. In France, most of the expatriates had higher education and some of them had tertiary education. Likewise, half of the expatriates in France had experience working abroad before the expatriation decision, with half of the interviewees having experience as entrepreneurs. On the contrary, in Spain, most of them did not have qualifications and skills (Stone & Stubbs, 2007).

The greatest contrast was the ability to speak the local language. In France, all expatriates self-evaluated themselves as fluent (Stone & Stubbs, 2007), while in Spain the expatriates showed difficulties with the language. This situation can be explained by the difference between the level of education and the previous experience working abroad (Stone & Stubbs, 2007).

The study also looked at which motivations made the expatriates want to build their own start-ups. The most common reason was that a start-up was a way to continue with their lifestyles and that they did not want to work for others or have the same kind of job that they had before the expatriation. Few of the interviewees chose the location to where they were going based on business opportunities, meaning that the ideas about start-ups were only advanced after the interviewees reallocated themselves and engaged in the following solutions: a way to have funds to continue their lifestyles; as an idea of fun; as a challenge; or to have something to do (Stone & Stubbs, 2007).

It is important to mention that business was a very positive to revive the rural areas of France and Spain, where there was a positive local impact for employment, but also the sharing of culture because of these start-ups.

One can conclude that self-employment can be considered a result of migration, even if expatriates did not have the idea of starting a business, since they could spot the business opportunities in the areas where they were and, regardless of the reasons that have led them to grab these opportunities and to create their own businesses, it is always seen as positive point because it can lead to the best use and revival of those rural areas and bring benefits both to the people living there and to the expatriates.

When analyzed following a gender-based perspective, expatriation seeks to find an explanation to understand what leads women to follow a SIE-perspective and not a company-assigned perspective. Apparently this occurs as most of the companies do not select women for their expatriate roles, contrary to what happens with men. Based on this gender discrimination, women end up opting for SIE roles. In addition to this, according to Tharenou (2010, p. 75) there are also “(...) *disadvantage, gender bias, and inequality of opportunity*.” These reasons lead women to leave their country and seek better work-

ing conditions and better opportunities for developing their careers, which they often do not get in their home country. On the other hand, there are situations where women want to flee oppressive cultures and societies and seek freedom. Socially accepted gender roles often prevent women from seeking employment abroad and have to relocate. In this context, expatriation is best seen for single and childless women (Tharenou, 2010).

Complementarily, Tharenou (2010) points out that expatriation may not always bring positive outcomes, since the same treatment that women suffer in the country of origin may also be felt in the host (or relocation) country. In her article, she points out that some studies on the subject indicate that women who go abroad benefit from career development. However, when they are about to return to their home country they do not receive as many benefits as men do. Tharenou (2010) concludes that for women to be able to secure the best conditions and job opportunities and to benefit their careers they must be proactive in finding options and career opportunities and that, despite expatriation, SIE can be a response to some careers, although it is not a solution to the unfair treatment women are subjected to.

DISCUSSION AND CONCLUSION

Expatriation is not a fully delineated phenomenon. Its definition has undergone constant mutations over time. As the world changes, so expatriation does, as it adapts to new challenges and evolves. If the definition initially encompassed only individuals leaving their country, the profile of expatriates has been changing over time showing distinctions between groups of individuals as well as differences within the same groups.

Self-initiated expatriates and company assigned expatriates are the two largest groups and within these, mainly within the SIEs group, we have several sub-types, such as expatpreneurs, refugees, mercenaries, explorers, and architects, according to the concepts outlined in the literature review. This clearly indicates that this type of expatriation can be seen differently.

Expatpreneurs, by their characteristics, were the sub-type on which this work was most related. One can conclude that its definition is more or less constant in all the articles analyzed on the subject, although there may not be a line that completely separates them from the profile of an immigrant. It is probably the most complex sub-type because of the broad perspectives in which expatpreneurs can be studied. This is related to its recent development and to its specificity in the global world in which we live today, which creates new specificities and challenges to the global labor market.

In general, the concept of expatriate reports positive consequences for expatriates and the communities where they live, as well as for the development of the areas where they live, showing the complexity of the effects they can bring to all those involved in this process. It was possible to realize that the cognitive, psychological and sociological processes have an effect on the success or failure of the expatriate, both professionally and personally.

Expatriation brings some light to certain phenomena regarding cultural and gender discrimination perspectives. In fact, this is particularly true in the case of the AEs, where women, on one hand, for cultural reasons are discouraged to embrace expatriation, which leads them to embrace expatriation at their own risk and, on the other hand, to feel difficulties when they return to their country of origin, encountering many more obstacles than men do during the expatriation and repatriation processes.

Lifestyle expatriation involves a different perspective of expatriation, as the creation of their start-ups was the main motivation of those expatriates. One particular aspect is that those expatriates decided to start-up their businesses after choosing the places they wanted to live in, but based on the type of em-

ployment before expatriation. Moreover, the place they relocated to was decided based on the business opportunity they had in mind previous to their relocation. The business ideas were based on the way they could figure out to generate their funds to continue their lifestyle, the idea of lifestyle they had in mind as well as the challenge they wanted to face.

There is no doubt that expatriation is not a simple phenomenon confined to the classical view of immigration, or only associated with the multinational companies that sent their employees/managers abroad. With the ongoing globalization process, expatriation developed new contours that traditionally were not envisaged. Nowadays, it involves more entrepreneurial, cultural, knowledge-based and gender-based contours based on global situations, which address challenges around the globe.

Expatriation is moderately normal in the EU, based on policies that promote free movement of citizens and labor market liberalization. This reality is not present in all countries. However, the resilience of human beings and their instinct for survival allow them to overcome great adversities and continue to seek comfort and happiness, which can happen through expatriation, both as AEs and SIEs, often giving rise to new phenomena as we have seen in the literature review. Today's expats will make all the difference in tomorrow's future as they contribute to multicultural wealth while having a positive impact on the economy, often changing paradigms and opening doors to new experiences.

FUTURE RESEARCH DIRECTIONS

Based on the different typologies presented throughout the chapter, it would be interesting to analyze the extent to which the expatriation process made expatpreneurs more entrepreneurial and how they perceive business opportunities in their expatriation processes. It will be important to analyze whether these opportunities are developed before or after expatriation and to what extent the expatriation experience has served to make the expatpreneur business more global. It would also be important to explore whether there are some differences between male and female expatpreneurs and, if there were, how they understand the evolution of the business and the expatpreneurs over time.

In order to complement the knowledge about AEs, it would be interesting to understand to what extent the career of these expatriates is influenced by the cultural diversity of the countries where they have been expatriated to over time. On the other hand, it would be interesting to analyze to what extent the expatriate cultural intelligence evolves over time regarding international assignments in homogenous or heterogeneous countries. Moreover, it would be of added value to understand if female expatriates are given the same opportunities to pursue an international career *vis-à-vis* male expatriates, and how those assignments influence their families.

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KEY TERMS AND DEFINITIONS

Company-Assigned Expatriates: Individuals expatriated through the organizations they represent and for which they will perform a particular function outside their country of origin. Normally, their assignments are clearly defined in terms of managerial tasks to be performed abroad and time horizon of the assignment.

Expat-Preneurs: An individual temporarily living abroad who initiates an international new venture, based on a self-employment opportunity in a host country.

Expatriate: A person who lives outside her/his native country.

Immigrant: A person who comes to a country to take up permanent residence.

Lifestyle Migration: This concept involves melting migration (as individuals who move from one country to another, seeking better living conditions) with Lifestyle (a 'free choice' to pursue a particular way of living through migration). It normally involves identity-making projects of individuals who approach migration as a form of consumption in contrast to the typically production-orientated migration flows.

Repatriation: It is normally the inverse process of expatriation. It corresponds to the first job of an individual/manager after returning from an international assignment, that normally does not last more than two years.

Self-initiated Expatriate: Is an individual who initiates and usually finances her/his own expatriation and are not transferred by organizations. It is an individual who relocates to a country of his/her choice to pursue cultural, personal, and career development experiences, often with no definite time frame in mind.

Digital Transformation Journeys: The Future Is Now

15

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INTRODUCTION

Big Data and Digital Transformation are hot topics since many years. Big Data are large volumes of data from one or more sources, analyzed through innovative information processing to develop insights, resulting in better business decisions and process adaptation¹. In 2018, human and machine data were expected to grow from 33ZB in 2018 to 175ZB by 2025 - of which a third in real-time (Reinsel, Gantz & Rydning, 2018).

Digital Transformation implies often Big Data powered changes (Mayhem, Saleh, & Williams, 2016). Whereas concrete outcomes of the latter are booming, Digital Transformation is still seen as a faraway, conceptual future. Nowadays, however, organizations should not ask themselves anymore how to prepare for the upcoming Digitization, but how to adapt to and in today's Digitized/Digitizing World.

To get there, they need to understand how to evolve by embracing new technological potential and by looking through the blurring frontiers between offline and online reality. They have to take changing habits and continuously transforming customer segments into account. They have to look beyond the mere 'product' and 'selling to customers' angle (Richter, & Wee, 2016). To keep their value, companies, organizations and even governments need to understand that mental mobility of people and their data-stimulated ecosystem have turned people's need for products in a need for shaped services.

This has a significant impact on the strategic vision, in for-profit and non-profit sectors alike. Typically, this requires a new way of working adapted to the redefined borders between reactivity and proactivity, and to the attention for real-time service and contextual adaptation. An organic compromise has to be found that answers the need for creative freedom and the need for an environment where management and development of human capabilities are possible in a structured way.

This article will shed light on core components for Digital Transformation. Concrete methodologies will also be analyzed that can guide the process of reviewing company fundamentals in the Digital Reality.

It will be explained that human means and data power need to be developed to develop a company's digitally quantified intuition² and to provide most value for the customer journey.

Altogether, this article will illustrate that the success of Digital Transformation goes through integrating technological possibilities and dynamic customer journeys in the corporate DNA. It will require a new internal perspective on projects, and create a new dynamic that, in the end, will allow people, companies and public and private organizations to be in the driving seat of this Fourth Industrial Revolution.

BACKGROUND

Reflections about Digitization and Digital Transformation exist since several years, also on intergovernmental level³. With technology developments in various fields amplifying one another, this will

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continue. It is laying the foundation for a revolution more all-encompassing than anything seen so far (Schwab, & Samans, 2016), putting additional pressure to leaders and organisations that are de facto already operating in a turbulent context with frequent and unpredictable change (De Stobbeleir, Peeters, Pfisterer, & Muylle, 2019).

There are several risks if the dynamic is not engineered and managed correctly. First of all, companies need to be aware that Digital is not an add-on, but the very essence of the transformation journey to remain in the game (Henke, Libarikian, & Wiseman, 2016). It involves a change in leadership, new business models, and an increased use of technology to improve the customer experience. It is only by integrating this Digital backbone that Digital strategies can have a lasting effect. Digital is one of the main reasons half of the companies on the Fortune 500 have disappeared since 2000 (Nanterme, 2016). The growing impact of the GAFAs and the NATUs⁴ only confirms this. Failing to understand its functioning can thus lead to companies losing their relevancy.

Traditionally, Digital Transformation is covered from separate angles. Certain sources analyze the impact of technology on job markets and human employability (Van Driessche, 2014). Others focus more on specific pieces of the corporate landscape – ranging from the need to extend the CxO suite with a Digital Officer, to the development of a new way of thinking, or the analysis of managerial choices to be made for techn(ological) transition.

Solely focusing on subsections risks to lead to an incomplete integration of the Digital dynamic. At best, the initiative will be an intermediary step. At worst, it will create a negative spiral that funnels means, time and potential - a risk further reinforced by the speed at which Digital is unfolding.

On the methodological level, a similar tendency can be observed. Agile frameworks like scrum⁵ or Kanban⁶ ensure guidance of essential aspects for agile product delivery (Galen, 2013). It is however less common to have agile covered for more profound transformations like those observed in the Digital Age.

The author wants to bring the components of the Digital journey together. Shaping their complementarity should open the possibilities of a new way of thinking about customers, organizations and projects, about shaping service and product delivery, about interacting with the ecosystem - and about creating value.

SOLUTIONS AND RECOMMENDATIONS

Changing Ecosystems, Dynamic Needs

Companies are continuously challenged to raise the bar, or to reinvent themselves. Digital Transformation is seen as one of the means to get there. This transformation is already well underway. Early 2016, the World Economic Forum in Davos called it the Fourth Industrial Revolution (Schwab & Samans, 2016).

Every industrial revolution is driven by new technologies. From a corporate perspective, new technologies get combined in the Fourth Industrial Revolution with technologies that finally become mature and affordable, like computing power, connected devices, genetic sequencing, artificial intelligence and the like.

From a human perspective, the way people live, work and interact is transforming at high speed: more than 2 billion people were on Facebook in 2017; some predict that more people will have mobile phones by 2020 than will have electricity or running water in their homes or villages; and children born in 2017 may never drive a car (Arbib & Seba, 2017; Schwab, 2016 ; Van Driessche, 2014).

The transformation of physical and digital worlds entails great potential. At the same time, this leads to (pressure for) increased human productivity. Customers expect businesses to anticipate their needs and provide personalised service through any communication channel. Business-to-Business (B2B) and Business-to-Consumer (B2C) businesses alike need to shift therefore from a model focused solely on selling products, to a service model driven by deeper connections with customers (Janssens, 2017).

This deeper connection is embodied through the concept of 'customer journeys'. Customer journeys are the sum of experiences and touchpoints that customers go through when interacting with a company, before, during and after the main interaction (Kalbach, 2016; Schadler, 2018; Truog, 2018; Van den Brink, 2018). By improving customer journeys, companies can continue to remain relevant in the Fourth Industrial Revolution.

ANTICIPATION AND ADAPTABILITY

Before analyzing strategy development or actionable translations, it is important to agree on what Digital really is. For some, it is about adding high tech niches to the portfolio. Others see it as collecting zealous amounts of data, being in constant communication with customers, or completely reshaping the company.

In practice, it is a dynamic sequencing of each of the above. It is a new way of thinking about service and product delivery, about organizing a company, about understanding and interacting with the larger ecosystem - and about creating value.

Data is the New Currency

In the Digital Age, people are using connected devices, privately and professionally, and are sharing large amounts of data every day.

By 2025, more than 6 billion consumers will interact with data every day, or 75% of the world's population. In 2025, each connected person will have at least one data interaction every 18 seconds. Many of these interactions are because of the billions of IoT devices connected across the globe, which are expected to create over 90ZB of data in 2025 (created by 150 billion devices). This is even before the advent of the nearly automated car, which is supposed to produce between 11 and 150 TB of data per day per car. At 30TB per car per day, this would equal roughly the data produced by hundreds of millions of Twitter users, all together on one year (Reinsel, Gantz & Rydning, 2018 ; Rossi 2018).

Through the data fuel, Artificial Intelligence (AI) is driving innovation across growing numbers of products and services. In 2017, organisations with AI expected to see a 39% increase on average in their revenues by 2020, alongside a 37% reduction in costs (Economic Times, 2017).

The higher the quantity and quality of the data, the higher the quality of the artificial learning. Machine learning algorithms and the like are therefore able to help businesses anticipate trends in consumer demands, personalize promotions for individual customers, and optimize pricing. Consumer sentiments towards a specific brand(s) can be unveiled (Stephen, 2017), supply chain operations can be further optimised (Gaus, Olsen & Deloso, 2018) and different types of cancer cells can be spotted through AI improved imagery (Tucker, 2018).

360° View of the Customer

To make data tangible, 360° views are key. A 360° view is the ability to see everything around you with no blind spots. It allows companies to capture every single part of the end-to-end relationship(s) it has with its customers. It includes sales and service information, marketing data, and information about who they are. From a B2B perspective, it also includes information about their business, what businesses they relate to, who has the buying power and the like (Loesel, 2014).

Figure 1. 360° view of the customer

Source: Own elaboration



In addition to creating an organisation's institutional memory, 360° information helps a company to understand who are in practice the largest accounts, identify whitespace to discover cross-selling opportunities, and connect in a more meaningful way with the biggest customers (Digital Marketing Institute, 2018).

In the past, this information got captured through different systems. Luckily, an increasing number of platforms, like Salesforce or Microsoft Dynamics, allows to capture this in a smooth way. To get there, clean and complete data are key (Sebastian-Coleman, 2013). It is therefore crucial to make it, on the one hand, easy for people to capture qualitative data, and, on the other hand, required to do so. By combining both aspects, contributing to the data power will become an organisational norm.

New Customer Journey(s)

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One of the biggest changes is the transition from a product and competition-based economy to a service and customer journey focused reality (Janssens, 2017). That is a profound shift. The opportunity, on a service perspective, is to rethink the way to satisfy a customer's need through a service (Schadler, 2018; Van den Brink, 2018), especially as many of the services that can be created were not there before.

Through data and 360° views, companies need to understand how to evolve to continue to matter. They need to embrace new technological possibilities and look through the blurring frontiers between offline and online realities (Hinssen, 2014, Kablach, 2016; Truog, 2018). Understanding this requires courage and commitment, especially as pressure on delivery and results remain constant.

Shaping Digital Transformations is thus about shaping a dynamical way of working. With a clear strategy, skilled people and powerful data, digitally activated companies should get a fine-grained sense of the interactive relations between customers and their ecosystem, take proactive decisions based and, ultimately, adapt their business models to shape people's journey-focused experience.

STRATEGIC VISION: MODELS AND METHODOLOGIES

Organizations are facing a major challenge to reinvent themselves. To help them, professionals have developed tools that make this Digital process more tangible and the outcome more actionable.

In the Digital Transformation process, a clear baseline reference can be built based on the Digital Quotient. This metric for the Digital Maturity of a company has been developed by consultancy company McKinsey, based on an evaluation of 18 practices related to digital strategy, culture and capabilities, in 150 companies around the world (Catlin, Scanlan, & Wilmott, 2015).

The Digital Quotient is driven by four main components.

- **Strategic Commitment:** Companies must not go for digital as an add-on of their core business, but by wholeheartedly committing to a clear strategy.
- **Development of Digital Capabilities:** Digital success depends on the ability to invest in the relevant capabilities. They need to be sized for and aligned with the strategy.
- **Adaptive Culture:** In complement of technical capabilities such as Big Data analytics and the like, a strong and adaptive culture helps to compensate for a lack of them.
- **Internal Coherence:** Organizations need to align their internal structure, talent management and key performance indicators with the chosen Digital strategy.

Companies that desire to launch the transition to becoming Digital-ready can shape their roadmap by making choices with regards to the components of the Digital Quotient. This vision is the foundation for future actions and the management with a clear sense of direction.

Various frameworks are available to make the strategy actionable. A holistic approach to structure it from conception to realization has been developed by Jo Caudron and Dado Van Peteghem (2014). The 'Digital Transformation Modeling' methodology aims at clarifying the potential impact of Digital on an organization's activities and builds an action plan based on these insights.

In essence, the process consists of five steps:

Step 1: Creating insights:

- Understanding that a company can be impacted by and needs to prepare for Digital Transformation. This is traditionally initiated by one of the company's stakeholders.

Step 2: Assessing potential impacts:

- Assessing impacts is done by evaluating the readiness of the company with regards to seven Drivers for Impact, and their respective constituents.
- Each of the Drivers for Impact is represented by an analogy: The Glasshouse, The Package, The Frog, The Gatekeeper, The Traveler, The Participant, The Cyborg⁷.
- The 'Cyborg', for instance, represents the impact driven by a series of technological evolutions, like the growing automation, the possibilities coming with real time data power, or additional potential offered by the Internet of Things.
- The 'Frog' materializes the fact that evolution does not have to be gradual anymore, but can be driven by shortcuts. The speed of insights, for example, can allow much faster reactions. Virtualization fits in this logic as it allows companies to jump over competitors more easily.
- Figures 2 and 3 illustrate the evaluation of the Drivers of Impact for an existing Glass Manufacturing company, and an existing Consultancy company. The evaluation has been done companywide. The former has more medium risks (amber). The latter has more risk factors under control (more black/green, less amber), but more risks with high impact (red).

Figure 2. Evaluation of the drivers of impact for an existing glass manufacturing company
own elaboration

The GlassHouse	The Package	The Frog	The GateKeeper	The Traveller	The Participant	The Cyborg
Transparency	Monolithic vs Atomic	Bypassing	New gatekeepers	Place	Community	Internet of Things
Accountability	APPification	Virtualization	Recommendations	Utility	Gamification	Wearables
Proximity	Long Tail	Fragmentation of Touchpoints	"Good is good enough"	Empowered Self	Collaboration	Quantified Self
Responsiveness	Personalised		Ambassadorship	Instant Gratification	The power of the crowd	Robotics
Bi-directional	Experience			New way of working		Data
Humanization	Speed			Contextual Awareness		Monitoring
Authenticity	Value for Money					
	(Self-) Service					
	Scalability					
Team(s)/Departement(s)/Division(s) concerned by the assesment: All Glass Divisions						
White: has 0 impact in a digital context.	Green: has an impact (in a digital context), plan is defined and actions in motion.	Amber: has an impact (in a digital context), plan is existing but nothing in motion yet.		Red: has an impact (in a digital context), but no plan or action put on paper.		

Figure 3. Evaluation of the drivers of impact for an existing consultancy company
own elaboration

The GlassHouse	The Package	The Frog	The GateKeeper	The Traveler	The Participant	The Cyborg
Transparency	Monolithic vs Atomic	Bypassing	New gatekeepers	Place	Community	Internet of Things
Accountability	APPification	Virtualization	Recommendations	Utility	Gamification	Wearables
Proximity	Long Tail	Fragmentation of Touchpoints	"Good is good enough"	Empowered Self	Collaboration	Quantified Self
Responsiveness	Personalised		Ambassadorship	Instant Gratification	The power of the crowd	Robotics
Bi-directional	Experience			New way of working		Data
Humanization	Speed			Contextual Awareness		Monitoring
Authenticity	Value for Money					
	(Self-) Service					
	Scalability					
Team(s)/Departement(s)/Division(s) concerned by the assesment: All Consultancy Practices						
White: has 0 impact in a digital context.	Green: has an impact (in a digital context), plan is defined and actions in motion.	Amber: has an impact (in a digital context), plan is existing but nothing in motion yet.	Red: has an impact (in a digital context), but no plan or action put on paper.			

Step 3: Developing scenarios:

- By developing scenarios, the reality resulting from the combination of two risk factors is evaluated. A risk factor is one of the main Drivers of Impact, or one of its major constituents.
- This leads to four possible scenarios: risk factor 1 and risk factor 2 have a high impact, 1 high and 2 low, 1 low and 2 high, 1 low and 2 low. In practice, this results only in three useable scenarios, as the last one offers little added value compared to the existing situation.
- Each combination represents a high risk environment that could become reality when both conditions are combined (or an existing risk reality for which a solution needs to be found).
- For each scenario a headline should be provided (Figures 4 and 5), as well as a detailed report of how to tackle the risks.

Step 4: Building Business Case(s):

- Based on the scenarios, actions need to be defined to avoid such a scenario to happen (or to turn the risks in opportunities). This will result in the building of one or more Business Cases.
- Once the Business Case is approved, the 'traditional' transformation lifecycle starts, at the organizational level, process level, IT level, or combined at multiple levels.

Step 5: Staying alert through trend watching:

- To ensure a lasting effect of the awakening created by the start of the Digital journey, it is important to stay alert through structural trend watching and periodic workshops.

Figure 4. Example of a scenario evaluation for a Glass Manufacturing company, based on the risks coming from a New Way of Working, and major Cyborg elements
Own Elaboration

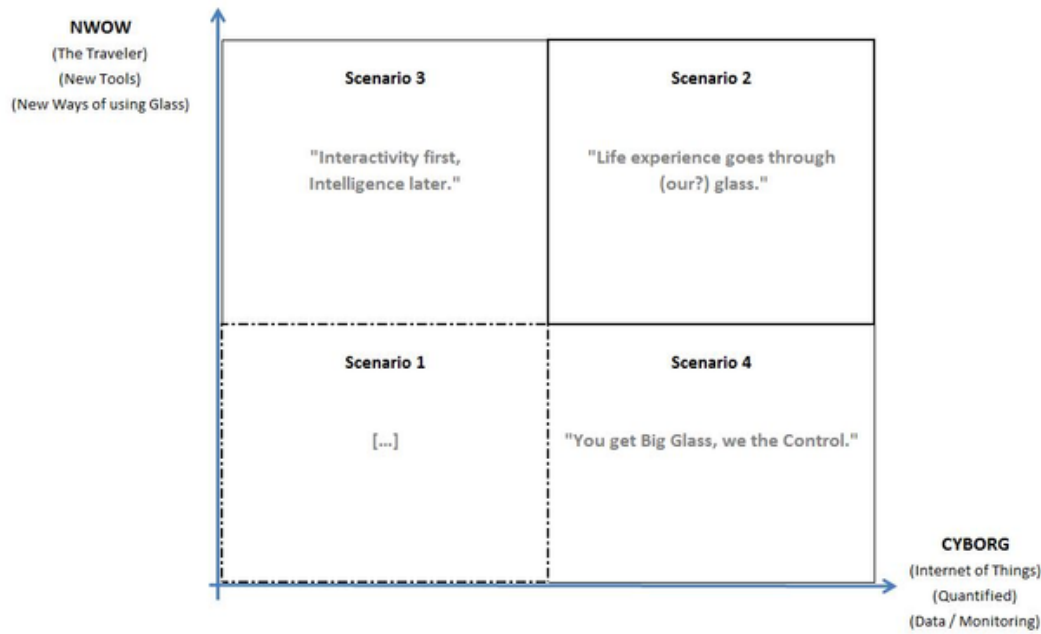
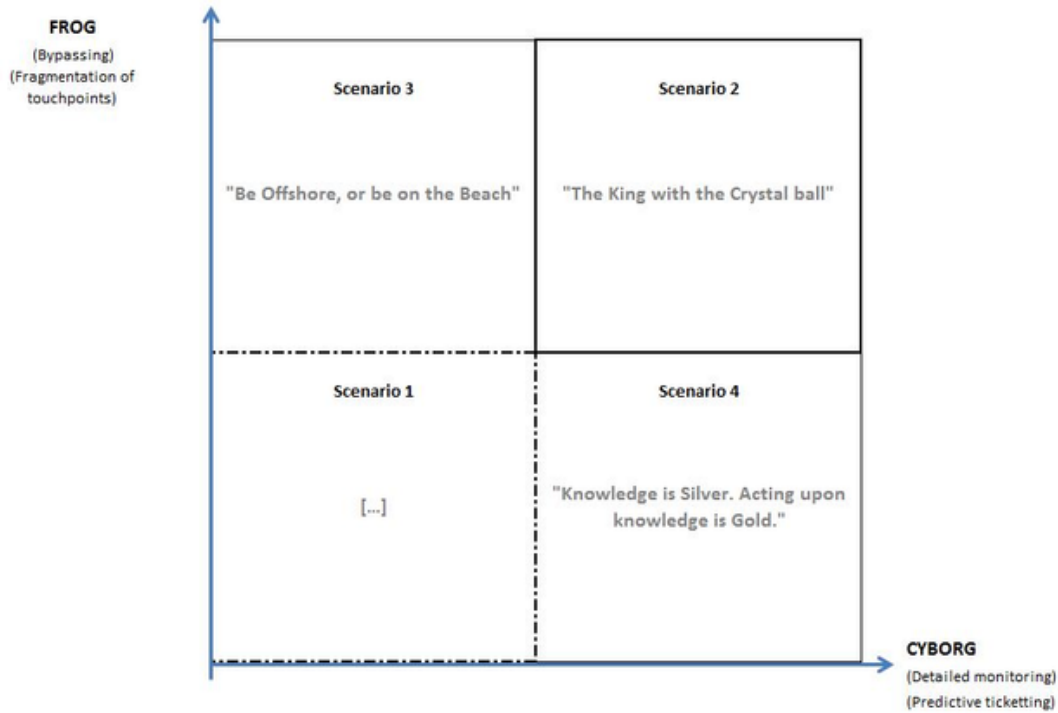


Figure 5. Example of a scenario evaluation for a Consultancy company, based on the risks coming from the Frog, and major Cyborg elements
Own Elaboration



EMPOWERING DIGITAL PEOPLE

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The Business Case might reveal gaps in terms of technical power or human capabilities. Whereas the data side can be managed through technological gear-up and anticipative sizing, human gaps have to be tackled by developing transversal capabilities.

The Business Case might reveal gaps in terms of technical power or human capabilities. Whereas the data side can be managed through technological gear-up and anticipative sizing, human gaps have to be tackled by developing transversal skills and capabilities. This implies shaping teams that are ready and able to take the leap, as well as a healthy dose of human understanding and people skills on project management side.

Management of skills disruption is an urgent concern in the Digital Age, and the rate of skills change accelerates across old and new jobs (Schwab & Samans, 2016). Consequently, project managers need to look for people that fit and that show, at the same time, a high level of adaptability.

Firstly, project managers need to nurture their people for and with the mental insights and technological catalysts of the Fourth Industrial Revolution, and create a stimulating environment (Bushnell & Stone, 2013; Knapp, Zeratsky & Kowitz, 2016). To do so, it has been increasingly important to do proactive workforce management, in collaboration with the out-of-project corporate organisation. With predictive HR management, for instance, companies can anticipate employee expectations and identify needs for mentoring. In turn, this will stimulate employee engagement and bottom-line project productivity.

Secondly, to make sure that the people adhere to the company and take ownership in project ecosystems, project managers need to consider the generational traits of teams (Bradt, 2014). This recurring concern has become increasingly relevant with the growing inflow of Millennials (also known as Generation Y) and Generation Z employees (Table 1).

Millennials value workplace satisfaction more than monetary compensation. Work-life balance and togetherness is considered essential. They are less likely than previous generations to put up with an unpleasant work environment. When satisfied, however, they are often passionate advocates for the organizations they work for (Tulgan, 2016). For projects, they are potent change agents.

Table 1. Generational composition of the US labour force

	Silent and Greatest generations	Baby Boom generation	Generation X	Millennial generation (Generation Y)	Post-Millennial generation (Generation Z)
Born	1945 or earlier	1946-1964	1965-1980	1981-1996	1997 and later
Age of working age adults in 2017	72 and older	53-71	37-52	21-36	16-20
% of US labour force in 2017	2%	25%	33%	35%	5%

Source: Fry, 2018

To Generation Z project members, company culture (and by extension project culture) is also more important than salary. They are looking for a sense of purpose (Stillman & Stillman, 2017). This does not mean that they are not ambitious. Generation Z ‘work hard and play hard’ and see their ambition

as one of their most valuable assets, albeit in a different way. Rather than aiming at growing into the upper levels of the organisation, they want to strengthen their CVs through micro-careers. They want to grow through lifelong learning and providing a lot of value to the organisation through short projects (Stillman & Stillman, 2017).

Note that some research categorizes people between 1995 and 2005 as Generation K (Hertz, 2013). More than 75% of Generation K is concerned about climate change and social equality – and is vastly worried about getting a job. They can want to co-create and be committed. Similar to the analysis of Generation Z, they want to be part of a community that supports them whenever and wherever they need it.

To have Generation Y and Z/K project members motivated and really own their work, they expect to be led, rather than being managed in the traditional way. For managers this implies emphasizing feedback, focusing on the team (instead of focusing only on the project), and offering them independence and inspiration (Bradt, 2014).

From a project point of view, it might be challenging to apply each of the above, while respecting time, budget and other constraints. Applying one or more, or taking time for human value exchange, however, may already help to increase involvement, motivation and therefore ownership.

Thirdly, managers need to learn to talk digital, data and customer journey themselves. They do not need to know everything. They should be able to ask questions to their teams and understand the answer (Groysberg & Slind, 2012). It will reinforce faith in the project culture and will cascade down to other employees.

Specifically on AI, realism has to be injected in project boards. Organisations tend to expect magic coming out of the blue, delivering quickly unparalleled performance without having to skill-up competencies (Brooks, 2017). In practice, many innovations take far longer to be deployed than people in the field imagine, and with extrapolated targets that are downscaled to a more stringent reality. Moreover, AI is not only driven by technology. Exactly as in financial investment where ambiguity tolerance still beats artificial intelligence, AI and data science projects require a significant share of professional expertise (Schuller, 2017).

When working with people in the digital reality, it is therefore important to find a good balance between aiming for the sky and stating the reality. While it might temper the motivation of some people, it will strengthen the project focus towards targets that might remain aggressive, but that are perceived as more realistic. Doing so will create a climate of ambitious trust, which, in turn, will motivate the blended project teams to fully take up their work.

Having the appropriate human capital on board and managing them accordingly is thus one of the cornerstones for the Fourth Industrial Revolution. This implies creating an appropriate environment and project culture, nurturing people, and managing them with a solid understanding of what Industry 4.0 means for them and for the service to the customer.

RECONCILING STRATEGIC TRANSFORMATION WITH NEW HUMAN DYNAMICS

While aiming to reconcile digital strategy with human empowerment, organisations have worked on new organisational models at their own level. Some models are having a growing impact throughout the corporate world. One of them is the transformational approach of changing a company in a ‘teal organisation’.

Formalised by Frederic Laloux (Laloux, 2014), Teal starts from the assumption that people are longing for better ways to work together. The approach wants to go far beyond a better life/work balance. Teal wants to develop a culture of self-management, wholeness, and a deeper sense of purpose.

Although this approach might seem hard to reconcile with corporate targets, experience in small to large companies supports the potential of this approach (Laloux, 2014). Organisations desiring to avoid radical change can introduce some elements separately. Over time, however, obtaining the full benefit depends on the extent to which the organisation embraces this approach on a structural level, including the organisation of the daily work as well as matters like the human resource management approach, strategy definition and financial management.

Digital web agency Yools, for example, decided to go through a profound transformation in 2015. After several years of existence and thousands of web development projects, they wanted to put the company focus back on the people. They wanted to create more happiness inside the company and trigger a positive impact on the business development dynamic, on the customers and on society. They transformed the organisation based on principles of meaningful mission, self steering and trust (Aerts, 2017).

Firstly, they proposed a new mission for the company, less based on money, but more driven by values. In complement, all employees got empowered to revise periodically the mission and the vision of the company, to keep their sentiment in line with the company's direction (Aerts, 2017).

Secondly, all 'Yoolsies' were mandated to take their own decisions. If people wanted to improve the company, they had to draft a proposal, ask others for feedback, and decide themselves if their project was worth it, before making things happen themselves. A foundational aspect was the increase in transparency. Yools decided to focus on transparency for decision taking, project cycles, and company results. Complete transparency on finance and salaries was deemed to radical of a change for a beginning (Aerts, 2017).

To guide this transformation process, Yools set up a series of daily and weekly ceremonies. This stimulated communication, canalised alignment and reinforced human bounding. Playbooks were created to support every process. One-on-one evaluations got replaced by group-driven peer feedback. Similarly, all employees got trained in new ways of self-expression and non-violent communication (Aerts, 2017).

Thirdly, trust was stimulated. The goal was to deliver qualitative project results without mandatory targets or timesheet controls. The idea was that the increased motivation would lead to increased ownership, which would ensure a regular delivery. To reinforce this aspect, coaches were appointed to help people in their new journey, in combination with moments of open sharing (Aerts, 2017).

Table 2. Evolutions in human collaboration

	Description	Guiding Metaphor	Foundations
ORANGE	Focus on beating competition; achieving profit and growth. Management by objectives.	Machine	Innovation Accountability Meritocracy
GREEN	Focus on culture and empowerment to boost employee motivation. Stakeholder replace shareholders as primary purpose.	Family	Empowerment Egalitarian Management Stakeholder Model
TEAL	Self-management replaces hierarchical pyramid. Organisations are regarded as living entities, oriented towards realising their potential.	Living organism	Self Management Wholeness Evolutionary Purpose

Source: Laloux, 2014

Subsequently, people left the company because they did not adhere to the new philosophy. To reinforce the company, the hiring process got adapted as the human fit had become the main catalyst for acceptance. The entire process could last from a couple of weeks to a couple of months (Aerts, 2017).

From a project perspective, all web projects were affected by this model based on trust, motivation and self steering. The initial phase of teal operation appeared to be extremely cumbersome for internal collaboration and external delivery. For senior employees, the long selection process of new resources appeared to be most challenging in periods of high demand. Strictly respecting the lack of managerial authority was not straightforward either, especially during periods of high pressure (Aerts, 2017).

After two years of human reshuffling, evolutive governance and growing understanding of and adherence to the model, project delivery attained a level of steady output and increased customer satisfaction. The company is growing and continues to hire new resources (Aerts, 2017).

For the employees that went through the transformation and that are still at Yools, the only ‘major back draw’ is that most Yoolsies would not want to work again in a traditional setting. Similarly, benchmarking with other teal companies indicated that the potential value in an era of digital transformation is tremendous, but highly dependent on a rigorous adherence to the teal philosophy, even in periods of project risk (Aerts, 2017).

DYNAMIC FEEDBACK AND AGILE PROJECTS

The biggest challenge for the execution of the Digital Strategy is the structural integration of the fundamental paradigm shift. Pre-Digital organizations focused on market share and people got managed accordingly. In the Digital Economy, companies need to be designed for reactivity, flexibility and agility. An integrated operational backbone is needed that embraces a continuously evolving service backbone, and a clearly articulated, but dynamic business strategy (Ross, 2016).

A fair share of this nimble way of working is initially coming from agile software development, focusing on rapid prototyping and getting releases out smoothly. This philosophy is now also influencing the development of business deliverables, especially as agile has grown into a maturing practice.

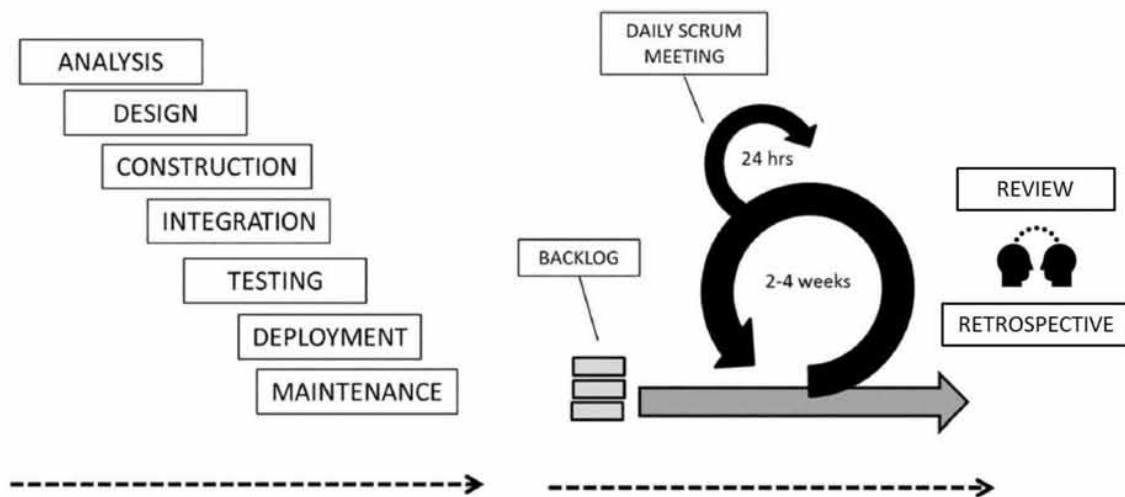
An increasing number of organisations has moved from using agile in pilot projects to accepting it as one of the main project management practices. Agile (and its subsequent versions) will therefore remain at the core of the projects of the coming years (Versione, 2018). For details on approaches, the author refers to dedicated literature⁸. Some attention points can nevertheless be highlighted.

Firstly, the fluidity associated with agile requires discipline of the main actors. Scope control, value driven priorities, failing fast, and regular iterations are part of the core principles. The success of agile comes from the unconditional availability of decision takers towards rapid feedback, during and after the iterations (Janssens, 2017).

Secondly, agile perimeters might have to integrate with more traditional ecosystems. To make such hybrid contexts work, managerial compromises must be made. When agile subsets are inserted in a waterfall environment⁹, they must work with less autonomy and with a different time perspective. Similarly, waterfall entities will have to adapt to a flexible way of working – or agile Scrum might have to blend with agile Kanban (Reddy, 2015).

Thirdly, the overarching focus on agile should not become a goal on itself. Managers can start by developing personal agility, for instance by breaking large tasks into small steps and test working models, by streamlining activities to focus on the most valuable customer benefits, or by celebrating learning (Rigby, 2018). In the end, however, managers should not forget to focus on developing their quantified

Figure 6. Combining waterfall approaches and agile might be needed
Source: Janssens, 2016



intuition and taking decisions that make a difference. The aim of agile is to be in support of the overall goal: providing appropriate solutions and value to customer needs and preferences (Highsmith, 2001).

Lastly, it should be noted that agile is not the same as agility. Agile is an iterative approach to software development and project management with specific principles. Agility, on the other hand, is an organisational trait characterized by durability, speed, flexibility and readiness (Prosci, 2017). It is a core competency and source of competitive advantage.

Agile and agility are related. As an organization grows agile project management practices, it can increase agility. Some reinforce their agility through adaptive leadership skills, for instance by reinforcing their vision and putting targeted efforts in strategy, people, structure and processes (De Stobbeleir, Peeters, Pfisterer, & Muylle, 2019). Similarly, many organizations working on improving their agility use agile development approaches given the desired outcome of agile and its inherent value for blended transformation leadership styles and strong teams (Viaene, 2018).

Overall, both agile and agility aim thus to equip organizations to more effectively respond to and seize opportunities. By combining the strengths of both, managers can reinforce the project management dynamic and contribute to shaping a company for reactivity and flexibility.

FUTURE RESEARCH DIRECTIONS

Algorithms power businesses like Amazon and Netflix. Health related apps are changing the medical world (Kirby, 2019). 5G is expected to redefine the data possibilities in all industries. And research about industries like hotels and retail indicate that benefits of skilled sales force may be diminishing in an increasingly data-driven world (Philips & van Ryzin, 2016).

Digital Transformation is thus providing society with substantial opportunities, as well as with challenges in the dynamic relation between agile organizations, rapid decision taking and the role of data powered artificial intelligence.

This raises the question whether machines or people should take decisions to provide the necessary value in the Digital Age. At the same time, it indicates that specialists and managers need to be able to sharpen their Digital Capabilities and elevate their quantified intuition to a higher level, in order to remain in control of their organization. To do so, several elements could be further explored.

From the methodological point of view, the project management toolbox has to be further enriched with actionable best practices. They will have to dedicate specific attention to the permeable delimitation between product delivery and service delivery. Likewise, cookbooks and exhaustive case reviews for hybrid contexts would be valuable. This will not dilute the role of project management frameworks and dynamic organizational management, but will improve compatibility with the Digital Reality.

Likewise, it will be valuable to analyze if best practices could be identified for specific sub-sectors. Also, attention to the public sphere would be valuable. By bringing public and private practices on par, it is imaginable to activate the potential of the public-private force field in domains like education, health, mobility or city management. In turn, this could benefit corporate and individual ecosystems.

Obviously, best practices will require continuous improvement. But the author believes that recurring efforts will be largely compensated by advantages in quality and outcome.

CONCLUSION

Managing the Digital Transformation is not a high-tech option for a faraway future. It is about how public and private organizations integrate technology to transform their activities - now. It involves a change in leadership, a different thinking, new business models, and increased use of technology to improve the customer experience. It is by integrating this backbone that Digital strategies can have a durable impact.

To get there, a series of key points have been addressed.

Firstly, it has been explained that a thorough understanding of the new reality is essential. The Fourth Industrial Revolution redefines borders between reactivity and proactivity, and creates the need for real-time service and contextual adaptation for the customer journey, based on a 360° understanding. It requires a dynamic silver lining, compatible with interactive work clusters and a hybrid organization.

It has been explained that this understanding needs to be translated through a strategy to profoundly revisit the company, encompassing the internal way of working, as well as the customer value proposition, the articulation of the product/service portfolio and the related follow-up dynamics.

Secondly, practical approaches have been analyzed that can guide this process. With the Digital Quotient, organizations have a baseline to put findings into perspective. Similarly, by embracing the Digital Transformation Modeling framework, a solid methodology is available to clarify the potential impact of Digital, create future scenarios for the Digital Age, and build an insight-based action plan.

Thirdly, it has been highlighted that putting a strategy into motion for Digital success implies an appropriate way of working and managing – encompassing the generational layers of the human work force and the collaborative maturity of the organization.

Lastly, it has been explained that the Digital way of working needs to be inspired by an agile philosophy. When doing so, organizations and managers are namely better prepared to develop their quantified intuition, and take relevant decisions for the company and the value provided to its customers.

Overall, Digital Transformation projects are thus part of a major change journey. A journey that shapes the present to be ready for an already ongoing future - and that will continue to transform at high speed. It is a new way of thinking about the interaction with customers, about shaping service and product delivery, about organizing an organization - and about creating value.

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KEY TERMS AND DEFINITIONS

360° View: Ability to capture every single part of the end-to-end relationship a company has with its customers. Includes sales and service information, marketing data, transactional information and information about who they are.

Agile: Project management methodology in which the development is characterized by the breakdown of tasks into short periods, with frequent reassessment of work and plans. Used in software related projects and digital transformation activities.

Customer Journey: Sum of experiences and touchpoints that customers go through when interacting with a company. Includes experiences and touchpoints before, during and after the main interaction.

Digital Quotient: Metric of the digital maturity of a company, based on the evaluation of a series of practices related to digital strategy, capabilities, and culture.

Digital Transformation: Process in which human and corporate society is shifted to new ways of working and thinking with digital and social technologies. Involves a change in leadership, a different mindset, the encouragement of innovation and new business models, and an increased use of technology to improve the experience of internal and external customers.

Fail Fast: Solution development approach used in volatile, uncertain and complex business contexts that focuses on trying something, getting fast feedback, and then rapidly inspecting and adapting. Sometimes referred to as Fail(ing) Forward.

Fourth Industrial Revolution: Industrial revolution driven by systems involving entirely new capabilities for people and machines. Represents new ways to embed technology in society, and induces new ways of working and thinking for human and corporate matters. Used as synonym for Digital Transformation, and, in specific cases, for Industry 4.0.

Kanban: Agile method to manage work by limiting work in progress. Team members pull work as capacity permits, rather than work being pushed into the process when requested. Stimulates continuous, incremental changes. Aims at facilitating change by minimizing resistance to it.

Quantified Intuition: Non-technical capability that helps in making impactful decisions at a fast rate, despite a high level of uncertainty and an important inflow of interconnected data.

Scrum: Iterative and incremental product development framework used in agile projects.

Teal: Stage in the evolution of human and organisational consciousness. Focuses on the development of a culture of self-management, wholeness, and a deeper sense of purpose.

Waterfall: Sequential project management methodology, in which project progress is regarded as a downwards process. Originally described as consisting of phases for Requirement Specifications, Design, Construction, Integration, Testing, Installation and Maintenance, variations exist on the naming and number of phases.

ENDNOTES

- ¹ For more information on Big Data, the author refers to the 'Key Terms and Definitions' section.
- ² For more information on quantified intuition, the author refers to: <https://www8.gsb.columbia.edu/>
- ³ For more information on international attention for Digital Transformation, the author refers to: <http://www.digitaltransformation2016.eu/> and <https://www.weforum.org/events/world-economic-forum-annual-meeting-2016>
- ⁴ The growing impact of technology is symbolically embodied by two groups of technology giants: Google, Apple, Facebook and Amazon (GAFA); and, increasingly, Netflix, Airbnb, Tesla, Uber (NATU).
- ⁵ For more information on scrum, the author refers to: <https://www.scrum.org/> and <https://www.scrumalliance.org/>
- ⁶ For more information on Kanban, the author refers to: <https://www.atlassian.com/agile/kanban>
- ⁷ For a detailed explanation of each driver and the related analogy, the author refers to Caudron & Van Peteghem (2014).
- ⁸ For information on agile, the author refers to <https://www.scrum.org/> and <https://www.scrumalliance.org/> for scrum, and to <https://www.atlassian.com/agile/kanban> for Kanban.
- ⁹ For information on waterfall methodologies, the author refers to: <https://www.pmi.org/PMBOK-Guide-and-Standards.aspx> (PMBOK), <http://www.prince-officialsite.com/> (Prince2).

Strategic HRM and Organizational Agility Enable Firms to Respond Rapidly and Flexibly to the Changing Environment

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INTRODUCTION

In the era of globalization and industrialization, the most pioneering and modern organizations are under excessive strain to work in a dynamic environment that always force them for prompt and quantifiable advantage in order to survive in this international competitive market. Under these circumstances, competitiveness and innovation as well as organizational resilience, i.e. organizational agility have become a hot issue of academic, business and managerial debates with regard to be agile and be able to sense and respond to market changes quickly and smoothly to sustain their efficiency, i.e. organizational competitiveness. Where, organizational agility is accountable for high ability to adapt, the ability to recognize change in the marketplace and allocate resources to take advantage of that change. Similarly, strategic HRM play the role of a facilitator that enables an organization to utilize its existing human resources in order to achieve its strategic goals and objectives. Additionally, strategic HRM also empowers organizations to enhance its business performance; develop an appropriate organizational culture, i.e. work culture which, will boost the organizational flexibility and innovation (Alsaadat, 2019); (Jackson et al, 2014); (Oppong & Nasir, 2017). Research shows that nowadays, strategic HRM along with organizational agility specially with the presence of human capital plays a crucial role in gaining competitive advantage and improving organizational performance.

This sub-chapter highlighted the significant features of strategic human resource management that endeavored for enhancing organizational learning through organizational agility and organizational capability. According to Wahyono (2018) Agility is nowadays a key aspects of organizational excellence due to its distinctive characteristics that incorporates the aptitude of an organization or firms' to successfully respond to the ever changing environment especially when the transforming businesses is going on so firms are needed to fit for the fulfilment of the purpose in this digitally enabled world (Abraham and Perkin, 2017). Current research has explored the significant aspects or perspectives of organizational agility. However, this chapter has been organized to provide a unique integrative framework that encompasses all dimensions of organizational agility development. Hence, the purpose of this sub-chapter is to discourse this gap in order to enhance firms' competitiveness and sustainability by presenting a conceptual and thematic model that captures various critical extents to the development of agility within firms' or organizations. Moreover, this chapter also emphasized the linkage between SHRM practices and organizational agility that enable firms to respond rapidly and flexibly to keep pace with the changing environment. In this sub-chapter the focus has been given on how firms can develop an ability as well as capacity to respond rapidly and flexibly to the changing environment and why firms' realize that they are capable to accept these unwanted challenges for the benefit of their organizational

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performance development. Finally, this subchapter highlights the important role that strategic human resource management plays in both developing organizational agility and strategic flexibility.

Accordingly, this study demonstrates that organization's capability for flexibility is developed through strategically managing human resources that enable to create competencies among the core employees at the organizational level. In addition, this flexible condition within the organization facilitate them to achieve the ability to respond and resist the unwanted shocks (Lengnick-Hall, Beck and Lengnick-Hall, 2011). Furthermore, to get the vivid description about the said topic this sub-chapter took effort to review two important elements about the possibilities of organizational capability to be flexible, i.e. organizations specific cognitive abilities (organizational agility), organizational behavioral characteristics, and contextual conditions (Strategic HRM capabilities) that enable them to respond rapidly in the dynamic environment (Saha et al, 2019). Similarly, in order to address a firms' competitiveness, it is necessary to highlight the strategic flexibility of a firm (i.e., their ability to accept the change for the benefit of overall performance) that empower them to face the prompt changes through organizational transformation. Hence it can be said that the outcome of this study envisaged the way SHRM practices affect the flexibility dimensions of an organization that enhance the robustness of firms, especially it significantly influences organizational agility and integrity (Bouaziz and Hachicha, 2018).

To comprehend the influence of strategic HRM on firms' competitiveness, it is necessary to indicate the key activities of human resources that facilitate businesses or organizations to create, undertake and maintain a sustainable organizational advantage. The theoretical framework of this study induces various approaches and models concerning organizational agility (OA), organizational learning, organizational knowledge. In this circumstances, it is necessary to mention that the notion of organizational learning is presently a subject of continuing debates between behaviorists and economists. Actually the concept of organizational learning was first introduced by Cyert and March, (1963) in the book "*a behavioral theory of the firm*". According to them organizational learning is a field of academic research and professional practice with a relatively recent development. Thus, companies should learn from their experiences with the intention of adapting themselves to the conditions of the environment. Correspondingly, Basten and Haamann (2018) acknowledged that Organizational learning (OL) enables organizations to transform individual knowledge into organizational knowledge and enhance organizational effectiveness and guides the organizations to design the appropriate learning processes in order to improve long-term performance. This chapter reveals the perception of organizational agility and human resource management strategy as an emerging perspective for knowledge and performance-driven organizational capability. Precisely, this study put efforts to identify and classify, the way businesses or an organization can rapidly improve its sustainable organizational knowledge, skills and abilities (KSAs) development strategy through progressing their organizational performance.

Consequently, to foresee the modern business world, it is essential to remark that the essence of organizational knowledge, organizational agility and importance of human resource strategy is viewed as an eminent approach to meet the global challenges. Where, in the new phase of globalization, HR is responsible for empowering the effect of change in organizations and shielding employees against the unwanted effects. Therefore, the purpose of this sub-chapter is to tighten and elucidate a conceptualization of organizational agility and organizational learning process that discusses about the spirit of organizational agility, i.e. flexibility, nimbleness, and speed of an organization as well as key activities of HR. It also accentuates the way HR specialists are involved in operational matters and are progressively observed as a source of competitive advantage in order to meet the global challenges. Though, it is very difficult to enhance firms' sustainable growth quickly due to the urge of gradual expansion of the competitive marketplace and today's rapidly-changing business world. In another way, it can have

said that nowadays organizational research, (i.e. administrative and managerial) deals with both the phases that are combined as well as inter- linked and focuses mainly on the following key elements, i.e. (human-centered and technology-oriented).

Henceforth, it is crucial to ensure that the success of any organization is based on the belief that an organization gains competitive advantage by using its people effectively and efficiently. Concerning this strategic role of HRM and organizational agility, this sub-chapter attempts to classify how firms can respond rapidly and flexibly to the changing environment without facing disturbance? How the HR competencies can really make a difference and influence on business performance? How firms' can enhance their organizational capability, organizational learning and organizational knowledge through the manifestation of strategic human resource management approach to meet the global competitiveness? Finally, this study suggested that strategic HRM and organizational agility both the approaches could be a very inspiring and demanding for the organizations of twenty first century. Specifically, it can be said that the key empowering factors of strategic HRM and organizational agility has a great influence on organizational competitiveness that enhances organizational learning capability as well as organizational knowledge development strategy, managerial competency, i.e. administration and technological upgradation, i.e. the advancement of information technology to achieve sustainable competitive Advantage.

This chapter has six additional sectors where, each sectors has distinctive remarkable part. Sector one provides a contextual overview of the whole the chapter by briefly describing the significant issues and conceptual approaches of strategic human resource management and its activities, organizational agility, organizational learning in relation to the present dynamic environment that empowering firms to act promptly during the phase of transformation as well as to resonate their (firms' / organizations) competitiveness. Sector two summaries the influence of organizational agility on strategic HRM that enhances firms' flexibility and competitiveness, along with the sub-sector, i.e. linkage between strategic HRM and organizational agility. Sub sector three presenting the challenging perspectives, key issues, deliberations and difficulties of organizational agility that fascinating organizational (managerial) of competitiveness. In this part it is obvious to discuss about the synergic consequence of human resource management strategy. Accordingly, subsection four extends the discussion by organizational agility and value of HRM strategy that can create a difference and influence on firms' performance. Later on, sector five proposed solutions and recommendations with the issues, influences and difficulties. At last sector six make conclusion, and accentuates the persuasion for additional coherent thinking on the proposed theme and topic that carried forward by the chapter as the implication of strategic HRM and its perspectives and positive approaches that strengthen organizational knowledge administrative competency as well as operational competency, (i.e. individual employees skills, and organizational capacity development skills) of an organization or firm can respond rapidly and flexibly to the changing environment without facing market turmoil through enhancing firms strategic capability.

Basically, the overall concern of this chapter is to point out the most possible way in which the significance of strategic human resource management (SHRM) as well as organizational agility concept can create and facilitate an organization to achieve a sustainable competitive advantage. It enables, whether the organization or firms are capable to achieves their two vital goals, such as: *the best possible way to enhance and maintain organizational flexibility* (both human resources and coordination flexibility) and *the best possible way to keep pace with the ever-changing dynamic environment* (both external and internal). With the aim to do so, this sub-chapter demonstrate a conceptual framework that delivers a theoretical groundwork for accepting the strategic role of human resources in an organization that empower them by supportive behavior, i.e. the appropriate and important aspects of the HR system to meet

the strategic needs of the firm and enabling them by fabricating these components to facilitate flexible reaction to a variety of strategic requirements.

BACKGROUND: THE CONTEXTUAL PERSPECTIVES OF STRATEGIC HUMAN RESOURCE MANAGEMENT AND ORGANIZATIONAL AGILITY

In order to address the contextual perceptions of strategic human resource management (SHRM) and organizational agility (OA) it is required to reveal the present scenario of strategic HRM concept which, has progressively been acknowledged as a dominant managerial competence development strategy in an organization. The conceptual perspective of strategic HRM is seen as an excellent management style due to its value in implementing a normal basis for managing people. Research shows, that SHRM provides a very suitable alternative solution in order to tackle the critical success factors of the firms'. While considering the global perspectives of strategic HRM, numerous researchers realizes the significance of strategic HRM, among them Adler and Ghadar (1993) stated that during the new era of industrialization and globalization strategic HRM has been considered as one of the new approaches of managing research and development (R & D), production, marketing, and finance that are presently incorporating today's global realities and occurring rapidly. Subsequently, researcher and Marier (2012) mentioned about another new interesting concept and practice of SHRM in developed countries like Germany, a dominant economic power among the developed nations and Europe. He emphasized the way strategic human resource management concept has been occurred in order to recount the turbulent situation within the organization during the phase of influential emerging economy.

In this chapter the author's determination is to accentuate the contextual perspectives of organizational agility that confers organizational essence, competence, suppleness, nimbleness and speediness. Where, the perceptive approaches of this study is to illuminate the impression organizational agility (OA) and strategic HRM, as well as the linkage between them. Moreover, research shows that organizational agility (OA) and the strategic HRM perspectives considerably boost firms' in order to visualize their goals transparently and easily to improve their degree of functioning (Alaraqi, 2017; Harraf et al. 2015). On the other hand, to indicate the importance of strategic HRM Armstrong, (2006) quoted that human resource management (HRM) is a strategic and coherent approach to the management of an organization's that deals with the most valued assets, i.e. the people. According to him HRM, i.e. the people's collective contribution enables firms' to accomplishment their goals and objectives. Simultaneously, Eneh, and Awara, (2016) described that during the age of rapid technological development, the importance of human resources has been observed as the key factor to the development and growth of an organization. Thus, the concept of strategic HRM can be considered as a new approach, that directly and indirectly supports firms in aligning the skills and expertise of the employees within the organization and empowers them to enhance organizational competency.

The theoretical framework of this chapter refers to the base of the whole research is grounded upon. It mainly, explained and elaborated the relationships among the strategic HRM, organizational learning, organizational agility, organizational knowledge and performance that has been explained in light of theories and relevant studies in literature. This sub-chapter represents the significance of human resources a strategic approach that endows firms to apprehend the value of internal and external customers, knowledge of competitors, products, technology and sources of competitive advantage. It is all about people and significantly it ensures that the capability of a firm to enhance its competitive ability is initiated along with the belief that an organization gains a competitive advantage by using its people effectively

and efficiently. Moreover, it emphasizes and explicate the contextual framework of organizational agility that deliberates about organizational spirit, capability, flexibility, nimbleness, and speediness. However, the key activities of strategic HRM intricate in operational matters that are increasingly observed as a source of competitive advantage in today's dynamic global market place.

Concerning to the perception of organizational agility various researchers from various fields stated different opinions for example researcher Albrecht, et al. (2015); Glenn, (2009) and Saha et al. (2017) considers that this issue can be considered as a multidisciplinary approach. Whereas, Nejatian et al. (2018) highlighted that the concept of agility is an organization's unique way of enhancing its competitive advantages in order to keep pace with the continuous changes of explosive markets. In addition, it is necessary to mention that in recent years much attention has been given to organizational capacity development in in order to face the global challenges that helps firms'/ organizations in the process of learning. Organizational agility concept is progressively developing its significance as one of the main tools for gaining and maintaining a competitive advantage in the disruptive technological innovation period (Žitkienė and Deksnys, 2018). Furthermore, it can be said that the capacity for enhancing organizational learning facilitates organizational learning process in which knowledge transfer takes place to achieve its advantages and helps to solve organizational problems and improve organizational performance, i.e. firms' competitiveness.

On the other hand, concerning the significance and distinctive features of organizational agility several researchers like (Nafei, 2016; Hugos, 2009; Mehrabi et al 2013; Tallon, and Pinsonneault, 2011; Yeganegi and Azar, 2012) have stated various opinions. Similarly, Alhadid (2016) and Najrani (2016) also addressed that actually the awareness of OA agility shows the impact of nimbleness in manufacturing firms', quickness in dealing with the market setting, and flexibility in dealing with manpower and fitness in technology for stimulating organizational or firms' performance. In addition, Ebrahimpour et al, (2012) emphasized that agility capabilities of an organization are considered for those today's forward-looking firms' that retain such characteristics in order to attain competitive advantage and gain an edge over competitors. Conversely, some researcher's such as Breu et al, (2001) ; Sull, (2009) ; Qin and Nembhard (2015) also highlighted that while considering the strategic activities of human resources as the most important assets in an organization that enables them to reconsider and transform the workforce to meet the business needs and to create organizational agility. More interestingly, according to Bill Gates, the success of an organization today requires the agility and drive to constantly rethink, reinvigorate, react, and reinvent." In another way, it can be said that to compete with the volatile market condition, organizational agility enhances the enterprises capability to consistently identify and capture business opportunities more quickly than its competitors do (Ganguly et al., 2009). Since, organizational agility is the capacity to sense and respond rapidly to changing customer needs, to make decisions rapidly, and to reallocate resource quickly as circumstances change Under this circumstance, organizational agility has become an important feature that has a noteworthy impact on employees' behaviour and organizational effectiveness (Kristensen and Shafiee, 2019; Chamanifard et al., 2015; Sull, 2009).

While discussing the contextual approaches of strategic HRM and organizational agility their effect on firms' competitiveness, it is obligatory to describe briefly the importance organizational leaning and its impact on firms' development. The activities of Strategic HRM and its effect on managerial skills and organizational performance offered some perceptions on how learning might occur at the organizational level to develop institutional capability as well as individual capability. To address the influence of strategic HRM there were plenty of research studies. However, there were some rare examples of linkages between SHRM and sustainable organizational learning practices that can improve firms' effectiveness and improve its performance through sufficient qualification, suitable working condition,

and potential motivation. Nowadays, the strategic part of HRM practices which were integrated within the organization stated that the success of the organizational effectiveness fabricated in developing positive attitudes of individuals, groups, and organizations that mainly enhanced individual competence as well organizational competence through organizational learning. Therefore, the context of this study identified the key concept of Strategic HRM that influenced and boosted knowledge, skills, and abilities (KSA's) of employees.

THE INFLUENCE OF ORGANIZATIONAL AGILITY ON STRATEGIC HRM ENHANCE FIRMS FLEXIBILITY AND COMPETITIVENESS

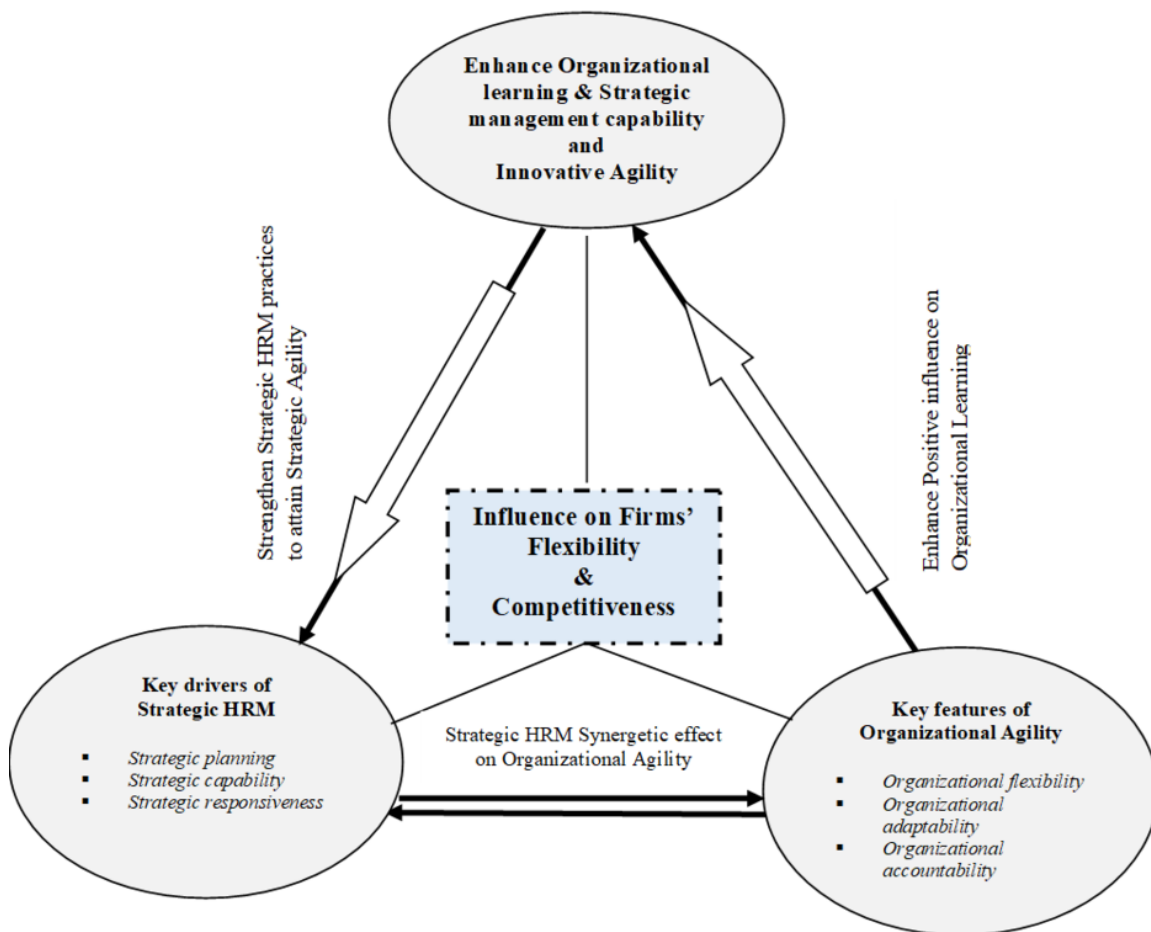
Linkage Between Strategic HRM and Organizational Agility

To address and describe the influence of organizational agility on strategic HRM, it is necessary to demonstrate the alignment of human resource management; and its significant strategy discourse that has an insightful effect on significant agile organizations development concepts. Nowadays a robust discussion is going on among academicians, researchers, management experts and government on how firms can respond rapidly and flexibly for enhancing their business competitiveness. To highlight the relationship between strategic HRM and organizational agility on firms' performance development, the below mentioned Fig. 1 demonstrates the linkage between strategic HRM and organizational agilities influence on firm's flexibility and Competitiveness.

The below mentioned Fig.1 basically reveals the key concepts of strategic HRM practices such as: strategic planning, strategic capability and strategic responsiveness that strengthen strategic HRM practices in order to attain and enhance firms' strategic capability. Moreover, it can be said that the influence on human resources strategies, ensure the strategic role of HR, generate strategic ability of an organization that increase individual employees' skills (competence), managerial competence and group competence through strategic responsiveness and organizational flexibility. On the other hand, Fig. 1 also highlights the influence and importance of strategic HRM, which is inclusive with the key features of organizational agility, such as: organizational capability, adaptability, flexibility and organizational effectiveness that facilitate firms or organizations to realize their effectiveness. Additionally, recent study on organizational performance development says that through strategic HRM practices firms' need to find a research niche in the international research market to cope up with the strains of the present business environment. Conferring to this ideology of strategic HRM and organizational agilities linkage, numerous researchers like Teimouri et al, (2017); Holbeche, (2015); Battistella et al, (2017) and Dubey et al. (2018) and Keshavarz et al. (2015) identifies that human resource actions, i.e. (individual performance) are one of the major tools to accelerate firm's performance in order to fulfil organizational objectives quickly, flexibly and capably, i.e., through organizational agility.

In another way, it can be said that organizational agility (OA) and its initiatives enable firms' to augment organizations performance progress style, include HR approach and organizational progress attitude in order to efficiently respond to the ever changing world. Regarding this burning topic OA, researchers and practitioners and academicians from varied disciplines envisioned that this topic can be viewed as multidisciplinary perspective. Hence, it is rational to entitle that organizational agility and strategic HRM has a strong inter-personal relationship or linkage that facilitate firms' as well as business growth that enhance organizational efficiency, i.e. firms' competency. Relating to this issue, it is necessary to refer that organizational agility has been used in this research based on the influence

Figure 1. The linkage between strategic HRM and organizational agilities influence on firm's flexibility and competitiveness



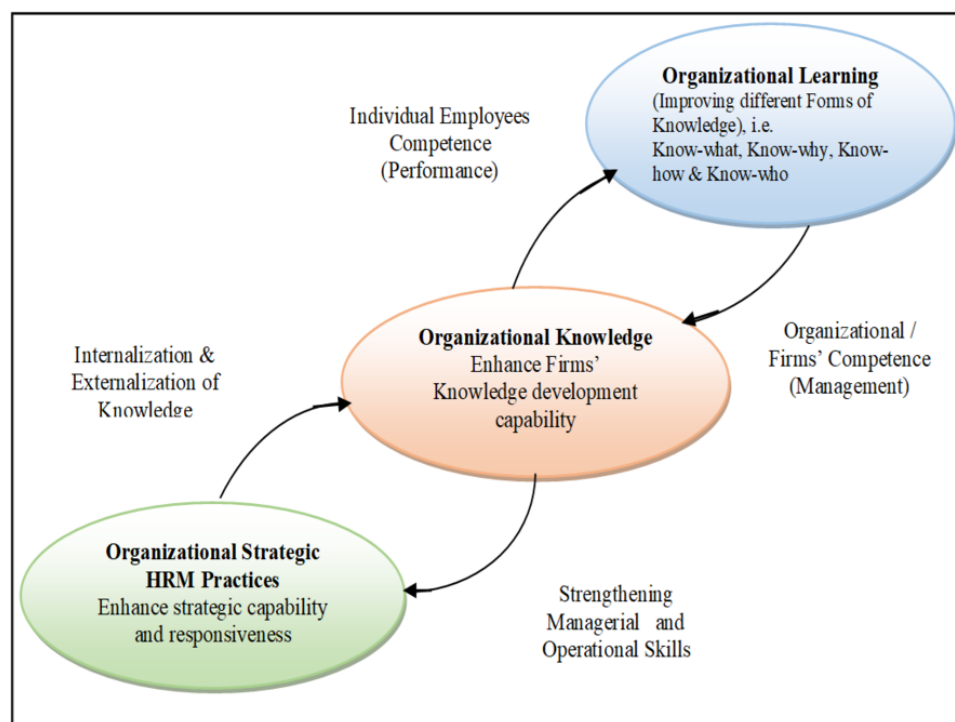
of strategic activities of HR on organizational nimbleness, the way human resources drive their agile qualities in order to strengthen strategic HRM practices, as well as enhancing the positive influence on organizational learning. Illustrating the linkage between strategic HRM and organizational agilities influence on firm's flexibility and competitiveness this chapter performs to develop a relationship model (Fig.1), about the effect of strategic HRM on organizational agility that enables firms' to achieve their sustainable organizational efficiency, i.e. competitive advantage.

Challenges of Strategic HRM Enhancing Organizational Learning

To represent the challenging perspectives of strategic HRM, key issues and deliberations, it is obvious to discuss about the synergic consequence of human resource management strategy that fascinating organizational learning to enhance organizational knowledge (i.e. managerial and operational competency) and competitiveness. To better understand the significance of organizational learning and its impact on human resources strategic practices Kou, (2011) expresses that strategies of HRM consist better in *organizational learning*, *organizational innovation*, that enhances knowledge management capability

which ultimately contributes to achieving organizational performance, (i.e. firms' effectiveness). In short it can be said that organizational learning improves organizational innovation and accumulates knowledge management capability, organizational innovation results in knowledge management capability. Thus firms need to create an environment to disseminate the use organizational knowledge in order to enhance organizational performance. Consequently, Cheng, Niu, and Niu, 2014; Chiva et al., 2014 remarked about the way organizational learning nowadays becoming a challenging perspective to strategic HRM due to its internationalization of knowledge and strategic organizational knowledge development capability. According to them, organizational learning is vital for the organizations or firms' when they are functioning in changeable environment in order to respond promptly to unpredicted circumstances than their competitors do (Garvin et al., 2008); (Basten and Haamann, 2018); (Saha et al., 2016).

Figure 2. Strategic HRM enhancing organizational knowledge through organizational learning



According to the findings of evolutionary economics, organizational behaviour and strategic HRM literature the author attempts to reveal the challenging perspective of Strategic HRM that enabling organizations or firms to enhance their knowledge development capability through organizational learning which has a great impact on firms' success and gain competitive advantage.

In this chapter the depicted Fig. 2 exemplify the challenging perception of strategic HRM that has been conducted in this study in order to explore the potential contribution of HRM strategy and its distinguishing features to gain some competitive advantages and enhance organizations' or firms' flexibility as well as capability and performance in relation to the implementation of organizational learning strategies (i.e. Know-what, know-why, know-how and know-who).

Organizational Agility and HRM Strategy on Firms Competitiveness

To visualize the significance of organizational agility and value of HRM strategy that can create a difference and influence on business performance, i.e. firms' competitiveness. On the other hand, the firm's competitiveness can respond rapidly and flexibly to the changing environment without facing market turbulence through organizational learning and strategic planning and strategic HRM practices. Through this concept, it intends to identify the key dimensions of organizational agility which focused on the right kind of people at the right time and at the right place to access to proper knowledge, skills and abilities (KSAs), innovative capability of the individual employee, and technological expansion. The strategic HRM approach within the organization or firms is considered to be a key player to enhance effectiveness, awareness, innovativeness, and competitiveness. The importance about organizational agility and HRM strategy on firms to competitiveness is expressed in Figure.3. The below mentioned represented Fig 3, discussed about the crucial elements and dimensions of organizational agility along with the key driving forces of human resource management. It demonstrates that basically organizational agility (OA) is consists of several key elements. Among them the most significant elements involve in organizational promptness and flexibility. For example: speed (which is responding to changes in the surrounding environment); adaptability (which enable institutions to cope up with the competitive world; and execution (Which is from the marketing perspective point facilitate institutions to enter in to the global market) Similarly, HRM is the strategic management that leads institutions to accomplish its goals through motivating and rewarding the right kind employees. Hence, it can be said that HRM consists of various driving forces and strategies that respond to face global challenges, namely knowledge skills and abilities(KSAs), i.e. organizational learning and strategic initiatives of human capital that encourage and stimulate enterprises to achieve sustainable competitive advantage.

Figure 3. Thematic model of organizational agility and strategic HRM's positive influence enhance firm's competitiveness



In order to justify the harmonization of organizational agility and strategic HRM that enable firms to enhance its effectiveness the described Fig. 3 demonstrates the way of organizational knowledge management proficiency and the innovative capability of an organization. The portrayed Fig.3 elucidates how

rapidly and cost-efficiently firms can adapt and enter in to the global market with the influence of strategic HRM and its key drivers along with the key distinctive features of organizational agility. Therefore, this study emphasizes the influence of strategic HRM and organizational agility on the enhancement of organizational knowledge as well as organizational learning capability that influences on organizational excellence, i.e. firms' competitiveness. Furthermore, this study explores and investigates the impression of OA and KM strategy as an identical perception of knowledge & innovation-driven growth of an organization. It describes that sustainability of an organization can be contingent on its agility, as the agile process of an organization promotes sustainable development. Simultaneously, from the organizational knowledge development point of view it enhances organizational strategic progress through its existing human capital's (human resources) innovative capability (Abbaspour et al., 2015); (Salamzadeh et al., 2014); (Doz and Kosonen, 2008). This perception has been already acknowledged by various scholars and researchers for example (Felipe, Roldán, and Leal-Rodríguez, 2016; Hatani and Mahrani, 2013; Mitchell, Obeidat and Bray, 2013; Bhatnagar and Sharma, 2005). Furthermore, from the organizational flexibility point of view, it is necessary to mention that in today's turbulence condition organizations need to share their risk along with their collaborative team members in order to compete successfully as well as to meet the global challenges (Page et al, 2016). Simultaneously, Trinh et al, (2012) also specified that the significance of organizational agility has been recognized by the organizations or firms who faced with challenges from a highly turbulent business environment. During that transition period they have realized and considered the agility concept as a novel approach of enhancing organizational capability in order to respond those changes and attain organizational competitiveness.

SOLUTIONS AND RECOMMENDATIONS

Finally, in order to identify the clarifications and recommendations concerning the debated issue of organizational agilities importance on firms' competitiveness, it has been viewed that the perception of strategic HRM enhances firm's competitive capability. It is mandatory to emphasize that in today's rapidly-changing business world, the impact of strategic human resource management (SHRM), and essence of organizational agility (OA) represents one of the most common strategic approaches to address the stresses of globalization and industrialization. Since, beginning of the 21st century, management development gradually becomes a part of the exclusive competence pillar. Hence, in recent years, many organizations or firms have attempted to manage their business performance using different strategies in order to achieve their mission, vision, and target as well as to meet the global challenges. Since all of us aware about the situation that to accelerate firms' knowledge and competitiveness organization need to have a proper organizational learning capability, i.e. employees' professional development facility, that enable them to regain their strength. The later experiences arguably enhance organizational learning. Different scholars have argued that harnessing the powers of human resources in institutional quality development strategy is one way to evoke the significance of institutional capacity development, i.e. organizational agility. Relating to this vibrant topic organizational agility and SHRM's key aspects and their role on enhancing firms' competitiveness this sub-chapter leads to the formation of significant research propositions and or hypothesis which states that SHRM is the key factor in HR development systems. Where, individual employee's proficiency (KSAs) creates value through them within their performance and individual creativity. In addition, this sub-chapter also expresses that organizational learning is used to strengthen the professional skills, and finally it can be said that organizational success enhances performance development of a firm or an organization.

Consequently, strategic HRM's activities and organizational agilities key features plays a motivating role to achieve sustainable organizational development, i.e. competitive advantage. In this chapter, the observed research expectations conclude that the currently organizations are under turbulence and due to that reason the importance of organizational agility is necessary for the firms in order to cope up with the changing world. Through organizational agility firms can enable to revive their effectiveness, i.e. (responsiveness, awareness and flexibilities) that promoting their competitiveness and aligning new business ideas.). Therefore, grounded on the said topic of research investigation, this study has drawn some significant managerial as well as operational approaches as recommendation for fostering firms' competitiveness. Initial clarifications of these recommendations have been exemplified below:

Recommendation 1: HR system in an organization is created by individual employee's talent, group talent, and organizational talent that outweighs the value through organizational learning. Thus, motivation, integration, and collaboration within the organization provides sustainable gains over the time, and balances the efforts for managing competence, namely management skills (managerial and operational) which, enables to maintain and extend the organizational success and long-term performance.

Recommendation 2: Organizations should change their mental as well as administrative setup in order to build systems, connection, collaboration for the new market growth, especially for those firms willing to cope up with global market opportunities. In this condition, organizational learning helps firms to strengthen the firms' competitive skill through improving four different types of knowledge, i.e. (Know-what), why it is necessary to achieve (Know-why), how it will be potential to make it (Know-how), who will be the right person to accomplish this task (Know-who) that can enhance organization's sustainability through internalization and externalization of knowledge (enhance firms' level of performance)

Recommendation 3: The third recommendation highlighted indicate that organizational performance in terms of flexibility and adaptability is achievable through organization's activities, especially, from the resource based perspective to process-based perspective. On the other hand, while discussing about the performance characteristics of an agile organization, it is required to state that organizations agile capacity is mainly existing on two important features, i.e. organizational adaptability and organizational flexibility; where, organizational adaptability mainly focuses on the way of an organization's procedure and structure, and status of reinforcement influence its capacity to quickly adapt to its business environment. Where, the opportunity (organizational or firms' excellence) with internal, i.e. HR's innovative capability to adapt the very fast response to sudden market changes and emerging threats by intensive customer interaction.

Recommendation 4: To overcome the excessive stress organizations need to enhance their competitive capability by collaborating as well as initiating a vibrant relationship between the academy and industry with the concept of performance –driven organizations innovative capability. So, for knowledge production organizations must put emphasis on academic fabric that can leverage and create strong driver for competitiveness. It is assumed that this conditions may help to take prompt decision and respond to the market need. It may also empower to build a business development strategy that substantiate a positive impact to achieve and sustain indigenous growth, i.e. organizational professional, commercial, managerial and operational benefit.

Recommendation 5: Finally, this chapter brings some hope for future which shows that human resource assets are the fundamental elements of success that they play a key role in the development of creating organizational agility. Thus author's feel that it is necessary to highlight that while considering human resources, strategic role, and its influence on organizational agility; decision makers of the organization are recommended to think about the capability to reconfigure and transform the employees to their business needs. Therefore, the firms' or organization need to be conscious about the fact that they can

stimulate the expansion of attitudes, behaviors, and competencies. Thus, in short it can be said that this study highlights the importance of organizational agility and human resource's effectiveness, which have a great effect on enhancing organizational performance, i.e. firms' strategic capability to compete due to their competitive abilities.

FUTURE RESEARCH DIRECTIONS

In the current policy discourse, the philosophy and the urge of strategic HRM and organizational agilities potential influence for organizational development as well as for enhancing organizational competitiveness is overwhelming. Consequently, it is necessary to address the value of organizational learning in organization, it is obligatory to emphasize that currently organizations' have to face always competitive challenges and turn them into organizations knowledge development opportunities. Henceforth, from the organizational knowledge development perspective point of view, organizational learning can be considered as an opportunity to make changes and keep pace with the dynamically changing environment. This impression highlights that organizational learning is a fundamental factor in stimulating innovation and creativity within the organization. Therefore, the question of sustainable organizational learning and performance development become crucial elements in assessing and strengthening the overall development of organizational effectiveness. In this changeover condition, the notion of 'organizational learning' has become a key aspect of enhancing research organizations competitiveness through aligning organizational culture, which should be an integral factor when considering organizational competitiveness. Research shows that the significance of the association of organizational along with the organizational culture both act as a source of competitive advantage that enables organizations to enhance and influence on an organization's development strategy.

On the other hand, from the scientific as well as practical perspective point, it is expected that this research will extend to its outlook to another area of research where, organizational culture is perceived and considered as a principle that maintaining the connections with the mission, vision and a strategy, of an organization's structure and size, the management's activities, or functions within an organization. Though several researchers have also mentioned that organizational culture has a great influence in creating and maintaining a high performance oriented organizational effectiveness within the same culture and cross cultures. Thus to foresee the future prospect of this study, it is critical to emphasize the fact that at the present time, the manifestation of organizational learning concept as well as the significance of organizational agility along with organizational culture has been aligned with the perception of organizational performance development strategy. It aims to increase the efficiency and effectiveness of organizational behavior that constitutes a standardize operational environment, which acts as a vital stimulant for achieving the organizational competitive advantage. Finally, it can be said that organizational competency development enhances internal communication strategy in relationship with the organizational culture, knowledge, administration and technological upgradation that facilitate sustainable organizational learning.

CONCLUSION

To conclude, the prior discussion regarding the significance of organizational agility that foster firm's competitiveness through human resources strategic activities. To meet the global challenges, today it is

compulsory not only to improve the managerial and institutional competitiveness but also to find out the hidden know-how, i.e. the way organizations can enhance their existing resources competitiveness quickly, flexibly, and promptly in this continuously changing world. In addition, this thesis suggested that organizational agility and human resources strategic approach could be a very thought-provoking interesting idea to the organizations of the twenty-first century that have a good impact on human resource management and knowledge management strategy. To accomplish institution's competitiveness and enhance sustainable institutional excellence (performance) this thesis highlighted the integration of organizational competency awareness and its interpretation as well as knowledge dissemination to ensure not only the institution's success but also its sustainability. Consequently, there is a critical need for business leaders to assess their employee's talent (innovative skills and abilities) constantly, in order to determine whether the appropriate expertise is capable to accomplish the business goal or not. If not, then how to identify the skills of current employees for developing within the organization to perform better, according to the level required for the organization to be competitive. To resolve this tricky conditions of an organization, this thesis provides some evidence (presented in the list of publications) of how organizational proficiency and superiority that encompasses organizational aptitude on knowledge development and performance development.

Precisely, this chapter finally deliberates the significant issues of Organizational Agility (OA) and its effect on Strategic human resource management (SHRM) that enables businesses to sustain their organizational learning as well as to enhance organizational competitiveness. Furthermore, it is necessary to mention that chapter also highlighted the key enabling perspectives of strategic human resource management that endeavored for enhancing organizational learning through organizational agility and organizational capability. Since, nowadays the most pioneering and contemporary organizations are under excessive stress to work in a dynamic environment which, always enforces them for prompt and quantifiable advantage in order to survive in this internationally competitive market. Under these circumstances, competitiveness and innovation have become a hot issue of academic, business and managerial debates with regard to be agile and be able to sense and respond to market changes quickly and smoothly to sustaining their efficiency, i.e. organizational competitiveness. On the other hand, the conceptual framework of this study induces various approaches and models concerning organizational agility (OA), an organizations competency development approach that comprises human resources strategic approach and organizational progress attitude to efficiently respond to the dynamic world.

While addressing the key positive facets of strategic HRM, finally this chapter demonstrates some valuable features for instance (i) It is a flexible process of developing a sense of direction, making the best use of resources and ensuring it with strategic fit; (ii) It encourages to foresee the organizational capability of a firm which, depends on its resource (human capital) capability; (iii) It generate the best organizational managerial capability; (iv) It ensures that the organization has the skilled, engaged, committed and well-motivated employees in order to achieve sustained competitive advantage (v) It delivers added value and advantages to achieve sustainable competitive advantage through the strategic development of the organization's rare, hard to imitate and hard to substitute human resources. Thus, it is foreseeable that HR organizations of the future will have to reinvent the wheel to reinforce their talent management practices as well as driving agility in their organization and those who distress to do so may put their organizations in difficulty. Nevertheless, the subject matter that whether HRM Strategy is an enabler or act as an impeder of organizational agility still remains unanswered.

Finally, it is essential to designate that this chapter provides an understanding of the significance of organizational agility and its influence through organizational learning, i.e. the strategic initiatives of HRM and its effect on the occurrence of turmoil business environment as a novel approach. Moreover,

while undertaking this study authors were mostly focusing on strategic HRM 's key driving forces that creates an enthusiasm among the researchers in order to study the importance of learning at the organizational level, how it influences an organization to be flexible; how it enables organizations to develop an innovative way of indulgent rapidly during the period of technological turbulence, (i.e. agility) that facilitates organizations either to create new knowledge or to modify the existing ones, (i.e. the impact of disrupting technological surveillance). Fundamentally, it is to be noted that strategic HRM influences RMHRM organizational learning (i.e. human resources learning capabilities, strategies within the organization) organizational agility (i.e. firm's fast-adopting capability, refinement and accepting the capability with the changing environment) and empower firms to take actions promptly and react flexibly to face the vibrant ever-changing business environment.

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KEY TERMS AND DEFINITIONS

15

Competitiveness: In this chapter, the term competitiveness has been considered as the capability of a firm or organization that are willing to meet the organizational requirement and sustain in long-run as well to compete globally. From the organizational development point competitiveness can be reflected as managerial and operational competency.

Organizational Agility (OA): In this chapter the notion of organizational agility (OA) is a novel reasonable and practical approach. It is very essential for the organizations looking forward to visualize themselves in the new millennium. It can be considered as strategic approach that facilitates organizations to take challenges in a very flexible way which empowers them to reinforce their existing resources that act as an elixir to enhance organizational effectiveness.

Organizational Development: In this chapter, the term organizational development can consider as an arena for research, where it is dedicated to intensifying the organizational knowledge and organizational effectiveness through enhancing individual employees' performance management.

Organizational Learning (OL): In this chapter, the term organizational learning has been regarded as the inquisitiveness (desire for knowledge development) of employees learning capability. It may also have regarded as a tool for organizational knowledge development process or media that encapsulate organizational performance.

Strategic Human Resource Management (SHRM): In this chapter, the term strategic HRM has been viewed as the process of organizational tactical planning that influence human resources in order to enhance individual employees' skill and group capability as well as strengthen managerial skill.

Learning Organisation: An Effect on Organisational Performance

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INTRODUCTION

A learning organization is an institution, which has the skills to change behaviour in order to form new information and understanding through the creation, gathering and transfer of information based on a continuous learning cycle. Organizations that could shed light on the future are those with learning capacity and enthusiasm and are able to form and use valid and reliable information. It is essential for the staff of an organization to be open to innovation and learning, in order to increase service quality, and convey the impact of being a learning organization to the forefront. Similar to the growing importance of being learning organizations in all fields and institutions, it is also gaining importance in educational institutions in terms of reforming information and adapting to change (Volante, 2010). Especially, gaining awareness of the characteristics of learning organizations can result in dynamism and innovation, as well as increased motivation and enthusiasm in the institutions (Tasargöl, 2013).

Organizations include multiple and intricate networks of relationships, which are sustained through communication and other forms of feedback with varying degrees of inter-dependence. With the rapid pace of growth, organizations face some challenges in training and retaining the intellectual capital of their workforce. First, due to the rapidly changing technologies, there is a need for continuous adaptation and retraining of the employees. Second, the training has to address a wide range of people with different backgrounds and abilities, ranging spectrum of needs and availability of time to study, etc. Further, as these learners are adults with considerable experience and awareness of what they would like to learn, training methods need to evolve to meet the needs of a modern knowledge society (Minch & Tabor, 2003). In addition, organizations are facing a number of key changes that focus attention on efficiency in relation to delivery methods. New opportunities are being offered by information technology (IT) which could facilitate major changes in the delivery of training and provide greater flexibility for learning (Littejohn & Watson, 2004).

In the digital age where information is regarded as the most important power, learning can be considered as an effective process of collecting, developing and transferring information (Alipour & Karimi, 2011). The concept of the learning organization has been linked to innovation and performance in organizations (Power & Waddell, 2004). The capacity for change and continuous improvement to meet the challenges in the environment in which organizations operate has been associated with the capability of these organizations to learn (Armstrong & Foley, 2003). Thus, organizations that learn will be able to keep abreast with developments and improvements in the business environment to operate successfully.

Organizations of the future will not survive without becoming communities of learning. It is absolutely essential for organizations to learn from their environments, to continually adjust to new and changing market dynamics, and just as is the case with the individual, to learn how to learn from an uncertain and

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unpredictable future. Continuous improvement requires a commitment to learning. Solving a problem, introducing a product, and reengineering a process all require seeing the world in a new light and acting accordingly. In the absence of learning, organizations and individuals simply repeat old practices. Change remains cosmetic, and improvements are either fortuitous or short-lived.

BACKGROUND

The learning organization perspective is perhaps the most popular within the management and business at the moment. Senge (2006) suggests that the most successful organizations are learning organizations and that the ability to learn faster than competitors is the only sustainable advantage. It might, therefore, be reasonable to assume that being a learning organization would manifest itself in an excellent performance, given that this must be a key area of competitive advantage. Senge (1990, 1996) developed five interrelated dimensions that are considered vital to building organizations that can truly learn known as 'Five Disciplines'. These disciplines include mental models, personal mastery, shared vision, team learning, and systems thinking. The five disciplines have remained as the core elements of the learning organization.

Pedler, et al. (1997) argued that there has been a shift within the field away from looking at the learning organization as the 'panacea' for any organizational improvement, towards a more pragmatic emphasis on the process of the learning organization. The learning organization is referred to as a journey with a number of maturity stages based on eleven characteristics that need to be developed on the way. These eleven characteristics include learning approach to strategy, participative policymaking, informative, formative accounting and control, internal exchange, reward flexibility, enabling structures, boundary workers as environmental scanners, inter-company learning, a learning climate, and self-development opportunities for all.

Watkins & Marsick (1993) viewed the learning organization as an integrative model, where learning is a continuous process, used strategically, and is integrated with overall work processes. This model integrated both structure and people as they are focusing on leveraging learning on three levels like the individual, team and organizational or system learning (Watkins & Marsick, 1996). At the individual level, continuous learning opportunities need to be created, allowing members in the organization to acquire knowledge and skills. At the team level, individuals learn as teams, focusing on collaboration and teamwork. This is followed by learning at the organization level incorporating individual and group learning and capture all in standard operating procedures, work processes, operations manuals, information systems, and the organizational culture. Learning at the organizational level is described as the most difficult, and least practised by companies as it requires the establishment of effective systems to capture and share learning, and gaining organizational consensus and commitment from all employees through empowering them toward a collective vision, resulting in increase in organizational performance (Watkins & Marsick, 2003).

Örtenblad (2002) developed a typology of the idea of a learning organization. He suggested that there are four understandings of the learning organization concept. The first is the old learning organization perspective, which focuses on the storage of knowledge in the organizational mind. Learning is viewed as applications of knowledge at different levels. The second type is the learning at work perspective, which sees a learning organization as an organization where individuals learn at the workplace. The third is the learning climate perspective, which sees the learning organization as one that facilitates the learning of its employees. The fourth is the learning structure perspective, which regards the learning

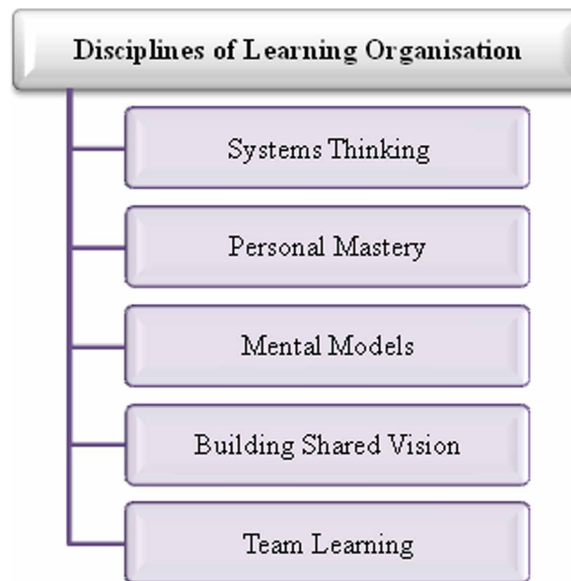
organization as a flexible entity (Örtenblad & Koris, 2014). Naser, et al. (2017) found that there is a high degree of importance of organizational dimension, knowledge management, the focus of continuing education, strategic partnerships and alliances, and keep up with the labour market in the organization. There is a fair level agreement about the axis of interest teams/committees, and scientific research. There is a moderate agreement about the importance of the human dimension, institutional culture, cognitive dimension, and consulting and training.

Dekoulou & Trivellas (2015) brought to light that learning-oriented operation is a crucial predictor of both employee job satisfaction and individual performance, while job satisfaction proved to be a mediator of the relationship between learning organization and job performance. Huili, et al. (2014) demonstrated the linkage mechanism of building a learning organization and business performance. The study found that learning dimension has the most significant impact on firm performance. Learning and innovation have a significant impact on performance, whereas, culture and leadership have a relative influence on non-financial indexes. Macpherson & Antonacopoulou (2013) identified that uneven outcomes were attributed to three critical contributing factors such as the leadership and governance structures, the meaningful ways in which members can participate and interact with others, and their identity and sense of belonging.

García-Morales, et al. (2012) argued that transformational leadership influences organizational performance positively through learning organization and innovation, learning organization influences organizational performance positively, both directly and indirectly through organizational innovation, and organizational innovation influences organizational performance positively. Singh (2016) argued that the learning organization have a great impact on organizational effectiveness. An organization can maintain a cordial learning environment within the organization through the senior managers by regulating data creation and data sharing among the employees within the organization. This will help in bringing the innovation capabilities and increasing the competitive advantage. The employees should continuously adapt to and learn for organization effectiveness. Abu-Shanab, et al. (2014) explored the relationship between different variables like information technology infrastructure, supportive organizational policies, knowledge sharing motivation, knowledge sharing practices and ongoing learning organization. The study indicated that there is a significant positive relationship between knowledge sharing practices and ongoing learning organization. Firms need to emphasise the role of learning organization in sustaining competitive advantage and furnish needed tools to encourage knowledge management practices. It is vital for organizations to set up an environment for social interaction as a means for knowledge sharing.

Moh'd Al-adaileh, et al. (2012) explored the influence of the knowledge conversion processes (KCP) on the success of a learning organization (LO) strategy implementation. The study revealed that socialisation, internalisation and their combination have a significant impact on the success of a learning organization strategy. Socialisation is the major influential factor, having the strongest impact on learning organization whereas, externalisation was found to have no statistical influence on learning organization. Aydin & Ceylan (2009) ascertained the impact of learning organization capacity (LOC) on organizational effectiveness. The study found that a company that features a high level of learning organization could have a higher level of worker satisfaction which can successively improve the money and growth performance of a company resulting in positive effects within the organization. Garvin et al. (2008) stated that learning organization is the place where the staff excel in the creation, acquisition, knowledge transfer, and consists of three basic building blocks like the internal supportive environment to learn, processes and practices to learn, and the behaviour of leadership that supports and enhances learning. A learning organization is different from other traditional organizations in terms of educational leadership, restructuring, allowing employees to participate and move effectively, and adopting

Figure 1. Disciplines of learning organization



participation strategy. A learning organization also provides opportunities for exchange of knowledge, information, strategy and culture.

LEARNING ORGANIZATION DISCIPLINES

Learning organization theory first gained major recognition in 1990 with the publication of *The Fifth Discipline: The Art and Practice of the Learning Organization* by Peter Senge. According to Senge (1990), an organization should be a place where “people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning to see the whole together.” Senge (2001) outlined five basic disciplines or components of a learning organization viz., personal mastery, mental models, building shared visions, team learning, and systems thinking. The five components of the learning organization were conceptualised to help people become active participants in understanding their reality at present and shaping it for the future. In his view, simply following best practices can do more harm than good, often leading to incomplete implementation and disappointing outcomes. He is not denying the value of learning from other organizations, or from well-conducted research. Rather, suggesting the importance of understanding and accommodating the nuances of each organization, and recognizing and responding to unavoidable changes in organizations’ environment as they occur. The five disciplines of the learning organization are shown in figure 1.

1. Systems Thinking

Systems thinking is looking at the interrelated parts of a process and recognizing and examining patterns and possibilities. In the context of learning organization theory, Senge (1990) refers to systems thinking as the fifth discipline. It is the discipline that integrates the other four disciplines, viz., personal mastery,

mental models, building shared visions, and team learning into a coherent body of theory and practice. Organizations are systems, comprised of interrelated parts and actions which often take years to fully play out their effects on each other. When an individual is inside an organizational system, it is hard to see or perceive full patterns of interactions and change, but can only see snapshots. When the decisions are made based on such limited information, it is hard to make good choices that solve fundamental problems (Kofman & Senge, 1995).

Systems thinking states that all the characteristics must be apparent at once in an organization for it to be a learning organization. If some of these characteristics are missing, then the organization falls short of its goal. However, some believe that the characteristics of a learning organization are factors that are gradually acquired, rather than developed simultaneously. It is the discipline that integrates all the employees of the organization, fusing them into a coherent body of theory and practice (Senge, et al., 1999). Systems thinking ability to comprehend and address the whole and to examine the inter-relationship between the parts provides for both the incentive and the means to integrate various disciplines in the organization.

2. Personal Mastery

Personal mastery is taking the time, and intellectual and emotional effort, to clarify, and then deepen one's personal vision. In essence, it is an individual figuring out what he or she considers truly important (Senge, et al., 1999). The central principle of personal mastery is creative tension. This involves using the gap between one's personal vision and one's current reality to generate energy for change. In order to do this effectively, individuals must have a clear view of both their vision and their reality (Senge, 2001).

Individuals striving for personal mastery are committed to life-long learning, and ever-increasing proficiency in their work, which they approach almost like a work of art. They are particularly interested in understanding how their actions affect others around them. Their goal is to attain expertise which can be shared with others, not to dominate others. They focus their energies on desired results and are much less concerned with the particular means or processes used to attain those results, which leaves their mind open to innovate and create solutions to problems (Senge, 1990). It is a process and lifelong learning discipline. People with a high level of personal mastery are acutely aware of their ignorance, their incompetence, and their growth areas. Therefore, it is important to develop a culture in the organization where personal mastery is practised in daily life.

3. Mental Models

Mental models are deeply ingrained assumptions/generalisations that influence how one understands the world behaves in the world and believes the world works. Mental models are the lenses through which individuals view their world (Senge, 1990). In order to examine mental models, one must first turn the mirror inward to unearth one's internal pictures of the world, and then bring those pictures to the surface and scrutinise them. Once an individual has accomplished this process, he or she must share his or her own thinking with others and expose it to their influence, so limitations in his or her worldview can be recognised.

In creating a learning environment it is important to replace confrontational attitudes with an open culture that promotes inquiry and trust. To achieve this, the learning organization needs mechanisms for locating and assessing organizational theories of action. Unwanted values need to be discarded by the process called 'unlearning' (Senge, 2001). If the organization is to develop a capacity to work with

mental models, then it is necessary for the employees to learn new skills and develop new orientations. For this, there need to be institutional changes in order to foster such a change. It involves seeking to distribute organizational responsibly far more widely while retaining coordination and control.

4. Building Shared Visions

Building shared visions is the process of translating individual visions into a shared picture of the future that an organization or a workgroup within an organization, wants to create. A shared vision is much more than the vision statements, which are often the vision of a single person or small group imposed on the rest of an organization. A truly shared vision is a common caring about a goal shared by all members of a working group and provides the focus and energy for subsequent team learning (Senge, et al., 1999). The development of a shared vision is important in motivating the employees to learn, as it creates a common identity that provides focus and energy for learning. The creation of a shared vision can be hindered by traditional structures where the organizational vision is imposed from above. Therefore, a learning organization tends to have a flat decentralised organizational structure.

The shared vision is often to succeed against a competitor for which there can be transitory goals. There should be long term goals that are intrinsic within the organization. The only way to arrive at a genuinely shared vision is to give each person with a stake in the organization's future a legitimate voice in the process. One can not dictate a vision, but it can emerge when all parties are brought into the process and have a long-term commitment towards it (Senge, 1990). When there is genuine vision, employees' excel and learn, not because they are told to, but because they want to. But many leaders have personal visions that never get translated into shared visions that galvanize the organization.

5. Team Learning

Team learning is a process in which co-workers in an organization "think together" until there is a consensus about how to reach a particular goal. Team learning is vital because teams, not individuals, are the fundamental learning unit in modern organizations. Unless teams in an organization can learn, the organization cannot learn (Reason & Bradbury, 2001). Team learning starts with dialogue. Three basic conditions must be present for dialogue to occur. First, team members must suspend their assumptions. This means they must be cognizant of their assumptions and willing to hold them for personal and group examination. Second, they must regard one another as colleagues, and give up any privileges of rank they normally are granted. Third, they must be guided, at least in the early stages of the process, by a facilitator. The facilitator's responsibilities include helping team members maintain ownership of the process and outcomes, keeping the dialogue moving, and reminding others of the conditions of dialogue (Senge, 1990).

Effective team learning balances dialogue and discussion. In dialogue, complex issues are explored, and no agreement is sought. In the discussion, different views are presented and defended, and decisions are made. Both dialogue and discussion can lead to new behaviours and actions. However, these behaviours and actions are simply a by-product of dialogue, while they are often the focus of discussion (Senge, et al., 1999). Team members who enter into dialogue regularly tend to develop a deep trust and an understanding and respect for one another's perspectives that carry over into discussions. Good teams are often in conflict, the free flow of conflicting ideas is essential for creative thinking. Negative patterns of interaction, such as defensiveness, can undermine dialogue, but if such patterns are recognized

Table 1. Summary of five disciplines of learning organization

Discipline	Description
Systems Thinking	This is a conceptual framework that allows people to study businesses as bounded objects. Learning organization uses this method of thinking when assessing the organization and has information systems that measure the performance of the organization as a whole and of its various components.
Personal Mastery	The commitment by an individual to the process of learning is known as personal mastery. Personal mastery is the discipline of continually clarifying and deepening employee's personal vision, of focusing their energies, of developing patience, and of seeing reality objectively. It goes beyond competence and skills, although it involves them.
Mental Models	The discipline of mental models starts with turning the mirror inward; learning to unearth our internal pictures of the world, to bring them to the surface and hold them rigorously to scrutiny. It also includes the ability to carry on 'learning' conversations that balance inquiry and advocacy, where people expose their own thinking effectively and make that thinking open to the influence of others.
Building Shared Vision	The development of a shared vision is important in motivating the employees to learn, as it creates a common identity that provides focus and energy for learning. The most successful visions normally build on the individual visions of the employees at all levels of the organization. Therefore, a learning organization tends to have a flat, decentralized organizational structure. The shared vision is often to succeed against a competitor for which there can be transitory goals.
Team Learning	A team or shared learning is that the employees grow more quickly and the problem-solving capacity of the organization is improved through better access to knowledge and expertise. A learning organization has structures that facilitate team learning with features such as boundary crossing and openness. The discipline of team learning starts with 'dialogue', the capacity of members of a team to suspend assumptions and enter into a genuine 'thinking together'.

Source: Peter Senge (1990)

and addressed, they can actually accelerate learning (Bennett & Brown, 1995). When teams are truly learning, they can produce extraordinary results.

In Senge's view, if all of the five disciplines are developed independently, much of the potential value of each discipline will be lost. On the other hand, if all five disciplines develop as an ensemble, and if an organization's employees consistently look at how each of the disciplines is connected to the others, the whole (the outcomes) can far exceed the sum of its parts (the inputs). The summary of the five basic disciplines of learning organizations is presented in table 1.

DIMENSIONS OF LEARNING ORGANIZATION

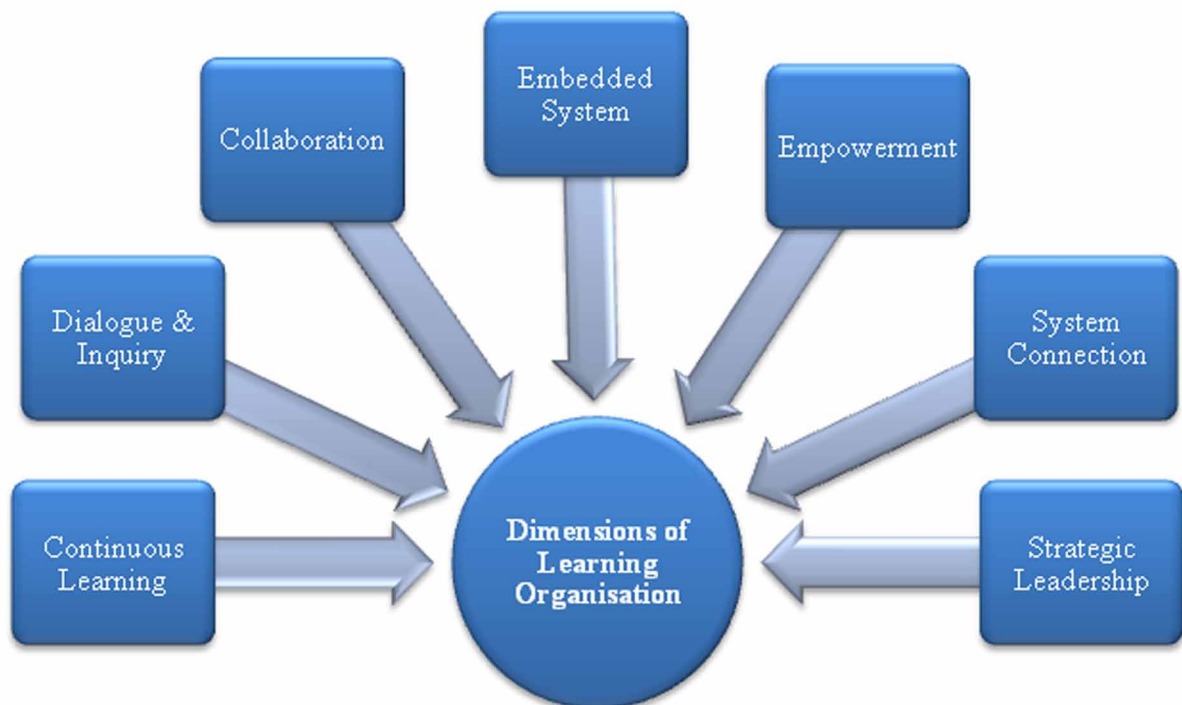
The organizations have experienced a trend of rapid transformation as global markets, and external political and economic changes make it impossible for any business or service-whether private, public, or non-profit to cling-to past ways of doing work. A learning organization arises from the total change strategies that institutions of all types are using to help navigate these challenges. Learning organizations proactively use learning in an integrated way to support and catalyse growth for individual workers, teams and other groups, entire organizations, and the institutions and communities with which they are linked (Marsick, 2000). Organizations have attempted to become learning organizations to establish or maintain their competitive advantage. This strategy has led to the formation and development of validated instruments to assess learning organization culture. Such diagnostic tools can be important, as organizational change necessitates the diagnosis of the current state of organizational culture at the first stage of the efforts (McLean, 2006).

Watkins & Marsick (1996) proposed an integrated model for a learning organization and defined a learning organization as "one that learns continuously and transforms itself. Learning is a continuous,

strategically used process integrated with and running parallel to work.” To measure an organization’s learning culture, they developed the ‘Dimensions of a Learning Organization Questionnaire (DLOQ)’, an instrument that was also validated by relating it to organizational performance. Watkins & Marsick (1993) suggested that the design of learning organization requires six action imperatives including empowering people toward a collective vision, promoting inquiry and dialogue, encouraging collaboration and team learning, creating continuous learning opportunities, connecting the organization to the environment, and establishing systems to capture and share learning. These action imperatives are expected to occur at four different levels for an organization to have the capacity of continuous learning and change i.e., individual (continuous learning and dialogue and inquiry), the team (collaboration and team learning), organization (empowerment and systems), and societal levels (connection to the environment) (Watkins & Marsick, 2013).

In addition, Watkins & Marsick (1993) provided seven characteristics (7Cs) of continuous, collaborative, connected, collective, creative, captured and codified, and capacity building of an organization that has an enhanced ability to change as a result of the achievement of the six action imperatives. These 7Cs are the framework used to audit an organization’s present capacity while identifying the gap between the current and the desired state for a learning organization. Watkins & Marsick (1997) published the DLOQ which was designed to measure the presumed seven dimensions of learning organization including continuous learning, dialogue & inquiry, collaboration, embedded system, empowerment, system connection, and strategic leadership. While some have suggested the underlying framing of the DLOQ is a theory (Swanson & Chermack, 2013). Watkins and Marsick have consistently indicated that the basis for the DLOQ is actually a model as shown in figure 2.

Figure 2. Dimensions of the Learning Organization



1. **Continuous Learning:** Continuous learning helps individuals to obtain new competencies to be applied to the work. When the individuals are rewarded for learning, it creates greater motivation for the individuals to become more receptive towards learning and develop high self-efficacy, which in return improves the individual's performance leading to improved organizational performance (Laatikainen, 2014). Vijjuprabha (2015) referred to continuous learning as providing opportunities to learn from the problems that people encounter, using incentives to support both formal and incidental learning and better planning.
2. **Dialogue& Inquiry:** The dimension dialogue& inquiry is concerned with learning from the experience of others (Pokharel & Choi, 2015). Dialogue provides a platform for questioning, being open to new ideas and understanding the opinion of other people (Watkins & Marsick, 2003). It ultimately serves in building a common understanding and cognition among individuals and a shared understanding of the organization. Inquiry involves questioning the views of others yet does not attack the individuals.
3. **Collaboration:** Organizations have continued to depend on teams to achieve effectiveness through task performance (Klein et al., 2011). Through team learning the members can adapt to changing circumstances, discover new ways of achieving team objectives, and continually refine practices and processes leading to the discovery of better ways of achieving team objectives, which finally results in better team performance (Bunderon & Sutcliffe, 2003). Kayes & Burnett (2006) developed a three-stage learning behaviour model of team learning and performance. The three identified behaviour models are tacit coordination, adapting and problem-solving.
 - Tacit coordination is the continuous and inferred organization of diverse roles, coordination of knowledge and responsibility in a team. Coordination here focuses on the synchronisation of knowledge and skills within a team. Tacit coordination between and among team members facilitates team processes such as decision making, exchange of information and interpersonal awareness thus enhances team performance.
 - The second behaviour is adapting which means responding to internal and external demands through adjusting actions and beliefs. The ability to continuously adapt to the environment allows team members to constantly change strategies and redefine goals in the middle of projects whenever the need arises. This behaviour keeps the team and organizational performance up to par due to the pro-activeness of teams.
 - Problem-solving as the last behaviour involves focusing and addressing problematic activities through collaboration. Collaboration involves channels that foster synchronization of skills and knowledge within the team. It facilitates decision-making, interpersonal awareness and knowledge sharing among team members. The level of performance depends on collaboration and shared interdependence between team members.
4. **Embedded System:** At the organizational level, relationships become structured while individual learning and some of the common understandings developed by groups become institutionalised; thus organizations are able to change to reflect new knowledge and learning (Yang, 2012). Organizations find ways to store knowledge and use it to sustain themselves during periods of high environmental turbulence and even high staff turnover (Watkins & Marsick, 2003). To be able to capture, maintain and integrate new information that is useful for improving organizational performance, a system to effectively capture and share learning is required (Tippins & Sohi, 2003). A good system to capture and share learning can improve organizational performance through people's access to critical knowledge and appropriate information (Lipshitz, et al., 2007). According to Weldy (2009), learning organizations have a memory to acquire, store, retrieve and manage information

and disseminate knowledge through the organization to new staff members to ensure improved organizational performance.

5. **Empowerment:** Another dimension of organizational learning is the empowerment of people towards a collective vision. Employee empowerment means involving employees in decision making by giving them the power in form of autonomy, the information in form of feedback, knowledge in form of training and reward in form of job enrichment (Demirci & Erbas, 2010). Empowerment enhances the employee's psychological attachment and commitment to the organization. An organizational learning system is supported by a common vision through ways such as keeping people committed to the vision and encouraging them to identify them with the vision that promotes organization goals (Garvin, et al., 2008). According to Yang & Choi (2009), employee empowerment is a powerful management tool and if managed well can cause an increase in performance, productivity and job satisfaction. Through empowerment, employees feel energized and become willing to do whatever it takes to get the work done thus enhancing the better performance of the organization (Ibua, 2014).
6. **System Connection:** The other dimension is connecting the organization to its environment or developing system connections. Organizational members are helped to note the effect of their work on the entire organization. The organization is linked to the community and members often scan the environment and use the information gathered to adjust their work practices (Watkins & Marsick, 2003). Organizations that take long to heed to environmental changes might end up being left with fewer options if they regain their desired position at all.
7. **Strategic Leadership:** The primary function of strategic leadership is to distribute organizational resources in such a way that gives the organization a competitive edge thus rip benefits from the dynamic environment (Weldy, 2009). Pazireh, et al. (2014) acknowledge that the vision and mission are one of the most important characteristics of a high performing organization. Developing an organization's vision and the organization's ability to manage change brought about by that vision brings competitive advantage. Strategic leadership is also involved in developing an organization's core competencies. A core competency is an organizational capability to perform in a manner consistently superior to its competitors thus achieving above-average organizational performance (Wendy, 2012). To enhance organizational performance, strategic leadership can influence organizational culture, rituals, symbols, reward systems and boundaries. Here, leadership uses learning strategies to enhance business performance and results.

According to Mrisha, et al. (2017), increased emphasis on an examination of the individual, team, and organizational level learning practices have stimulated tremendous interest in the concept of the learning organization (Ellinger, et al., 2000). The summary of the findings related to the dimension of the learning organization questionnaire (DLOQ) framework based on organizational levels is shown in table 2.

FRAMEWORK AND HYPOTHESES

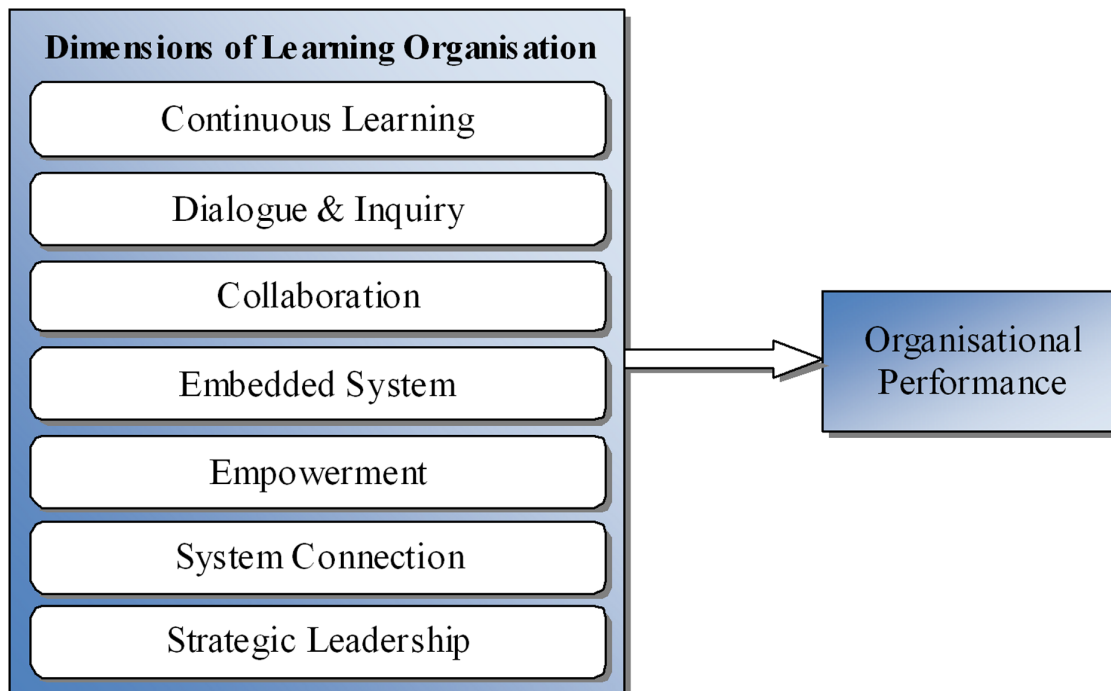
The dimensions of the learning organization help the employees to increase their performance in the organization. The question is do the seven dimensions of learning organization have an impact on employees' efficiency and organizational performance? Therefore, an enquiry into the employees' response to learning organization has become essential. The framework of a learning organization is developed

Table 2. Dimensions of learning organization questionnaire (DLOQ) framework

Dimension	Description
Individual Level Learning	
Continuous Learning	The extent of developing learning in the organization by learning how to learn new knowledge, values and skills and creating continuous learning opportunities through experiments for personal and career development on the job.
Dialogue & Inquiry	Dialogue is the extent to which the culture of organization allows members to have open communication with open minds to talk, discuss, and explain their experiences and skills. Inquiry involves questioning the views of others yet does not attack the individuals.
Team Level Learning	
Collaboration	The degree to which an organization tries to design work for organizational members to achieve a unified action on common purposes has shared the vision and personal mastery to exchange their views and ideas and learn how to work collaboratively.
Embedded System	The extent of creating organizational capacity through both high and low technology systems and finding ways to maintain what is learned.
Organizational Level Learning	
Empowerment	The process of enabling organization members to participate in policy making, to know how to get something done, to assess their needs, to influence others and to create a shared and collective vision. This process continues to get feedback from organization members to recognize the gap between the current status and the new vision.
System Connection	The extent to which an organization has open systems to connect the organization to its external and internal environment to help organization members to see the impact of their work on the entire organization and think worldwide.
Strategic Leadership	Strategic leadership refers to organizational leaders' competence to think strategically, being a model, champion, support learning and energize the organization to create change. This also develops a collective vision to help organization members to move in the new direction.

Source: Watkins & Marsick (1997)

Figure 3. Learning organization framework



based on the Dimensions of Learning Organization Questionnaire (DLOQ) Framework proposed by Watkins & Marsick (1997) as shown in figure-3.

To know the effect of the dimensions of a learning organization on organizational performance, the following hypotheses (H) are developed:

- H₁:** Continuous learning does not show a significant impact on organizational performance.
- H₂:** Dialogue & Inquiry does not show a significant impact on organizational performance.
- H₃:** Collaboration does not show a significant impact on organizational performance.
- H₄:** Embedded system does not show a significant impact on organizational performance.
- H₅:** Empowerment does not show a significant impact on organizational performance.
- H₆:** System connection does not show a significant impact on organizational performance.
- H₇:** Strategic leadership does not show a significant impact on organizational performance.

METHODOLOGY

The current chapter measures the effect of the dimensions of the learning organization on organizational performance. The required data were collected from both primary and secondary sources. The secondary data was collected from books, journals, magazines, unpublished theses and institution websites to know the various concepts of the learning organization. The primary data resources are collected using a survey method from the employees working in different private business units of Visakhapatnam, India. To get the required data, a structured questionnaire was designed and distributed to the employees through emails and some respondents were interviewed personally. The purpose of the survey was explained to the respondents and they were assured of the confidentiality of their responses. A total of 216 valid responses were considered for statistical data analysis.

To measure the impact of the seven dimensions on organizational performance, a 5-point Likert rating scale technique was used ranging from highly satisfied (5) to highly dissatisfied (1). For evaluating the responses, inferential statistics are used to make a conclusion based on the results and significance. Descriptive analytical tools such as mean, standard deviation, values, factor loadings, composite reliability, Cronbach's alpha, and average variance extracted were used to summarize the respondents' opinion on learning organization. The seven dimensions were tested for their relationship with organizational performance using correlation, and the hypotheses were tested using multi-regression and ANOVA analysis.

STATISTICAL DATA ANALYSIS

To analyse the employees' opinion on learning organization, seven imperative dimensions like continuous learning, dialogue & inquiry, collaboration, embedded system, empowerment, system connection, and strategic leadership are identified. The descriptive statistic results regarding the employees' opinion on learning organization are shown in table 3. The mean scores, standard deviation, t-values, factor loadings, average variance extracted, composite reliability and Cronbach's alpha are computed as shown in table 3. The Cronbach's alpha value reveals that all variables have internal consistency as they are above 0.80. The composite reliability values also show the validity of the variables is above 0.80.

The descriptive statistics show that the overall mean values are in the range of 3.27- 3.85 indicating that the employees are satisfied with the concept of learning organization and agreed that it helps in increasing organizational performance. The standard deviation values range from 0.640- 1.011. Among

the seven dimensions, the highly rated dimension is 'empowerment' with a mean value of 3.62 followed by the dimension's 'system connection (3.58)', 'dialogue & inquiry (3.57)', 'strategic leadership (3.56)', 'collaboration (3.50)', 'embedded system (3.49)', and 'continuous learning (3.27)'. The organizational performance is rated at 3.85 indicating the usefulness of learning organization in an organization.

The dimension continuous learning assessed based on four parameters reveal that, 'I have the materials and equipment to do my work right (3.37)' got the highest rating from the respondents followed by 'there is someone at work who encourages my development (3.34)', 'supervisor provides feedback on my areas for improvement (3.25)', and 'I have opportunities at work to learn and grow (3.11)'. In the case of dialogue & inquiry, 'I know what is expected of me at work (3.62)' secured the highest rating followed by 'I am strongly encouraged to report unsafe conditions (3.60)', 'issues are resolved by constructive discussions with supervisor (3.54)', and 'safety information is always brought to my attention (3.51)' by the respondents. With regard to collaboration the variable, 'there are always enough people available to get the job done safely (3.52)' is highly rated followed by the variables 'co-workers often give tips to each other on how to work safely (3.44)', 'I am clear about what my responsibilities are for health and safety (3.66)' and 'my supervisor encourages me on innovative ideas (3.37)' by the respondents.

The respondents' opinion on the dimension embedded system reveals that 'management clearly considers the safety of employees of great importance' got the highest rating with a mean value of 3.43 followed by the variables 'a no-blame approach is used to persuade people acting unsafely when their behaviour is inappropriate (3.69)', 'customers are encouraged to provide feedback (3.49)', and 'I feel a culture of an organization can be correlated with vision and mission statement (3.35)'. With regard to empowerment, the variable 'I have received recognition or praise for doing good work (3.87)' secured higher rating by the respondents followed by the variables 'at work my opinions seem to count (3.94)', 'I have enough opportunity to build capability through technical/behavioural training (3.48)' and 'I am comfortable in discussing personal/professional matters with my reporting officer (3.17)'.

The respondents' opinion on strategic leadership reveals that the variable 'management acts decisively when a safety concern is raised (3.74)' secured highest rating following by the variables 'corrective action is taken when management is informed about unsafe practices (3.42)', 'at my location, prompt resolution of customer issues is recognised (3.14)' and 'I have sufficient time for transformational thinking rather than transactional issues (3.92)'. With regard to organizational performance, the variable 'qualitative improvements are achieved in the work' secured highest rating from the respondents with a mean value of 3.90 followed by the variables 'able to find solutions to the challenges being faced (3.98)', 'managers have been successful in driving productivity and performance (3.71)' and 'managers have been inspirational and instrumental in bringing a change in the attitude of employees (3.82)'.

From table 3, it can be observed that all the t-values are significant at $p < 0.05$ significance level (2-tailed). The test shows that the embedded system ($t=34.65$) is a highly significant dimension among the seven dimensions of the learning organization. The other dimensions of learning organization collaboration ($t=27.75$), system connection ($t=26.75$), empowerment ($t=26.26$), continuous learning ($t=25.16$), strategic leadership ($t=24.20$), and dialogue & inquiry ($t=23.26$) also show a significant positive impact on organizational performance.

The factor loadings ranged from 0.598-0.985 reveal that all the dimensions of learning organization have a positive impact on the employees' efficiency and organizational performance. In the case of continuous learning, the highest loaded factor is 'the supervisor provides feedback on my areas for improvement (0.985)'. The variable 'safety information is always brought to my attention (0.848)' is the highest influential factor in case of dialogue & inquiry. In the case of collaboration, the variable 'my supervisor encourages me on innovative ideas (0.832)' got higher factor loading. With regard to the

Table 3. Respondents opinion on dimensions of the learning organization(n=216)

Dimensions	Mean	SD	t	FL	AVE	CR	CA
Continuous Learning	3.27	0.640	25.16		0.770	0.930	0.91
There is someone at work who encourages my development	3.34	0.604	27.18	.782			
I have the materials and equipment to do my work right	3.37	0.497	30.15	.761			
The supervisor provides feedback on my areas for improvement	3.25	0.627	24.10	.985			
I have opportunities at work to learn and grow	3.11	0.831	19.21	.959			
Dialogue & Inquiry	3.57	0.651	23.26		0.643	0.878	0.88
I know what is expected of me at work	3.62	0.616	25.06	.795			
Safety information is always brought to my attention	3.51	0.714	20.18	.848			
I am strongly encouraged to report unsafe conditions	3.60	0.610	22.78	.818			
Issues are resolved by constructive discussions with the supervisor	3.54	0.663	25.01	.743			
Collaboration	3.50	0.783	27.79		0.582	0.847	0.90
There are always enough people available to get the job done safely	3.52	0.756	27.78	.719			
Co-workers often give tips to each other on how to work safely	3.44	0.819	25.85	.743			
I am clear about what my responsibilities are for health and safety	3.66	0.721	36.38	.752			
My supervisor encourages me on innovative ideas	3.37	0.836	21.15	.832			
Embedded System	3.49	0.705	34.65		0.531	0.818	0.86
Management considers the safety of employees of great importance	3.43	0.713	31.50	.825			
A no-blame approach is used to persuade people acting unsafely when their behaviour is inappropriate	3.69	0.661	26.55	.690			
Customers are encouraged to provide feedback	3.49	0.680	32.69	.734			
I feel a culture of an organization can be correlated with Vision and Mission statement	3.35	0.764	47.87	.653			
Empowerment	3.62	0.729	26.26		0.502	0.799	0.89
I have received recognition or praise for doing good work	3.87	0.708	30.14	.598			
At work, my opinions seem to count	3.94	0.673	32.23	.759			
I have enough opportunity to build capability through technical/ behavioural training	3.48	0.715	21.76	.633			
I am comfortable in discussing personal/professional matters with my reporting officer	3.17	0.819	20.92	.821			
System Connection	3.58	0.717	26.75		0.729	0.914	0.93
The mission/purpose of my company makes me feel my job is important	3.84	0.610	17.40	.918			
I do not receive praise for working conditions	3.39	0.818	45.65	.826			
Management operates an open door policy on working conditions	3.63	0.648	21.74	.766			
I have work profile matching to my passion	3.44	0.791	22.19	.896			
Strategic Leadership	3.56	0.996	24.20		0.593	0.851	0.85
Management acts decisively when a safety concern is raised	3.74	0.965	25.84	.791			
Corrective action is taken when management is informed about unsafe practices	3.42	1.005	23.19	.841			
At my location, prompt resolution of customer issues is recognised	3.14	1.059	21.32	.584			
I have sufficient time for transformational thinking rather than transactional issues.	3.92	0.954	26.46	.836			
Organizational Performance	3.85	1.011	22.23		0.777	0.931	0.86
Qualitative improvements are achieved in the work	3.90	0.913	22.66	.985			
Able to find solutions to the challenges being faced	3.98	0.883	24.84	.959			
Managers have been successful in driving productivity and performance	3.71	1.109	19.28	.918			
Managers have been inspirational and instrumental in bringing a change in the attitude of employees	3.82	1.137	22.12	.614			

Note: All the t-values are significant at the 0.05 level (2-tailed)

SD-Standard Deviation, FL-Factor Loadings, AVE-Average Variance Extracted, CR-Composite Reliability, CA-Cronbach's Alpha

embedded system, the highly loaded factor is ‘management clearly considers the safety of employees of great importance (0.825)’. ‘I am comfortable discussing personal/professional matters with my reporting officer (0.821)’ is the highest factor in the case of empowerment. In the case of system connection, the highest factor loading is ‘the mission/purpose of my company makes me feel my job is important (0.918)’. In the case of strategic leadership, the factor ‘corrective action is taken when management is informed about unsafe practices (0.841)’ is a highly rated factor. With regard to organizational performance, the variable ‘qualitative improvements are achieved in the work (0.985)’ got the highest factor loading. Thus, it can be observed that the loadings of seven dimensions are in the acceptable range.

The average variance extracted (AVE) values show that continuous learning (0.770) got the highest

Table 4. Correlation Matrix

Dimensions	1	2	3	4	5	6	7	8
1. Continuous Learning	1							
2. Dialogue & Inquiry	.647**	1						
3. Collaboration	.631**	.909**	1					
4. Embedded System	.715**	.716**	.754**	1				
5. Empowerment	.509**	.592**	.698**	.370**	1			
6. System Connection	.662**	.235*	.279**	.224*	.189*	1		
7. Strategic Leadership	.628**	.328**	.375**	.021	.490**	.832**	1	
8. Organizational Performance	.825**	.656**	.698**	.735**	.216*	.726**	.541**	1
**. Correlation is significant at the 0.01 level (2-tailed).								
*. Correlation is significant at the 0.05 level (2-tailed).								

variance, whereas empowerment recorded (0.502) the lowest variance. The inter-item correlation between the dimensions of learning organization was also examined and it was found that all the paired correlation measures are significant at $p < 0.01$ and $p < 0.05$ level (2-tailed), as shown in table 4. Therefore, the validity of the research has been achieved to a satisfactory level.

Table 5. Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.841 ^a	.819	.801	.16863
a. Predictors: (Constant), continuous learning, dialogue & inquiry, collaboration, embedded system, empowerment, system connection, strategic leadership				

RESULTS AND DISCUSSION

The statistical significance of all the dimensions of the learning organization was examined to determine the validity of the hypothesised paths. The results of the model summary, ANOVA, and regression co-

efficient values for the relationship between dimensions of a learning organization and organizational performance were analysed and interpreted.

Table 6. ANOVA^a

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	7.234	6	8.470	143.13	.001 ^b
Residual	2.438	200	.035		
Total	78.672	216			
a. Dependent Variable: organizational performance					
b. Predictors: (Constant), continuous learning, dialogue & inquiry, collaboration, embedded system, empowerment, system connection, strategic leadership					

The model summary table5 reveals that the linear regression coefficient ($R=0.841$) indicating a maximum correlation between the dependent and independent variables. In terms of variability R-Square (0.819) shows that the independent variables continuous learning, dialogue & inquiry, collaboration, embedded system, empowerment, system connection, and strategic leadership can predict 82 per cent

Table 7. Coefficients^a

Dimensions	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	.652	.155		3.32	.000
Continuous Learning	.390	.163	.314	1.29	.023
Dialogue & Inquiry	.469	.141	.446	3.27	.008
Collaboration	.371	.134	.331	1.60	.015
Embedded System	.257	.119	.229	1.11	.012
Empowerment	.047	.128	.045	1.26	.038
System Connection	.547	.132	.327	3.23	.005
Strategic Leadership	.231	.121	.321	2.44	.014
a. Dependent Variable: organizational performance					

Note: All the t-values are significant at 0.05 levels.

of the variance in the dependent variable organizational performance.

The results of the ANOVA test shown in table 6 indicates that the dependent variable organizational performance ($F=143.13$, $p=0.001 < 0.01$) shows a significant relation with the independent variables continuous learning, dialogue & inquiry, collaboration, embedded system, empowerment, system connection, and strategic leadership.

The coefficient results shown in Table 7 reveals the relationship between the dimensions of the learning organization and organizational performance. The dimension continuous learning ($t=1.29$; $p=0.023 < 0.05$) shows a significant positive relationship with organizational performance not supporting the

hypothesis H_1 . Dialogue & inquiry ($t=3.27$; $p=0.008 < 0.05$) shows a significantly positive relation with organizational performance not supporting the hypothesis H_2 . The dimension collaboration has a positive significant relationship with organizational performance ($t=1.60$; $p=0.015 < 0.05$) rejecting the hypothesis H_3 . Embedded system dimension shows a strong positive significant relation with organization performance ($t=1.11$; $p=0.012 < 0.05$) and thus, the hypothesis H_4 is also not supported. Empowerment dimension shows a significant positive relationship with organizational performance ($t=1.26$; $p=0.038 < 0.05$), hence, the hypothesis H_5 is not supported. The dimension system connection has a strong positive significant relationship with organizational performance ($t=3.23$; $p=0.005 < 0.05$), rejecting the hypothesis H_6 . The strategic leadership dimension also reveals a significant positive relationship with organizational performance ($t=2.44$; $p=0.014 < 0.05$) not supporting the hypothesis H_7 . Thus, the regression analysis results provide strong support for the rejection of the null hypotheses relating to the relationship between independent variables continuous learning, dialogue & inquiry, collaboration, embedded system, empowerment, system connection, and strategic leadership with the dependent variable organizational performance.

CONCLUSION AND MANAGERIAL IMPLICATIONS

The strategic importance of adopting learning orientation has become essential for organizations as it could contribute towards organizational success. The capability to learn does not naturally and readily occur within organizations. However, it is imperative for the organizations to ensure that the resources are allocated and efforts made to instil learning within the organizations. The research concludes that the seven dimensions of learning organizations viz., continuous learning, dialogue & inquiry, collaboration, embedded system, empowerment, system connection, and strategic leadership have a significant positive effect on the employees' efficiency and organizational performance.

The organizations need to establish systemic interventions to create a continuous learning culture within the company across the strategic business units in order to leverage the skills. The managers need to pay attention to the factors that facilitate organizational learning since they have a direct influence on innovation and organizational performance. It is essential to have the tolerance to ambiguity, uncertainty and errors. Promoting dialogue and inquiry among the team members' fosters team learning, and helps organizations to agile in the highly dynamic and competitive landscape. In essence, teams provide vehicles for learning from others by creating peer group virtual team network in the company through various IT interventions and tools. This helps in facilitating the organizations to have a broad understanding of the employee needs and expectations, which help to evaluate their performance in terms of learning and competencies. Good communication between the managers and employees can improve the distribution of knowledge within the organization. Managers can use formal mechanisms to ensure sharing of best practices among employees and departments, making employees talk to each other using multi-functional work teams.

LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

The scope of the study is limited only to the employee's opinion on the effect of the learning organization dimensions on organizational performance in Visakhapatnam district, Andhra Pradesh, India. It is essential to know the employee's perception of learning organization in various other regions and at different

levels of the organization. Future research is required to measure the variables over a long period and establish how long it takes before changes in learning can lead to changes in performance. The findings can be further used for conducting future studies focusing on ascertaining the relation of the emotional quotient with the performance management system. The practitioners can develop a performance matrix to measure the business outcomes and cascade it to different levels of the organization. The research can be undertaken on individual and group learning related to organizational change and transformation.

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KEY TERMS AND DEFINITIONS

Educational Leadership: Educational leadership is a collaborative process that unites the talents and forces of teachers, students and parents to improve the quality of education and the education system itself.

Innovation: Innovation is the process of translating an idea or invention into a product/service that creates value or for which customers pay.

Knowledge Management: Knowledge management is the systematic process of managing the organization's knowledge assets for the purpose of creating value and meeting tactical & strategic requirements.

Knowledge Sharing: Knowledge sharing is an act of exchanging information or understanding between individuals, teams, communities, or organizations.

Leadership: Leadership refers to the ability of an individual or a group of individuals to influence and guide followers or other members of an organization.

Learning Cycle: Learning cycle is referred to as how individuals learn from past experiences.

Learning Organization: An organization that facilitates the learning of its employees so that the organization can continuously transform itself is referred to as a learning organization.

Organizational Learning: Organizational learning can be seen as the collaborative learning process of individuals and analysing learning processes without concerning the outcomes.

Social Interaction: A social interaction is an exchange of communication between two or more individuals and is a building block of society.

Strategic Learning: Strategic learning is referred to as a means of evaluation to assisting the organizations or groups to learn quickly from their work and adapt their strategies.

Unified Communication Technologies at a Global Automotive Organization

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INTRODUCTION

Information and Communications Technologies (ICTs) influence and shape the world and society (Seeburger, Foth, & Tjondronegoro, 2015). This influence spans organizations and society, stemming from the foundational influence of electronic and computing technologies, spanning over six decades of the third industrial revolution (Skilton & Hovsepian, 2018).

The purpose of this study was to address the challenges of integrating and managing both the complex technology-oriented advancements in a multitude of organizations and fields, in terms of the developing Internet of Things (IoT), and human-centered, in the daily lives of people. Demands for communication between devices, sensors and systems are reciprocally driving an increased demand for people to communicate using, and manage, the undeniable rapid acceleration of the digital ecosystem of the IoT, and an unprecedented volume of data. This study will offer insights into key topics, such as organizational structure, strategic leadership, information technology management, business analytics, and digital transformation in the context of a global automotive organization, among others. It will be comprised of content allowing for greater breadth and range that highlights major breakthroughs, discoveries, and authoritative research results as they pertain to reference work, which should greatly benefit the expansion of coverage into aspects of organizational research, growth and development.

The main research question raised in the study was: *To what extent does digital transformation, implemented through Unified Communication and Collaboration (UC&C) technologies, impact improved productivity and enhanced facilitation of innovation within a global automotive organization?* A framework for the implementation of UC&C technologies was developed and implemented in one of the world's largest automotive organizations, General Motors (GM).

Following the development and implementation of the framework and digital transformation, qualitative and quantitative research were conducted, establishing observational and metric driven data to support analysis. A critical realist interpretation of the authoritative research results suggested that digitally transformed UC&C technologies can change the work practices of employees. The study concluded that

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digital transformation, delivered via a UC&C technologies framework, can impact productivity and create opportunities for driving innovation within a global automotive organization.

In terms of practical managerial significance and appropriateness for this book, this chapter is properly directed to the proposed target audience of the book, in that it presents findings for researchers, educators, students, professionals, and knowledge seekers all around the world.

Now that the general perspective of the article has been described, the objectives of this chapter will therefore specifically be to determine what the factors are impacting:

1. The digital transformation of UC&C technologies within global automotive organizations, and how can these be best applied?
2. Productivity and innovation within a global automotive organization during digital transformation via UC&C technologies, and to what extent?

BACKGROUND

This section will provide broad definitions and discussions of the topic and incorporate the views of others (literature review) into the discussion to support, refute or demonstrate the authors' position on the topic.

The Combinatorial Effect of Mobile, Transmission Control Protocol/ Internet Protocol (IP) and Sensor Technology

According to Sathi (2016), the potential impact of the Internet of Things from an organizational perspective will be between \$4 and \$11 trillion per year by the year 2025. Central to this forecast is the introduction of data and information services, powered by IoT enabled sensor technology. It has been predicted that driverless autonomous vehicles, enabled via connected mobile infrastructure, internet connectivity and an array of intelligent sensor-based technologies, will take dominance in taxi and ride sharing fleets by the year 2030.

Evolving through the Internet of Things and associated concepts, such as Industry 4.0, connected mobile sensor technologies provide opportunities for the creation of a context aware internet. Combined with machine learning and intelligent data strategies, this evolution of capability holds the potential to transition from data and information transmission to automated and assisted cognitive decision making (Perara, Zaslavsky, Christen, & Goergakopoulos, 2014).

The ability to sense, process and make decisions on information in real time is already opening up opportunities in new areas of the cognitive internet related innovation, such as the 'cognitive Internet of Energy' (Vermesan & Friess, 2015).

Challenges in Digital Transformation

A workplace is no longer only the physical office space, but rather a combination of physical, virtual, social, and mental spaces, which are interlinked with each other to form a collaborative working environment. The challenge for digital organizations within the age of the IoT extends beyond the digitization of organizational processes, connectivity, system integration and automated analysis of data; it is how to make these four spaces support the knowledge workers' tasks in a distributed work setting. There is no one rule to follow. Organizations should start the process by analyzing the work of knowledge workers.

While this challenge garners much attention in research and industry, the impact of resulting complex interconnected systems and technologies on people is often left unaddressed (Liska, 2018). From the perspective of digitization within a large organization, only considering human interaction, integration and adoption as afterthoughts represents a barrier, if not carefully considered during planning.

The landscape of challenges associated with digital transformation can be as broad and far-reaching as the technology landscape of the internet of everything, from which they arise. In parallel to the changing digital landscape, challenges associated with digital transformation can be expected to morph and grow over time. Karacay (2018) points out that the roles and skills needed by employees will require ongoing and significant transformation.

People Challenges: Culture, Skills, Communication

Employees within a digital organizational model need to adapt to an environment of increased real-time collaboration with other people, and with automated and intelligent data-driven systems. An increase in real-time communication drives a requirement for employees to handle continuous change, as systems adjust for performance and enhancement, based on digital intelligence gained from data analytics and digital systems. The types of demands for change on employees with digitization have occurred in the past, but transition planning is required to mitigate significant adverse impacts on the organization and its employees (Liska, 2018).

Many organizations fail at change, because often, leaders have not given change management the proper attention. Effective management of change increases the effectiveness of the implementation and acceptance of changes. Ineffective management of change oftentimes affects employees negatively and makes the next change objective more difficult to implement. Additionally, the fear of managing the change is a leading cause of anxiety in managers.

To meet such challenges, digital-first organizations are viewing these challenges in the context of their digital organizational strategy. This approach blends talent, disciplines, digital systems and technologies (Cognizant, 2016).

The Fourth Industrial Revolution

Prior to Industry 4.0, there were three previously recognized industrial revolutions. The first three industrial revolutions brought about innovation and leverage of the steam engine, electrification, and finally, computers and communication within organizations. Each revolution brought about dramatic changes in organizational production, output and processes. The fourth industrial revolution anticipates the elimination of the barriers between man and machine, extending the cyber-physical characteristics of the Internet of Things to the industrial world (Salkin, Oner, Unstundag, & Cevikcan, 2018).

Industry 4.0 represents an extensive portfolio of integrated modular capabilities (Thramboulidis, Vachtsevanou, & Solanos, 2018), customized to each organization's unique needs, as opposed to a large, rigid, monolithic end-to-end solution.

THEORETICAL MODEL AND DESIGN

The study of documentation associated with the literature review of this research served as the primary source for concepts leveraged by the researcher in the study. These concepts were further applied in the

establishment and construction of appropriate categories for evaluation of the hypotheses associated with the study and its theoretical model. While sharing general scope and character, there are many varied definitions on the meaning and interpretation of theory and theoretical models in literature (Strayhorn, 2013).

Theoretical Model

The definition of theory supplied by Schneider (2006) suggests that theories make general, yet explicit statements, about observed phenomena in the world, and how they work. The establishment of theories is essential in the process of the development of science and technology.

The theoretical model for the research study facilitates the development of theory associated with the research study through the identification of core concepts, and exploration of relationships between these concepts in terms of propositions. Theories in themselves are not taken for granted and propositions can result from established theories; however, the researcher creates, develops and tests theories through the observation of lesser understood phenomena (Ridder, 2016). As a core component of the research design and associated theoretical model, theoretical propositions assist in guiding the process for data collection and analysis.

Theoretical Background

According to Mioara (2012, p. 263), “knowledge and communication constitute a vital necessity to the social, organizational, human being”, which is so important that it can “cause its stagnation and even its disappearance”. People and organizations often take the exchange of information between people for granted; after all, communication is a foundational element of societal and organizational life and behavior of every individual and group.

Research (see e.g. Ebadi & Utterback, 1984) suggests that communication on several levels, including centrality, network cohesiveness and diversity, positively impact and contribute to technological innovation within groups and organizations. Studies relating to education and training (see e.g. Mioara, 2012) suggest that approaches to new technology **adoption**, organizational application and fostering of a technology-enabled information culture is required to fully capitalize on the potential of communication to drive innovation.

This study seeks to evaluate the *extent of the impact* of digital *transformation*, in the form of UC&C technologies deployment within the context of *improved* productivity and *enhanced facilitation* of innovation in a global automotive manufacturing, engineering, design, sales and marketing *organization*.

The research associated with the primary question has been operationalized via three sub-questions around which the study was structured:

1. What is the sequence and drivers that are causing a shift and bias towards the digital transformation of global automotive organizations and where is such digital transformation of UC&C technologies implied?
2. What form should a model for digital transformation UC&C technologies take to deliver successful integration of people within an organization?
3. Which factors impact digitally transformed UC&C technologies in terms of improved productivity and the enhanced facilitation of innovation within a global automotive organization?

The first part of the first sub-question relates to the economic, technological and organization **factors** that are *sequencing and driving* the rapid shift towards digital transformation and **adoption** within automotive design, engineering and sales. This sub-question also explores the potential impact of *UC&C* technologies within the organization.

The second sub-question explores the landscape of *emerging and existing UC&C* technologies that are leveraged within organizations and influenced by the shift towards greater *digital transformation*.

The final sub-question focuses on, explores and seeks to evaluate the impact that digital transformation, enabled and implemented via a *UC&C* technologies eco-system and framework, can have on productivity and capacity towards innovation within a global automotive organization.

Research Variables

Independent variables associated with the study include the *sequence and drivers* of *transformed* change towards digitization in automotive organizations, and the *characteristics* of *associated UC&C* technologies. These variables are established against the broader area of automotive organizations that encompass traditional large-scale manufacturing operations, sales and marketing functions, and automotive specific design and engineering processes.

Non-independence may arise due to several factors, for example, the sampling of individuals from too narrow a selection of groups, influenced, for example, by related social interactions. Non-independence due to sequence may occur where observations are taken repeatedly from a single unit over time and space, where units observed lack special independence. Stevens (2009) highlights the importance of the assumption of independence of observations and the serious implications in research associated with violation of such assumptions.

The sub-assessment of these variables aligned within the sphere of an automotive organization, versus organizations in general, may infer the existence of an active-independent variable within the study (automotive). Per Gliner, Morgan and Leech (2009), an active independent variable is attributed to a given group of participants within the scope and period of a study on at least one level. The outcome and analysis of the dependent variables are thus constrained to the influence of the field of the automotive organization, versus environments across all organizations as a whole.

Parke (2013) emphasizes the importance of avoiding issues associated with multi-collinearity in research, due to moderate or high relationships among the independent variables. To avoid outcomes within the study associated with multi-collinearity of research variables, the variables associated with the **second sub-question**, relating to the *characteristics* of *emerging and existing UC&C* technologies in digitally transformed organizations, is positioned independent of any specific organization. This avoids narrow alignment of the relationship between the variables associated with the **first sub-question**, which is focused within the sphere of the automotive organization and resulting *technologies* and *associated* strategies identified in the **second sub-question**.

In order to evaluate the primary research question and develop related hypothesis, the relationships between the independent and dependent variables of the study were assessed. Suggested outcomes of the variable analysis align to positive, negative/inverse and curvilinear relationships and seek to provide a link between the research questions, purpose of the study and its observed phenomenon, and possible hypotheses that were subsequently developed (Rubin & Babbie, 2009).

Within the scope of this study, the dependent variables of *productivity* and *innovation* were proposed. The design of the study avoided the leverage of specific control variables associated with specific functions of the automotive practice. A common model and set of technologies were applied within the case

study across all organization functions. This approach aligns with that advocated by Collins, Joseph and Bielaczyc (2004) in their study of Design Research issues. While not directly related to the educational context of Design Research, the case study associated with the latter research was set in a large organization environment. Many variables associated with such a large global organization cannot be specifically controlled. To characterize the research situation and optimize current and future associated research, a process of incremental design refinement via quantitative and qualitative observation was required.

Diversity of Participation

Since GM is a global organization and has offices in different countries, employees from each of GM's business regions, North America (38.81%), Europe & Middle East (21.46%), South America (22.68%) and Asia (17.05%), were sampled during the survey. North America hosts the largest population of GM employees, accounting for the slightly higher cohort from that region engaged in the survey. No specific provision was, however, made for possible cultural differences.

Although the survey did not specially account for the age distribution of participants (e.g. so-called Millennials, X-generation, etc.), the demographics collected for interview participants did include measures relating to their self-assessed technical proficiency, as well as indications relating to the number of years that a participant had experience in the industry and in the particular role at that time.

THEORY DEVELOPMENT

The theoretical model presented within this study has been developed in order to investigate whether digitally transformed UC&C technologies positively impacts productivity and innovation. The study specifically focused on a broad set of workgroups and functions within a global automotive organization, including manufacturing, design, sales, marketing, corporate functions (Information Technology, Human Resources) and engineering.

It is proposed within the theoretical model of the study that multi-mode digital transformation through a UC&C technologies eco-system facilitates increased interactions between individuals and functions. The study seeks to explore the **hypothesis** that digital transformation increases communication and fosters relationships among teams, leading to a perceived impact on productivity and the enhanced facilitation of innovation within the organization. The proposed model conveys the sequence and drivers associated with the path to increased perceived productivity and innovation through digital transformation via an UC&C technologies model and deployment.

This consolidated model facilitated the compression of the research questions and the establishment of related research hypotheses, supporting perceived impact on productivity and enhanced facilitation of innovation.

Digital Transformation via UC&C Technologies Impacts Inclusion of Individuals Within Groups Across a Global Automotive Organization

The concept of enhanced connectedness supporting more effective **relationships** is supported in many areas of literature and research relating to digital communities and engagement. Raine and Wellman (2012) highlight the emergence of networked individualism facilitated through loose and fragmented digital communities and networks that provide support. While many of these communities pre-dated their

digital manifestations, Raine and Wellman (2012) also underline how the advancement and growth of these groups has been facilitated through digital communications technologies and infrastructure.

Digitally Transformed UC&C Technologies Impact Productivity

The social and information richness theory suggest that user performance will be enhanced if the social presence of a medium is matched to the communication requirements of a task (Karahanna & Straub, 1999). The latter authors therefore posit that forms of media that are perceived as high in social presence are more appropriate in situations, such as conflict resolution, asserting influence and personal communication.

De Kort, IJsselstijn and Poels (2007) highlight that developments in digital communication technology and internet connectivity has opened up wider channels that facilitate improved social interaction. Many elements, including visual facial cues, language, tone of voice and body posture, contribute to the establishment of social presence, as the process of computer mediated communication escalates through the various levels of available digital mediums (chat, voice, video).

Establishment of virtual physical presence is a fundamental element of the establishment of a digital persona and social presence within the digital world. Short, Williams and Christie (1976) developed one of the earliest descriptions of a digital social presence, defining it as the existence of a personal or human element in a medium. Establishing and maintaining a digital persona is not limited to organizations. Research indicates that the maintenance of a *digital self* is becoming a common practice in daily life. For example, over 81% of adults between the ages of 18 and 29 are wireless internet users and 73% of American teens with access to wired internet connectivity use social networking technologies to communicate and engage with their peers (Lenhart, Purcell, & Smith, 2010). Research has also shown that 54% of online adults maintain an identity on at least one social network, and the maintenance of multiple identities on separate networks is on the rise.

Within the scope of UC&C technologies, rich presence functionality helps to establish a virtual social presence for the user through the provision of status **indicators** at multiple levels, such as online/office, availability status (working/busy/free), group status (membership and group availability), device status (phone, PC, tablet) and physical location (country, city, building).

Digital Transformation Through UC&C Technologies Impact Innovation

Social context is important when people engage in multi-party interactions. Computer mediated communication is central to the formation of collective emotion across the virtual human community on the internet (Skowron, Rank, Garcia, & Holyst, 2017). Virtual environments are a digital representation of the real world. These digital environments seek to replicate the natural processes of human social interaction and communication. The processes associated with communication have developed and refined over the history of mankind's development as a species.

The term 'rich media' has been used in literature to describe media, which has broad capacity for communication, supporting digital interaction in multiple forms (Martinik, 2015). UC&C technologies and the associated presentation of integrated, digital rich-media pathways for communication have the potential to address the shortcomings of computer mediated communication highlighted in both media richness theory (Daft & Lengel, 1986) and media naturalness theory (Kock, 2005). Media richness theory suggests that outcomes will be negatively affected if knowledge intensive tasks are carried out via media that is low in multi-modal (richness) capability. Media naturalness theory suggests that communication

carried out via computer and digital mediation can be perceived as lacking elements of communication found via face-to-face communication (audible and visual cues) and potentially pose obstacles for effective communication (Kock, 2013).

Digitally transformed UC&C technologies facilitate mediated interaction, communication and the sharing of both information and emotion. Combined, these features facilitate and influence visible and audible social cues, emotional display and expression (Gonzalez, Diaz-Herrera, & Tucker, 2014).

The cognitive model of media choice proposed by Robert and Dennis (2005) highlights the apparent paradox that exists in communication between the transmission and subsequent processing of information (Dennis, Fuller, & Valacich, 2009). Robert and Dennis (2005) also suggested that the leverage of asynchronous communication methods and media, such as those found in UC&C solutions, can enhance the processing of information. Through a media naturalness hypothesis, Kock (2005) underscores the potential for synchronous communication to increase psychological arousal.

If the technologies and their targeted enabling features are appropriately positioned for ease of integration, this can positively impact trust relationships within the work system, reduce inhibiting **factors** impacting interaction and engagement, and increase organizational efficiency, safety and productivity (Demerouti, Derks, Lieke, & Bakker, 2014). With its intuitive and converged presentation of blended digital multi-media, as well as synchronous and asynchronous communication channels, UC&C is well positioned to support balanced interpersonal and cognitive participation.

Factors, including the trend towards the digital transformation of organization processes, and changing work practices through collaborative innovation, have led to organizations having started changing their approaches to work practices through the digital transformation of UC&C technologies. This approach places a requirement on employees to organize and carry out their work practices in a more creative manner by leveraging 'new ways of working' (Demerouti, et al., 2014). The latter authors, however, warned that the introduction of new technologies to work practices can lead to a negative impact on organizational trust, if the technologies are not **easy to use**.

DEPLOYED MODEL

Hill (2018) argues that recognizing the value of iterative development as key to organizational and functional strategies. The production model that was deployed within the scope of the research study in General Motors was modified and improved via an iterative phased development and release approach. Hill (2018) also suggests that strategy development is frequently characterized through infrequent engagement and aggregation of executive opinion.

The model proposed within the scope of this research provides an architecture that can be leveraged to guide the development of a strategy and the downstream deployment of specific technical and operational components aligned to pre-defined outcomes.

Core Governance Domain

The Core Governance Domain is focused on the design and specification of key stakeholders and governance processes that are essential to framing and guiding digital transformation. Horizontally, the specified sub-modules represent elements of the strategy that are foundational in the overall specification of requirements and outcomes. These sub-modules also play a key role in horizontally influencing

the development and validation of established outcomes, in terms of the resulting strategy, technologies and functional operation.

The preliminary model design specified four modules within the Core Governance Domain, inclusive of Organizational Architecture, Organization Stakeholders, “IT Transformation Governance, and Program Governance” (Bolton, Goosen, & Kritzinger, 2016, p. 7). The iterative development of the model identified redundancy between the IT Transformation Governance and Program Governance modules. Separate specification of processes and artefacts proved to introduce redundancy and increase complexity in practical operation. Objectives and outcomes identified with these modules were found to significantly overlap, specifically in defined goals and objects, Program Governance and key performance indicators, resulting in a decision to collapse and consolidate the specification of these two modules into one.

The Organization Architecture module leveraged the existing architectural governance processes managed by GM’s Information Technology organization. This approach ensured reusability of developed artefacts within other common, existing processes within the model (for example, technology standards within change control), and ensuring compatibility for integration with existing and future strategic adjacent technical service models within GM.

Operational Management Domain

Please note that further details regarding the Operational Management Domain are contained in Bolton et al. (2016).

Integrated Feature Domain

Features selected for inclusion as solutions within the Integrated Feature Domain were subject to evaluation modelled on the innovation decision process suggested by Rogers (2010). The latter author proposed a process with five main steps, described as knowledge, persuasion, decision, implementation and confirmation, which facilitates decision making relating to the **adoption** or rejection of the implementation of an innovation. The process moves from forming of a general attitude towards innovation, through to the specific decision to adopt or reject.

This model was adapted from the knowledge and persuasion steps as specified in the model by Rogers (2010). Adaptions included the removal of a specific module attributed to the ‘trialability’ of new features, with the integration of the trialability concepts into a more generalized end user observation module.

Unified Services Domain

The Unified Services Domain (USD) is focused on establishing the integrated technical services and components that support upper layer end user features and applications exposed via the Integrated Feature Domain modules. The Unified Services Domain includes horizontal service components identified in the UC&C functional architecture. These components are focused on service integration versus feature delivery.

The core modules of USD are associated with the provision of underlying network services, such as IP services, voice and video codecs, session management, media resource allocation, physical and logical (software) end point devices and services, carrier transport services, quality and performance management systems. While many management, software engineering, computer and communications models exist, such as eTOM, ONAP, DevOps and OSI, no single existing model is structured to ubiq-

uitously cover the computer, telecommunication, middleware and application environment represented by an organizationally transformed UC&C technologies solution.

The Unified Service Domain element of the GM model is critical in facilitating the specification and inter-relationship of core services, features and components within the targeted state collaboration ecosystem. The GM ICT team utilized the Enhanced UC&C (E-UC&C) model as guide for designing and building the underlying solution architecture. The depicted reference architecture relates to the real-time voice, instant messaging and audio services sub-system developed within the scope of the research study, and operationally deployed in GM. The underlying system components and applications are overlaid against the E-UC&C primary domain structures. This system reference architecture was employed to map out the primary signaling protocol paths, sub-system relationships, border, internal and external endpoint elements and core communication integration and session management systems.

The reference architecture associated with the integrated video broadcast sub-system developed and deployed within the GM case study is highlighted. This parallel communication system was developed to integrate real-time multi-cast and unicast transmission of media across the GM organization to all users and locations. The broadcast sub-system was similarly designed aligned to the E-UC&C model, ensuring layered compatibility with the real-time audio, video and instant messaging sub-system.

SOLUTIONS AND RECOMMENDATIONS

This section will discuss solutions and recommendations in dealing with the issues, controversies, or problems presented in the preceding section.

Discussion and review of findings associated with the established research hypotheses are essential in relation to the evaluation of the overall outcome of the research. Did the observations, findings and identified results validate the hypotheses developed in association with the research problem and questions? The following discussion outlines the summary conclusions of the study and the context of the established hypotheses.

Digital Transformation via UC&C Technologies Impacts Inclusion of Individuals Within Groups Across a Global Automotive Organization

Evaluation of the end user survey and interviews supports the view that digitally transformed UC&C technologies enhanced the ability of people and groups to engage and **collaborate**. Findings from the research data show that users reported a positive experience aligned with leverage of the multi-channel features associated with UC&C technologies. Through the use of these features, users reported that it was easier to engage with and **collaborate** effectively with virtual teams. Users described the ability to engage in ad-hoc meetings with peers and virtual teams and obtaining answers to questions quickly.

These observations contrast with legacy communication and collaboration technologies that required face-to-face communication to facilitate information exchange at any level beyond audio conference, or basic slide sharing using external technologies. Users also described positive attitudes relating to the ability to engage personally with peers and partners when working in remote locations. The new digitally transformed capabilities made it easier to include other parties in media rich virtual meetings and facilitated their direct participation. Tracking of feature-use across regions and room-to-room tele-presence engagements supports the view of increased cross-region and function engagement, inferring a high level of inclusion of people in virtual meetings outside of their workplace locations.

UC&C technologies, which are intuitively easy to use and adopt, combined with positive results from quick engagement when desired versus restricted schedule were experienced, lead users to positively associate the UC&C technologies with supporting their innovation processes, specifically **creativity**. Findings within the study showed that the consolidated features within the UC&C technologies, combined with the intuitively easy-to-use and adopt interface, resulted in many users establishing **changing work practices** and increasing organizational efficiency.

A small number of users reported having some difficulty in easily using, adopting, realigning and/or **changing** their **work practices** to the UC&C technologies; however, they still identified the technologies as having the potential to improve their productivity. After being introduced to digital transformation through UC&C technologies, most users preferred to keep ‘their’ new technologies, leading to legacy technologies’ reduction and eventual elimination. Especially data from transformation and adoption metrics showed indicators of cultural change in terms of method of communication employed by users’ post-adoption of the digitally transformed UC&C technologies. Finally, the results from the post-application and deployment of the digitally transformed E-UC&C framework and eco-system could be tracked and validated as generating direct savings to General Motors.

Digitally Transformed UC&C Technologies Impact Productivity

Findings indicate that the virtual persona and presence established by the end users have a positive impact on personal productivity, as it increases the opportunity to engage in real-time **collaboration** when needed. Feedback from end users indicates that digital presence **indicators** are useful in identifying other users or groups, who may be available for immediate ad-hoc communication and engagement.

Also, it is likely that the custom presence **indicators** help set a baseline expectation for the requesting party in establishing the probable timeframe for response. For example, when a user is in an ad-hoc or scheduled meeting, that user’s presence and status will be set to ‘busy’, indicating that the user is already engaged in **collaboration** or work of some form. When a user is presenting using their laptop or PC, the presence indicator is set to ‘presenting’, and blocks instant messaging pop-ups for the requested user, setting the expectation that an immediate response is unlikely to occur. It is likely that users reporting their experience of the UC&C technologies as having the effect of removing the sense of distance from their peers and partners is tied to the presence **indicators**, as they get real-time status views of their colleagues’ location and engagement status. This status develops an arguable perception of virtual presence. Users can additionally place commentary on what their current or planned daily activities are in the ‘What’s happening today’ field of the UC&C technologies, further establishing their digital presence and persona.

Both survey respondents and interviewees described the digitally transformed UC&C technologies as leading to increased organizational efficiency, with the latter also indicating the increased speed of their communication processes and finding access to all of the features in one technology convenient. Convenience in having one technology to access multiple channels for communication, both within the office and remotely when travelling, or at home, is likely to be associated with end users’ perception of productivity. The more convenient it is to do something and/or execute a task, the more productive users are when executing the task. Findings within the research also indicated that digitally transformed UC&C technologies and systems facilitate the opportunity for users to establish and maintain working relationships with colleagues and organization partners. Relationship building is enhanced and enabled through the facility of a virtual team and peer engagement. The research data shows that users perceived the ability to flexibly escalate communication through different levels and modes of communication to assist them in building relationships through rich information sharing in a virtual workspace. Finally,

data from the interviews suggested that participants gained a sense of satisfaction from seeing their peers and business partners changing their work practices in line with changes associated with the **adoption** of the new toolset and features.

Digital Transformation Through UC&C Technologies Impact Innovation

Four factors relating to innovation was identified from the interviews, which are related to changing work practices, collaboration, creativity and generating savings. Users reported that the capabilities of the digitally transformed UC&C technologies and methods led to them changing their work practices and enhanced their ability to engage in collaboration. Users also found that multi-channel features facilitated richer virtual engagements supporting creative engagement, even when users were remote from each other. Within the creative process, the ability to engage in an ad-hoc collaboration, as needed, helps users capitalize when they have ideas, or need problems and questions quickly addressed. Engaging quickly through the digitally transformed UC&C technologies increases speed-to-action creative thoughts or tasks. It is reasonable to assume that the speed-to-engage offered by the new technologies helps maintain velocity and immediacy in creative collaboration, tied to innovation generation, such as sharing and working through new ideas or rapidly developing plans and proof of concepts. Many users identified generating savings associated with leveraging the digitally transformed technologies within their work practices, and this is likely due to users seeing the generation of innovation as an asset of the organization. Innovation leads to new products, or product enhancement, and ultimately higher margins and revenue. If the users can engage and drive more innovation through digitally transformed technologies, or speed up innovation generation, the organization will benefit financially.

The factor related to **convenience and speed** (mentioned regarding productivity) within the UC&C toolset is likely to align with the changing work practices that users reported.

RECOMMENDATIONS

The inception of digital technology and associated innovations have been used by organizations to improve and innovate their products and services. Organizations are increasingly recognizing the value of patterns of social interaction within their organizational models and associated value chains. Patterns of social interaction apply both to the organizational workforce and customers, uncovering value within service-based organizations and connected consumer product lines. Intelligent digital organizations leverage these patterns of social interactions and associated data, in combination with ‘big data’ strategies and real-time analytics, to enable contextualized and automated decisions (Gilchrist, 2016). These strategies enable the establishment of predictive recommendations and rapid decisions focused on increasing productivity.

“The population associated with the target deployment outcome” represented “100% of GM’s full-time salaried employees. The target population for” pre- and post-validation “deployment was focused on a representative subset of management and non-management employees. A” Z-score “of 2.576 with corresponding confidence level of 99% was used with a standard deviation of” 0.5 “and confidence interval of +/-5% to calculate the **recommended** survey sample and interview sample sizes. Based upon these variables a minimum target sample population of 664” was adopted (Bolton, et al., 2016, p. 7).

FUTURE RESEARCH DIRECTIONS

This section will discuss future and emerging trends and provide insight about the future of the encyclopedia's theme from the perspective of the article focus. The viability of a paradigm, model, implementation issues of proposed programs, etc., may be included in this section. Future research opportunities within the domain of the topic are suggested.

Further research is required to fully validate the impact of digitally transformed UC&C technologies on the organizational processes and end user communities of large organizations. While this research study provides valuable insight into the experiences of one such a global organization, further research should be carried out to contrast and validate the developed theories of increased productivity and the ability to drive innovation within a broader set of organizations. Opportunities exist to build on the theories and findings developed in association with this study; for example, the execution of a longitudinal study of digital transformations within a cross-section of organizations. This approach would allow for contrast and validation of the theories presented within this article against a broader set of organizations of similar size and complexity.

This research also highlights phenomenon relating to end user **adoption** of new technologies, specifically communication and collaboration technologies and the potential of new technologies to rapidly change end user work practices. In the case of this study, evidence exists of users rapidly changing well-established work practices relating to communication and collaboration and aligning those changes to the **ease of use** and perceived benefits of using the new technologies. Following this, an opportunity to focus research on the identification of specific drivers influencing positive **adoption** and change could be established. The experience of user **adoption** rates and magnitude of changing work practice can be contrasted against similar transformations of communication and non-communication related digital processes, to identify common drivers, with a view to establishing a framework for more predictive positive transformation outcomes.

CONCLUSION

This conclusion section will provide discussion of the overall coverage of the article and concluding remarks. The **purpose** of the empirical study was to observe and compare theories using real-life data. The process of empirical study enabled the researcher to develop and evaluate new concepts, processes, technologies, methods and techniques. Output from empirical studies can facilitate improving existing processes by using evidence and evaluating hypothesis formed during the study. Shdaimah, Stahl and Schram (2011) argued that one of the benefits derived from an empirical study is the establishment of facts about problems that can subsequently be analyzed and addressed. The research study was carried out over a five-year period leveraging General Motors, one of the world's largest automotive manufacturing and sales organizations, as a case study focus. Demands and changes in the organizational landscape of General Motors, including a significant shift to globalized operations and increased infusion of technology into their organization processes, drove a reciprocal demand for digital transformation and optimization of communication and collaboration among employees. Under the scope of the study, a unique E-UC&C model was developed and tailored to guide the establishment of a technical and service architecture, facilitating broad digital transformation across multiple facets of employee-to-employee, employee-to-partner, employee-to-customer and organization-to-employee communication and collaboration. Digitally transformed UC&C technologies were deployed across organizational systems. An

impact assessment and summary of results attributed to the implemented framework, deployed under the E-UC&C model, was presented.

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KEY TERMS AND DEFINITIONS

Digital Transformation: Although digital transformation has existed in the lexicon of human thought for over fifty years and propelled humanity towards new horizons in terms of possibilities, the potential for digital transformation to enhance communication in our society and across our industries is beginning to be realized.

Global Automotive Organization: A global automotive original equipment manufacturer facing challenges as it digitally transforms its systems, service and work practices are likely to be familiar to many large global organizations.

Impact: The central issue addressed in this chapter is the relationship between the transformation of communication through digital methods and tools and the resulting impact within a global automotive organization on people and their social interactions.

Innovation: Organizations drive combinatorial innovation through technology convergence and standardization.

Internet of Things (IoT): Towards building the hyperconnected society, the Internet of Things is based on smart objects in terms of technology, middleware, and applications, with research in this regard including innovation value chains, ecosystems, and markets.

Productivity: Productivity improvement can be introduced rapidly through combinatorial digital innovation.

Unified Communication and Collaboration (UC&C) Technologies: UC&C technologies provide an integrated suite of presence-aware communication and collaboration capabilities.

Social Media and Organizational Communication

15

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INTRODUCTION

The online environment is a whole new channel of social interaction. For an organization, however, the online environment is a form of bidirectional communication, with the ultimate goal of gaining profit or various benefits from the image of such an entity. These aspects help us acknowledge the importance of using the Internet, as an organization, to maintain the relationship with both the public and the staff. Nowadays, when we think about the online environment, we automatically think about Social Media: social networks, Social Bookmarking sites, business blogs, and many other web pages where users can interact and can generate or access content, as well as static sites, generating unidirectional information.

Social Media is not only used to announce or promote a new product. This channel can also be used for direct sales, online advertising, maintaining the relationship with the public and especially for brand awareness. In addition to this component, that is specific to marketing, public relations or advertising, the online environment also plays an important part in human resources. With the development of Web 2.0, the selection and integration processes, as well as staff management, have become much easier, with the help of various online platforms offering professional services, as “organizations increasingly rely on online communication (social networks, blogs, official site, newsletter, digital marketing)” (Briciu, Briciu and Găitan, 2019, p. 44).

Therefore, public content management on the Internet becomes a specific activity for specialists in organizational communication. Thus, the organization involved in a Social Media campaign or simply existing in the virtual environment creates a presence that is meant to provide greater visibility and awareness. Through the channels it uses (website, blog, social networks, etc.), the organization maintains a permanent dialogue with its audience and uses its own resources to attract as many stakeholders of its virtual message as possible.

This chapter’s objective is to take into consideration the online environment as the new channel for social interaction, putting into focus the organizational communication and its development from Web 1.0 to Web 2.0. The chapter will also discuss the implication of Social Media characteristics and defining the terms, such as social bookmarks, wikis, social networks, photo and video sharing, etc. The chapter will also include a case study discussing the communication strategy using Social Media channels of a renowned Romanian brand from the petroleum and gas industry.

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Figure 1. Web 1.0 vs. Web 2.0 features



BACKGROUND

In the past decades, information technology developed significantly, both in terms of hardware and software. This has had a major impact in simplifying organizational communication processes, especially in the business sphere. Originating from the United States, the Internet is based on “a network of linked computers, each one connected to a set of others, supporting the electronic communication between computers around the world” (Henslowe, 1999, p. 87). In order to better understand the evolution of the Internet and the emergence of Social Media, we need to take into consideration the relevant distinction between Web 1.0 and Web 2.0, and especially between the concepts of static and dynamic (See Figure 1).

In the beginning of the ‘90s, with free access to the Internet globally, users accessed pages via Web 1.0. Subsequently, the transition to Web 2.0 was a subtle one, with users being able to interact through content generation. In Web 1.0 there is limited interaction between websites and users. “Web 1.0 is simply an information portal where the public passively receives information without being able to post comments and feedback.” (Mitruț and Stoica, 2016, p.3). The content is static and the users cannot change it. Digital content is generated only by writing code in text editors. Users cannot generate content; they can only view the information that is displayed on the website by its administrator. “We can say that the transition to Web 2.0 was made when Content Management Systems emerged, allowing users to create their own web pages. They were open-source, and hosting was free.” (Mitruț and Stoica, 2016, p.6). Web 1.0 is a static environment, a place where you could find information instead of a forum for sharing ideas or creating new products together. Moreover, Lincoln (2009) states that Web 1.0 is a world of simple transactions, opposing the emergence of Web 2.0, the new medium where “people can interact and participate rather than just read” (p. 8).”. These can be categorized as dynamic sites. “This appears to be quite innocuous stuff, very open and honest, customer-orientated and very much in line with the way corporate should be behaving in a Web 2.0 world” (Brown, 2009, p. 36). Today, Web 2.0 is associated with a large range of tools and software used for viewing and developing the websites, but what is also important is allowing the user to interact directly with any web content in order to obtain custom products. As a short conclusion to what was presented above, Lincoln (2009, p. 8) strongly states that “because of the ambiguity of the term Web 2.0, many people prefer to use the term social media”.

New technologies are used to change the dynamics of the environment in which people create and discover value through publication. A first definition refers to Social Media as being “any highly scalable and accessible communications technology or technique that enables any individual to influence groups of other individuals easily” (Blossom, 2009, p. 29) or, from a different point of view, “Social media is synonymous with community. People want to connect. They want to talk. They want to share. They belong to whatever community they want – no matter how big or small.” (Lincoln, 2009, p.14), but also “the next step of Web 2.0 technology development” (Briciu, Briciu and Găitan, 2019, p. 43).

According to Kaplan and Haenlein (2010, p. 61), Social Media is a group of Internet-based applications that have the purposes, ideological and technological foundation of Web 2.0 and that allow the creation and exchange of user-generated content. In other words, Social Media is more about “the ideas that you share, collaborate on, create and participate in rather than observe” (Lincoln, 2009, p. 10), because in these platforms users should be able to create and access digital content (Kane et al., 2014). There is a lot of controversy surrounding the definitions of Social Media as it is a trend to update old definitions or to create a new one, as it is the case with the development of technology, use and adoption of social media (Kapoor et al., 2017; Briciu, Mircea and Briciu, 2020).

Brown (2009) considers that Web 2.0 is not a different version of the web, but can be viewed as a gradual update of the former. Content is no longer offered to visitors or generated only by administrators and employees of various organizations, but can be created by users that are connected via existing informal networks on the Internet. They contribute and actively participate in spreading information through the web. Typical examples for this new aspect are blogs, as well as portals or platforms for sharing images, music, video, text and software such as Facebook, Flickr, YouTube, or Dropbox.

SOCIAL MEDIA SPECIFIC APPLICATIONS IN AN ONLINE ORGANIZATIONAL CONTEXT

According to Phillips and Young, “communication today is an adventure playground for people with an interest in the subject. There are so many ways people can communicate” (2009, p. 10). Social Media is booming nowadays with the emergence of more and more modern technologies, becoming essential in people’s lives, with the use of specific applications increasing as well. Garcia-Morales, Martín-Rojas & Lardón-López (2018, p. 359) suggests that “organizations that exploit social media connections in their innovation processes can expect successful innovation activities that improve the organization’s overall long-term performance”.

This subchapter provides an overview of social media channels that were available in recent years. There are many other forms of organizational communication, such as blogs, microblogs, social book-marking, wikis, social networking sites and more. The list is not exhaustive (and how it could be, when new Social Media services become available in the online environment and gain user popularity so quickly), but the most significant ones will be briefly outlined.

Blogs. A blog is a website owned by an entity (a person, a group of people, a company, etc.) where articles are posted on specific topics, and people who visit the blog can add comments. The author can edit the articles using different colors or fonts for the text, pictures, videos, audio and everything that he considers relevant, or thinks will make the article more appealing to the public. Once the Blogger platform was launched in 1999, the concept exploded on the Internet and led to the emergence of a large number of bloggers (Brown, 2009, p. 26). Unlike other sites, blogs usually allow people who access them to add comments and express their opinion. The word “blog” is a truncation of “weblog”, and the

content generators are called “bloggers”. They write various types of texts and publish them on web pages that are dedicated to a certain topic or organize them in posts that are displayed in reverse chronological order, and made available to the general public. Blogs can be edited online using web browsers or content editing programs. Bloggers can attach pictures, charts, or audio-video recordings to their posts. According to Quesenberry (2019, p. 55) businesses that have prioritized blogging are thirteen times more likely to receive positive return on investment.

Microblogging is a different form of blogging that limits the author to 140-200 characters (extremely short blogs). The most popular microblogging platform is Twitter, while Facebook was also considered a microblogging platform because of the Status option. Users can then choose to publish their posts for anyone to read or restrict them to a certain group. The character limit allows these messages to be uploaded through a variety of means, especially SMS, which means they can be published anywhere, anytime.

Social Bookmarks Phillips and Young (2009, p. 13) show that “Social bookmarks allow you record web pages of interest through online lists that can be sorted, indexed, shared with small groups of colleagues or made available to the wider public. The most popular of these sites is Delicious. These are very useful services for practitioners.” One of the ways a site can be developed is that its main pages are indexed on Delicious. News pages, as well as product and service pages on sites could benefit from allowing readers to quickly insert the page into their collections on the Delicious site.

Wikis are series of websites created and used to access information on a specific topic quickly and easily. Unlike for other websites, no technical knowledge is required for creating or adding content to them. The largest wiki platform is Wikipedia, which is an encyclopedia of wikis (Brown, 2009, p. 39). Wikipedia offers information related to a wide range of topics, but the validity of the information can not be ensured, because anyone can edit the articles. Whether we are a specialist in organizational communication or not, whether we promote a product, image or brand, the way we approach a particular topic cannot be objective. According to these ideas, there are cases where a company employee is entitled to modify the content of an article, for example, to delete spam messages or to correct the mistakes of the original author. It is important to note that “wikis are mostly used inside organizations to allow a group of people to create, reference and edit web pages to form an evolving body of knowledge for the group” (Phillips and Young, 2009, p. 31).

Social networks sites are websites that allow the exchange of information through interactive content between multiple people. “They are micro-websites that allow people to exchange interactive, user-submitted content among a network of friends through personal profiles, blogs and comment discussion lists” (Phillips and Young, 2009, p. 26). These social networking services can be easily configured, and content-wise you can upload photos, videos, and audio recordings. Facebook, Instagram, Snapchat are social networks used globally by both individuals and companies. Social networking sites have emerged in the ‘90s, starting with *classmates.com* which aimed to help people find former school mates. They increased in number, expanded, and became online communities (Brown, 2009, p. 50). The created communities are based on different interests, connections or people you know. These networks are “all built around groups of friends or contacts coalescing around each other. They can send messages, they can share music and video and sometimes play games with each other. There are common interest groups, a variety of utility platforms and applications” (Brown, 2009, p. 165). LinkedIn is also a social network, but it is business and employment-oriented: “the network allows signed-up users to maintain a contact list, with career histories of people they know and trust through business” (Brown, 2009, p. 167). LinkedIn is a much safer network than Facebook in terms of data security, because it only allows the connection between users who have previously interacted. Thus, direct connections are created between people, which are grouped into networks of mutual connections. This may facilitate the recruiting process for

some companies, as potential candidates can be recommended by other network users, and they have all their professional background published on LinkedIn.

The chat is a technology that allows messaging between two or more people in real time. One of the first programs that allowed chatting was “ICQ (Internet Relay Chat) and a number of other technologies were commonly used as stand-alone services in the early days of the internet and were among the forerunners of today’s social media” (Philips and Young, 2009, p.13). Chatting exists in many forms, such as online chats, instant messaging, online forums and virtual worlds. Large companies use chats both inside the organization (intranet) and embedded in their website, wikis, blogs to optimize communication with the public. Even though this online communication channel is one of the most affordable ones out there, there is a risk of messages not being transmitted correctly when we use it, because of duplication, use of abbreviated words, etc.

Photo sharing is the act of transferring digital photos online and sharing them with others, whether limited to a selection of people or making them accessible to the wider public (Brown, 2009, p. 169). There are dedicated platforms for photo sharing, such as Flickr and Photobucket. Another platform that gained popularity in recent years is Pinterest, which managed to gradually eclipse the other two. Carr (2012) argues that Pinterest is a social network that is supported by the visual content it carries. The platform provides a virtual space where users can save or send images, quotes, or DIY projects. Pinterest practically allows users to make a collection of things they are interested in, to which they can give access to acquaintances. Instagram, a mobile photo (and now also short video) capturing and sharing service, has been in spotlight in the recent years gaining more than one billion users (Clement, 2019). According to Quesenberry (2019, p. 54) “Instagram has played an integral role in helping to lift sales for brands such as Gatorade which saw a 3 percent increased household penetration and 4 percent increased sales”. He also considers that Snapchat can be the ideal place to reach younger target markets like millennials (Quesenberry, 2019).

Video sharing. There are countless video sharing sites and platforms, and one of them is familiar to everyone: YouTube. Brown states that YouTube is “the gold standard for sharing video on the internet” (2009, p. 164). It is easy to use: you upload videos and watch videos uploaded by others. The large number of users and the large amount of content provide a much richer experience than suggested by the simplicity of the concept. Broadcasters and TV producers upload content and use YouTube as a music tone (there is even the possibility of creating a playlist). Video sharing sites can pose a threat to companies if consumers share their unfavorable customer experience or malfunctions that they encountered.

Search engines are the most used websites because they help their users find information. In order to stand out, a company website should appear among the top search results. Google, the most popular search engine, uses the number of sites that are linked to that website as an algorithm (Phillips and Young, 2009, p. 24). Most search engines work based on a very simple principle: they search for pages or specific content on certain web pages by looking for and tracking hyperlinks (web page navigation items). In organizational communication, it is very important to gain the “trust” of a search engine. People often find out about organizations, events, or other things that interest them by accessing search engines. If an organization does not promote itself well enough and does not get enough attention from people, it will not get it from the search engine, either. Thus, the organization must be popular and record a high number of searches to be “favored” by the search engine.

Mashups. Brown (2009, p. 177) indicates that “mashups are web applications that combine things from multiple sources and bring them together to form something that is greater than the sum of its parts.” A mashup is any combination of elements in the online environment. For example, websites may include mashups, as they may have embedded video content from YouTube to be viewed on the site, or

a map in the contact section, provided via Google Maps. Facebook is also a great source of mashups due to the content diversity on the network and the multitude of embedded applications such as games, chat, video calls, etc.

Podcasting. A podcast is an audio file (usually an MP3 file) embedded in a web page (usually a blog) that works on almost the same principle as the syndication of RSS (i.e., Really Simple Syndication) content and allows users to add comments or respond to the content it offers. They can also provide information about events, conferences or festivals, facilitating participation in different events for people who can not be physically present. First of all, to be uploaded to a podcast channel, a podcast must contain ID3 tags, like files that tell us the title of the song, the artist, the album, and so on. Then the podcast has to be enabled for RSS, so subscribers get updates every time new episodes are uploaded. Podcasts must also exist on a third server (different from the one on which it is uploaded and the one on which it is loaded), allowing any user to download it at any time. “There are many other ways of publishing podcasts. For example, a number of blogging programs will allow you to embed audio in your blog and also have the facility to syndicate. Once you have set up the feed the blog host will detect whenever you load audio into your blog and will syndicate it as a podcast. Where the podcast is embedded in the blog it is sometimes referred to as a blogcast.” (Brown, 2009, p. 47). Influenced by the development on technology (mostly on smartphones and Bluetooth devices), podcasts had grown in the last years “reaching new audiences on apps such as iTunes, SoundCloud, Stitcher, Tune In, and can be a great engagement tool and distribution channel for content marketing efforts” (Quesenberry, 2019, p. 198). Kampoor et al. (2017) consider that these platforms have reestablished the dynamics between organizations, employees, and consumers. Social media give users, managers, and developers new capabilities to act and interact in ways that were difficult or impossible in earlier online or offline settings (Kane et al., 2014). Kwayu, Lal & Abubakre (2017) emphasize how social media platforms enhance the competitiveness and creates business affecting with a faster rate some processes and practices within an organisation.

ORGANIZATIONAL COMMUNICATION IN THE ONLINE CONTEXT

Online organizational communication has become a phenomenon, along with technological development and the need for economic actors to communicate effectively and at a low cost. Also, this changed the communication boundaries allowing “communications among people outside the company through web-based social media platforms that cannot be controlled by the firm” (Kane et al. 2009 cited in Kane et al. 2014, p. 298).

Web 2.0 technologies and the widespread use of online applications place online communication in the present day, when the content display process is no longer in the hands of programming specialists and the use of tools by communicators with no technical studies is facilitated. Technologies become accessible, from a knowledge point of view, many of them being open access and adaptable to the needs of the organization.

The Internet is generating a new type of interaction. “Internet use threatens to erode time that was previously allocated to human interaction (...) Large media corporations have taken a keen interest in monitoring the Internet because it provides access to a market for their goods, products, and services” (Wicks, 2001, p. 163). In other words, measuring audience in the online environment and the presence of organizations in this virtual space is becoming a modern way to meet institutional interests, in the context where the user network is more accessible than in real life. Institutions that are active in this type of media produce messages that are meant to attract this virtual audience. “In order to offer products or

services in the current economic context, organizations must offer the consumer a more dynamic role in both offline and online environments” (Hosu, Culic, and Deac, 2014, p. 21). Organizations conduct market research in the online environment. Audience and user preference measurements are made for specific channels or topics so they can be present in those places. Once they understand the online presence of their target audience, companies act. “The Internet provides users with a sense of companionship by enabling them to join virtual communities (...) Because the Internet provides such varied offerings, it quickly became a major competitor for the time and attention of the consumer” (Wicks, 2001, p. 165).

Organizations are present in the online environment in a variety of ways, starting with exposure through an official website and social media profiles (LinkedIn, Facebook, Instagram, etc.), to pop-ups and cookies. In addition, they often use databases to distribute certain messages through e-mail platforms or even social network feeds. These online activities are managed by either company employees or consulting and advertising firms. Online presence can be provided either free of charge, simply by generating accounts, or by using paid and sponsored accounts that are paid monthly or annually based on visibility. Most companies show their contact information and activity in the online environment so that the audience can easily keep in touch with the organization. Companies can even allocate large budgets for end-to-end image campaigns to create an online presence. Various activities can be hosted to attract the desired segment, such as contests, CSR campaigns, games, raffles, and more (Briciu, Briciu and Găitan, 2019, p. 48).

Social media technologies have a major impact on organizational performance directly and indirectly through the innovation capability of changing the way different stakeholders and organizations communicate and transfer information and knowledge (Aral et al., 2013, Garcia-Morales, Martín-Rojas & Lardón-López, 2018). The online environment is useful not only in terms of communication with the external public. Organizations also use this channel to facilitate communication with the internal public. This type of interaction “takes the form of electronic mail, distribution lists (i.e., listserves), multi-user dungeons (MUDs; also called multi-user object domains [MOOs]), chatrooms, and Usenet (...) to enable employees within companies to communicate and work collaboratively on company documents. Employees conducted electronic brainstorming sessions with individuals or groups of employees to solve problems or develop plans” (Wicks, 2001, p. 168). Thus, time and costs are reduced, and interaction is much easier to accomplish.

Castelló, Etter & Årup Nielsen (2016) emphasize with their study the importance of legitimacy building in a globalized networked society for corporations in order to maintain communication with stakeholders who have multiple, often conflicting sustainable development agendas. After a study that investigates social media assimilation in firms Bharati, Zhang & Chaudhury (2013, p. 268) consider that “assimilation of wikis, web services, and LinkedIn in an organization is influenced by the organization’s ability to integrate existing technologies with new technologies, which is a measure of its absorptive capacity”. So, the management should encourage employees spending time on Social Media for learning and for enabling multiple ways of communication with customers.

It’s relevant the way Quesenberry (2019, p. 54) reflects on how companies are using the social media platforms just few of them moving beyond the main social platforms to “strategically add social channels well suited to their business goals and target audience”. Even that the data is few years outdated, he remarks that “the high percentage of Fortune 500 companies on LinkedIn, Facebook, and Twitter, only two-thirds (66 percent) are using YouTube and just over one-third (36 percent) have corporate blogs. Under half of Fortune 500 brands are using other social channels like Instagram (45 percent) and Pinterest (33 percent) and only 40 percent of Fortune 500 CEOs are active on social media”.

Also, for the employer branding the presence on social media is very important and also it gives the companies the opportunity to create a link between their brand and employees (e.g., LinkedIn) so they gain more brand ambassadors. Nowadays, recruiters use social media to post job advertisements and to recruit. Singh and Sharma (2014, p. 236) consider that the social media is becoming an important tool in the recruitment process, companies gaining major benefits as: wider access and geographical spread “with real-time interaction and 24x7 job search activity”, increased job visibility, a better candidate quality, finding hard-to-reach candidates, better ROI and competitive advantage on the market.

CASE STUDY – OMV PETROM AND ORGANIZATIONAL COMMUNICATION THROUGH SOCIAL MEDIA IN ROMANIA

To illustrate the importance of a company’s presence in the online environment and the use of the specific Social Media applications presented above, an example of Petrom business activity in the living space is presented below.

About the Company

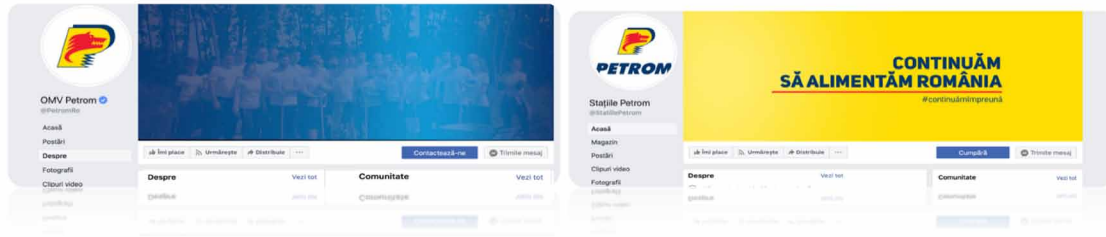
According to the data on the official website in 2018, OMV Petrom is a solid and modern company and the largest energy company from South-East Europe, operating more than 200 commercial oil and gas fields, onshore and offshore. This company was developed at the end of 2004 when the national petroleum company Petrom was privatized, with Austrian OMV AG being the new majority shareholder. The company underwent a vast reorganization and restructuring process but remains the most powerful brand from this industry in Romania. In the online environment, OMV Petrom’s carries out an intense activity, both as a commercial brand and as an employer brand. It is present in the form of sponsored advertising messages in Social Media, websites, forums, articles and many other mentions on various pages.

Presence on Social Media (September 2019)

As far as the Social Media component is concerned, OMV Petrom has a presence on some of main platforms used on Romania: Facebook, Instagram, LinkedIn and YouTube. Romania has 15.04 million internet users (77% penetration) with 11 million active social media users (56% penetration), 9.8 million being mobile social media users (50% penetration) (Hootsuite & We are Social, 2019). The same report shows that there are 10 million monthly active users of Facebook, 3.8 millions monthly active users of Instagram, 2.6 million monthly active users of LinkedIn, 1.4 million monthly active users of Snapchat and just 348 thousands of Twitter monthly active users in Romania. So, the OMV Petrom ‘s social media presence just on those platforms it’s understandable as Snapchat is targeted mostly for teenagers and younger people, reaching with adverts just 8.2% percentage of Romanians aged 13+ and Twitter, not so popular among Romanians reaches with adverts just 2% percentage of people aged 13+ (Hootsuite & We are Social, 2019). According to Ioana Bucalău, Digital & Online Expert at OMV (SMARK, 2019), they considered the expansion on different social media platforms, but because of the content applicability on customers they didn’t sow the sense, even with the growth on other platforms, they keep the social media communication mainly on Facebook. So, on Facebook (2019), OMV Petrom has two official pages (See Figure 2), the official page of the brand (@Petromro) that has 54,879 people who rated the page and 55,047 followers. They post on average three times on a week with an average

Figure 2. OMV Petrom Facebook Official pages: @PetromRo and @StatiilePetrom (Facebook, September 2019)

15



of just 6 comments/ post. For the share component, the numbers are higher with an average of 50 times. The page contains an About section, sections for photos, posts and videos, events and community. The other Facebook page is for the gas stations (@StatiilePetrom) and has 92,495 people who rated the page and 92,999 followers. This one is more interactive with posts once/ day with an average of 13 comments and 50 share by each post. For this page the producer responds to the comments within the hour, which means that the profile is managed by someone permanently. The page contains an About section, a Shop section with price offers for products within the gas stations, sections for photos, posts and videos, also a section with the terms and condition for their promotional campaigns and contests.

The cover video is specifically addressing the Romanian public on both pages, presenting on @Petromro page the last social responsibility campaign and in the @StatiilePetrom page the last advertising campaign for the gas stations. Both pages have also affiliate a Messenger account where users can communicate with the organization. Also, Ioana Bucalău, Digital & Online Expert at OMV (SMARK, 2019) specified that with the collaboration between their Petrom Brand Manager and the digital agency Atelieru + Cohn & Janssen, they growth the engagement, gaining sometimes one million viral reach on Facebook.

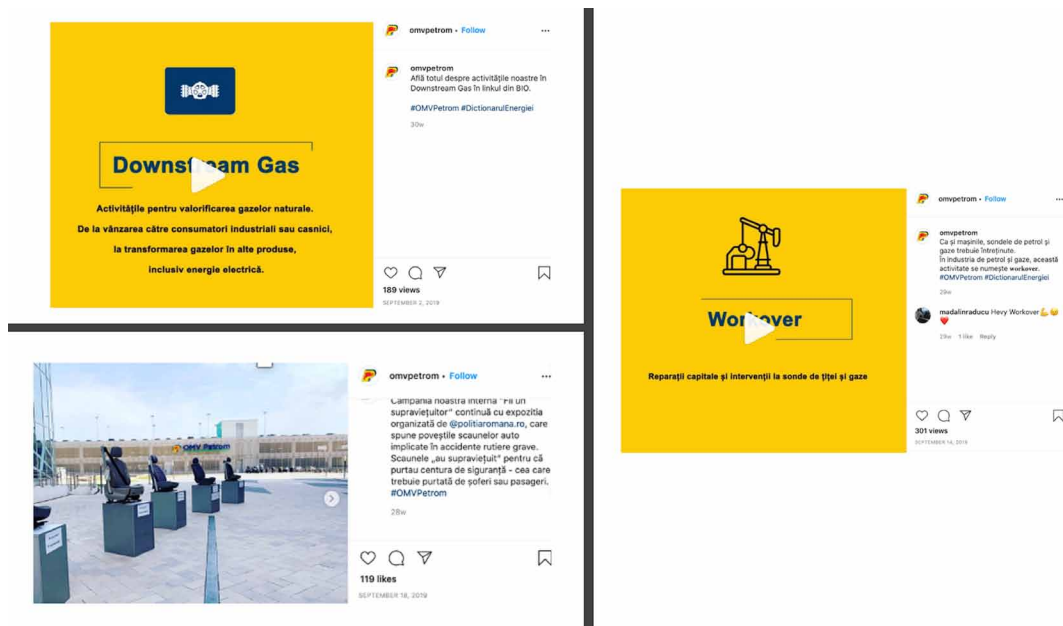
OMV Petrom's Instagram Page has 197 posts (40 posted on 2019), 1,272 followers, and links to the official website. The interactions are small with rarely one comment/post and with an average of 110 hundred appreciation/ post (See Figure 3).

On LinkedIn (2019), OMV Petrom is only present as an organization profile and has 54,304 followers within 5,076 employees. Posts are taken from the Facebook official account. The content on LinkedIn is a formal one, based on sources, specific to a respectable employer. There is an About field, a section with important employees, a corporate overview, and a section presenting the last CSR campaigns. On the OMV Petrom's Youtube account there are 242 videos uploaded since September 2009 with 34,075,929 views and 7,390 K followers (See Figure 4).

Employer Brand

OMV Petrom shapes its employer brand from its own website that is linked with each profile on social media. Here on the section Jobs and careers we can find their recruitment policy, employees success stories, training and internship programmes and jobs available within the OMV Group. Another important presence for the employer brand is on Glassdoor - a platform that allows employees to comment about their jobs and salaries and for the employer to advertise the job offer and to recruit. On this platform, OMV Group has 104 reviews, 11 jobs, 32 salaries, 22 interviews, a list of 75 benefits and 11 photos (Glassdoor, 2019).

Figure 3. OMV's Instagram posts on September 2019

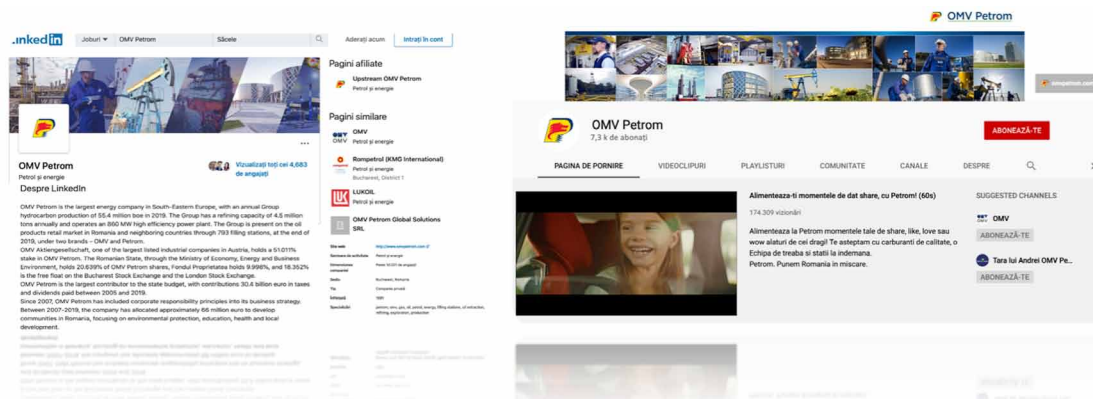


SOLUTIONS AND RECOMMENDATIONS

Doorley and Garcia (2007, pp. 122 - 125) build a connection between organizational communication practices and online presence through Social Media for successful promotion. These recommendations are still viable and take place in several steps, as follows:

1. **Start with the Customer, Not the Medium:** The message must be built on the characteristics of the consumers or potential business partners. The press should only be the binder of communication, not its purpose. It is the only way the impact of the brand can be certain.
2. **Develop Solid Positioning:** Even the “best media-reaching techniques cannot compensate for undifferentiated positioning” (Doorley and Garcia, 2007, p. 123). Positioning is the way you want

Figure 4. OMV's Petrom LinkedIn and YouTube profiles (September 2019)



your brand to be seen by consumers. For example, Volvo is the car brand that is known for safety, while BMW is well-known for technical quality.

3. **Target, Tailor and Personalize Your Messages:** Digital technology has leveled the playing field in marketing and organizational communication. Connecting to the Internet is easily accessible nowadays so any user can search for and find a multitude of responses to their requests, so it is important that the message used to promote a particular product is original, innovative and attracts public attention. If the message meets these requirements, technology can further help with transmitting it to the target audience.
4. **Integrate (or Strategically Align) all Communication Elements and Campaigns:** Integrated marketing refers to the use of all means of promotion during a campaign to provide the correct message. Joining old media techniques with new media and Social Media is the most effective way to promote, so TV and radio commercials, written press articles, and online media are indispensable tools in this process.
5. **Personalize and Measure:** In the new context that is Social Media, measuring audience, hits, or consumption is mandatory. If a company is aware it is losing consumers, it can change or adjust the campaign, depending on the public's discontent.
6. Recognize and Accept the Fact that Every Published Communication Is Potentially

Accessible Anywhere - In this case, reference is not made only to official press releases, but also to a simple anonymous comment posted on a social network. Social Media brings such easy ways to advertise, but it's equally simple for these tools to become the main enemy in a time of crisis.

Use Technology as a Means, Not an End - Technology does not have to replace human creativity and intelligence. It is only a means of making communication faster, easier and more dynamic.

FUTURE RESEARCH DIRECTIONS

In the next decade, the process of replacing humans with machines will increase. Smarter, more reliable and faster technologies will emerge, capturing all existing industries under the new Web 3.0 concept (Funk, 2009; Briciu, Rezeanu and Briciu, 2020), which is the natural transition from the current Web 2.0 form or a semantic Web, that "opens new technological opportunities for web developers in combining data and services from different sources" (Mika, 2007, p. 24). Of course, with this process, unemployment will further increase, which can only be solved by re-qualification for other newer specializations in the online environment. This will be the beginning of a "new kind of partnership with machines that will build on our mutual strengths, resulting in a new level of human-machine collaboration and codependence." (Davies et al., 2011, p. 3) as, nowadays, our technical systems reside "in large data-driven organizational and administrative systems and even social media platforms that provide the frames within which much work and human interactions of all kinds take place" (Redström & Wiltse 2018, p.108).

The five trends and technologies in Web 3.0, according to Funk (2009, p. 128) are: (1) The Semantic Web and Artificial Intelligence; (2) Cloud computing; (3) Universal, portable, and online identities; (4) 3-D internet and (5) True convergence of web, mobile devices, and other equipment (See Figure 5).

Any aspect of the surrounding world will be transformed into data systems, "the diffusion of sensors, communications, and processing power into everyday objects and environments will unleash an unprecedented torrent of data and the opportunity to see patterns and design systems on a scale never before possible" (Davies et al., 2011, p.4). This change will also have an impact on a social level, leading

Figure 5. Adapting Web 3.0 features (according to Funk 2009, p.128)



to the discovery of new models and relationships that have not yet been discovered. Technologies will become more sophisticated, being compressed into much smaller objects than the ones we now have. Caring for the environment will make future technologies environmentally friendly. Also, as Kapoor et al. (2017) remark most of the research on this field focus on the organizational structure and setting and so is a lack of studies in analyzing stakeholders' potential in adopting social media technologies to accomplish their work goals and to share their life within.

CONCLUSION

Finally, we can consider that the online environment is a second reality in terms of professional activity. Specialists become users and vice versa, networking and communicating permanently. That is why organizations need to feel their presence in this environment, which has become, almost as important as real life. The online environment is therefore in favor of any organization that wants to be connected to this technologically and professionalized world.

The need for digital competences is indisputable as an essential feature in everyday professional services. Nowadays, specialists are acquiring information, comparing and discussing in the virtual environment, which means that any company must be able to expose its message in an efficient way. The online environment has become an incredible network of interconnected users at the level of humanity, which allows the creation of professional trends and a global framework of expectations. This phenomenon is unprecedented in history, when messages were spread on paper.

The online environment and the other digital media have revolutionized human interaction. This is the network effect that organizations must use to reach their goals. This online presence of billions of people can be used both in organizational communication activities and in other areas, for research or facilitating professional activities. The fast transmission of information with great visibility no longer depends on a single issuing agent but is spread by tens, hundreds or thousands of users. With one share, the content becomes visible to all contacts who use the same channel in real time. Software resources also support daily managerial and production activities. The online environment is, therefore, in favor of any organization that wants to be connected to this world of technology and professionalism, considering the following key points:

- Social Media brings more power and attitude to people, helping them promote and express their point of view about a particular product.
- Companies can use various social media channels to connect with their customers and attract new ones. Those who have decided to take this step only saw benefits.
- Traditional media suffers because of Social Media, where content is rediscovered, having new value every time.
- Influence is what helps reach objectives in Web 2.0, not control.
- To increase your chances of success, the online environment must be seen as an offline one, with an appropriate behavior.

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KEY TERMS AND DEFINITIONS

Internet: A global system of interconnected computer networks that facilitates data communication services.

Online Environment: The virtual space in which a computed defined system can function being connected to other(s) connected systems through a communication electronic channel and sharing content.

Online Organizational Communication: A web-based online communication targeted to specific publics used in the organizational context.

Organizational Communication: Various communication channels, strategies, and techniques through which the corporation interacts with customers and other audiences.

Social Media: A range of different Web 2.0 internet-based tools that increase and enhance the exchange of information.

Web 1.0: Online activities centered on client-server architecture, where processing is done by the server, and the client is only used to display the content.

Web 2.0: A term that designates a whole range of interactive and collaborative aspects of the internet.

Organizational Behavior

15

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INTRODUCTION

As organizations adapt to the challenges of technology an understanding of organizational behavior (OB) theories supports the development of new management and leadership behaviors, but OB is a dynamic multifaceted field with ambiguous definitions and conflicting articulated structures (Borkowski, 2015; Cummings, 1976; Vasu, Stewart, & Garson, 2017). According to Kaifi and Noori (2011), OB is an applied discipline, but its study requires a basic understanding of sociology, psychology, philosophy, anthropology, social psychology, economics, and axiology. Studies in organizational leadership, organizational culture, organizational development, organizational theory, organizational management, and change management are also constructs of OB (Otaghsara & Hamzehzadeh, 2017; Schaerer et al., 2018; Stouten, Rousseau, & De Cremer, 2018). OB applied in organizations uses scientific methods and practical experience to recognize, explain, and influence the attitudes and behaviors of individuals and teams in the organization (Kafi & Noori, 2011; Otaghsara & Hamzehzadeh, 2017; Schaerer et al., 2018; Stouten, Rousseau, & De Cremer, 2018).

With the expansion of global business and rapid changes in technology there has been a paradigm shift in management, calling for the use of positivity rather than negativity, expansion of collaboration across departments, and a growing emphasis on diversity and inclusion to support innovation. This shift promotes positive organizational policies and procedures while maximizing resources (Otaghsara & Hamzehzadeh, 2017). According to Bakker (2008), negative approach-based terms influenced organizational culture undesirably, and Luthans and Avolio (2007) claim developing a positive organizational behavior framework is a source of an organization's competitive advantage. This article will discuss the evolving theories of organizational behavior addressing the challenges of technology and change, as well as placing the discussion within the context of seminal theories.

BACKGROUND

The practice of OB is multifaceted, based on multiple organizational theories, management theories, organizational disciplines, and the intersection of research and practice (Cummings, 1976; Frederick, 2014; Vasu, Stewart, & Garson, 2017). Moorhead and Griffin (1995, pg. 4) defined OB as "the study of human behavior in organizational settings, the interface between human behavior and the organization, and the organization itself." Frederick (2014, pg. 564) discusses it as "...an applied behavioral science that involves integration of studies undertaken in behavioral disciplines such as psychology, sociology, anthropology, social psychology, and political science." Kafi and Noori (2011, pg. 89) describe OB as "a field of study devoted to recognizing, explaining, and eventually developing the attitudes and behaviors of people (individual and group) with organizations." Kafi and Noori further state OB is based on "scientific knowledge and applied practice."

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The goal of OB is to provide tools through theories and concepts, to aid in understanding, measuring, analyzing, describing, and managing attitudes of individuals, groups, and the organization itself. OB allows managers to make effective use of resources to meet organizational goals. Various definitions of OB reflect the multiple perspectives, disciplines, and uses of the evolving discipline. The following review of disciplines and theories applied in OB focuses on creating an understanding of the foundational constructs of the various facets supporting OB, contributing to an understanding of the evolution of OB to the current positive focus.

Organizational Behavior (OB) literature references multiple constructs, including Organizational Theories, Organizational Development, and Leadership Theories. OB tools appear in strategic decision-making, communication strategies, organizational learning, managing change, driving innovation, and accomplishing the goals of the organization through understanding and influencing individual and group behaviors within the organization. A review of a sampling of the classic theories OB evolved from follows.

The development of classical organizational theories at the beginning of the 20th Century leaned heavily on Frederick Taylor's *scientific management theory* (Hatch, 1997; Taylor, 1911). "Taylorism" included 4 basic principles: 1) find the 'best way' to perform each task, 2) match each work to the 'best fit' task, 3) use transactional leadership, closely monitoring works and motivate through reward and punishment, 4) management's duty is planning and control. While Taylor improved production in the simple industrialized organizations, it proved too limited to respond to the major challenges and changes of the 21st century (Wagner-Tsukamoto, 2007).

Max Weber, expanding on the scientific management theory to install even more authority and control, reducing diversity and ambiguity in organizations, developed the *bureaucratic theory*. Weber (1947) focused on the hierarchy structure of power, division of labor and specialization, and creating stability and uniformity. He also discussed the idea that organizational behavior is a network of human interactions, where all behavior might be understood by looking at cause and effect. Mooney and Reiley (1931) continued in this vein, emphasizing the establishment of a universal set of management principles that applied to all organizations (Walonick, 1993). During this same time, Henri Fayol (1949) created a management theory called *Fayolism* emphasizing staffing, recruitment, strategic planning, and policies and procedures to support efficiency. Sometimes referred to as the father of operational theory, Fayol focused on management, as opposed to Taylor's focus on the task (Ott, 1989).

Classical management theory was limited, rigid, transactional, and framed all motivation within the context of economic reward. During the early manufacturing era, as society moved toward the urban industrial base it served as a transition tool. However, individuals did not respond well to the transactional, mechanistic approach that ignored their basic humanity and throttled individual creativity and innovation (Carroll & Gillen, 1987; Ott, 1989). According to Scott (1961) "...classical organization theory has relevant insights into the nature of organization, but the value of this theory is limited by its narrow concentration on the formal anatomy of organization." (pg. 10).

As research continued in the field of maximizing workers' efforts, the Hawthorne Experiment, 1929-1932, applied the clinical methods of Jean Piaget, a noted psychologist, to the field of business research (Hsueh, 2002). These studies influenced organizations as management began to understand the importance of interactions of groups and individuals, social relationships in the workplace, and people-management skills (Carroll & Gillen, 1987; Hatch, 1997; Hsueh, 2002). Maslow's Hierarchy of Human Needs was introduced in the 1940s, and integrated into the business lexicon as a motivational tool, explaining how individuals' inborn needs motivate them and influence their actions (Hatch, 1997; Maslow, 1954). The acceptance of the behavioral sciences in business developed into the Neoclassical Organization Theory.

According to Scott (1961) Neoclassical Organization Theory evolved as a reaction to the authoritarian structure of Classical management theories. Focused on informal organizational structure, human needs, and creating an atmosphere of cohesive values and purpose, organizational success became linked to leadership styles that emphasized managerial power based on acceptance. Barnard (1939), identified as a transitional theorist, built a body of work combining elements of both classical and neoclassical theories. Simon (1945) contributed a model of “limited rationality” to explain unpredictable worker reactions to management attention, legitimizing reductionism, quantification, and deductive logic as methods of studying organizations (Walonick, 1993). Despite the introduction of elements of the evolving human relations movement, these theorists shared the attitude management’s duty is to maintain equilibrium through controlling and manipulating workers and their environment.

Within the context of the neoclassical theories, the importance of the social system as part of management motivational tools was established. While classified as neoclassical, the concept of the social system as an interactional part of the organization points the way to modern theories (Scott, 1961).

Various theories emerged throughout the 1950s and 1960s, particularly in America. Douglas McGregor contrasted the philosophical differences between the human relations approach and the scientific management school of thought (Augier, 2013; Carson, 2005) while Drucker (1954) popularized Management by Objectives, emphasizing participative goal setting, choice of actions, and decision making. These works contributed to the understanding of implementing organizational missions throughout organizations, as well as introducing collaborative perspectives. The concept of collaboration of team members of all ranks and positions in determining best practices and strategies is the foundation of modern organizational and leadership theories focused on managing change and supporting innovation. As the focus on planned change grew, Organizational Development (OD) emerged as a body of theory and practice (McGill, 1947).

Organizational Development describes multiple social-science approaches to planned organizational change (Anderson, 2016; Namada, 2018). It is a sustained, long-range process of reflective, self-analytical planned change. It builds on past and present research to create a collaborative system inclusive of data collection and diagnosis, as well as OB disciplines (Anderson, 2016; Namada, 2018). Contemporary models of OD change include Design Thinking, Spiral Dynamics, and Continuous Change (Beck & Cowan, 1996; Brown, 2008; Martin & Martin, 2009; Weick & Quinn, 1999).

While there is a practical value in the classical and neoclassical theories, if adapted to changing conditions, contemporary approaches often use the System Theory. The Systems Theory looks at the organization as a whole with mutually connected parts (Martz, 2013). Other approaches analysis pieces of the organization, viewed from the perspectives of the various disciplines, while the System Theory views the organization in its totality. In the 1960s, the Open Systems Perspective emerged, as human relations concerns expanded to include a focus on organizational growth and survival (Augier, 2013; Martz, 2013). Daniel Katz and Robert Kahn wrote a seminal work on the open systems perspective, stating organizations will continue to expand and survives only as long as they import more energy from the environment than they expend (Ashmos & Huber, 1987; Katz & Kahn, 1978). Emery and Trist called for different responses to varied environmental conditions to manage change, even as the environmental contexts in which organizations existed were increasing in complexity (Emery, 2000). In the 1980s, the productivity improvements made by Japanese companies led to Theory Z, a blending of American and Japanese practices (Lunenburg, 2011). Within the Open Systems Theory, complexity and expanding global markets drove the need for adaptation to change, and Change Management Theories evolved.

According to Cummings, Bridgman, and Brown (2016) Kurt Lewin’s work on the change process is regarded as the classic approach to managing change. Lewin’s approach lists the three steps to change as

unfreezing, changing, and freezing. Lewin is often called the “founding father of change management” and the “intellectual father of contemporary theories” (Schein, 1988, pg. 239). Kotter (1978; 1996) is another seminal author of change management, with his 8- step Change Model. The 8- steps include: 1) create urgency, 2) form a powerful coalition, 3) create a vision for change, 4) communicate the vision, 5) remove obstacles, 6) create short-term wins, 7) build on the change, and 8) anchor the change in organizational culture. As organizations continued to seek ways to adapt to the rapid change of globalization and technology challenges, new change management models emerged, exploring leadership concepts, collaborative teams, and organizational learning to support organizational innovation and efficiency.

Organizational learning demonstrates an integration of disciplines. David Kolb (1984) created a learning model of experiential learning, building an understanding of the different stages of acquiring knowledge. His model is a learning cycle demonstrating the learner making sense of the experience. King (2009) expanded on organizational learning, including knowledge management as a key piece of learning within global organizations. Managing teams and diversity is not a new topic, as seen in Eckrel and Grossman’s (2004) discussion on the growth of teams in the workplace and the need for diversity. Behavioral management, or leadership, is built into organizational learning and collaboration of teams. Senge (1990) was a pioneer of learning organizations, claiming without continual learning, supporting people growing and expanding their capacity to create as well as work in teams, organizations would not be flexible enough to adapt to rapid change. While known for his work with learning organizations, Senge’s theories are often included in leadership models as well.

One of the recognized founders of the field of OD, Richard Beckhard, applied behavioral sciences to real life situations, describing an approach that was an innovative bottoms-up change effort (Fry, 2017). His work with collaborators McGregor, Bennis, and Schein initiated the Network of Organizational Development. Beckhard and Harris (1987) claimed the basic units of change are groups, not individuals; decision-making should be located where the information sources are without regard to role of hierarchy; open communication, mutual trust and confidence across divisions and level is needed; and people support what they create. Beckhard was instrumental in creating change models that influenced change management leadership styles. (Fry, 2017)

Leadership studies include seminal works such as the work of historian James Burns (1998) on Transformational Leadership and discussions by Bass and Avolio (1994; 1997) analyzing Transactional and Transformational Leadership. Situational/Contingency Models of leadership with their emphasis on being flexible and adaptable are part of the classic models of managing change. Some of the major models include: Kurt Lewin’s Three Styles model, Tannenbaum and Schmidt’s Leadership Continuum model, The Fiedler Contingency model, Path-Goal theory, the Situational Leadership model championed by Hersey and Blanchard (1969), and Bolman’s and Deal’s Four-Frame model (Scouller, 2011). Greenleaf (1977) espoused the Contingency Leadership Model and continued his leadership studies, creating the model for Servant Leadership. Kouzes & Posner’s Leadership Model emphasized transformational features to build a model based on five leadership practices. More process-oriented theories include learning organizations. In these models, the work of leaders supports the followers, and includes an element of social responsibility (Bass & Avolio, 1997; Nawaz & Khan, 2016). Leadership models have moved from acquired traits to adaptive, situational styles, to models focused on the interactions of groups and group members to improve the organization as well as the individual (Asrar-ul-Haq & Anwar, 2018; Nawaz & Khan, 2016). Recent leadership models developed in response to the call for innovation and creativity. Models include Peter Senge’s (1997, 2006) work developing learning organizations through leadership, Authentic Leadership built on followers’ trust of the leader (Avolio & Gardner, 2005), the Creative Leadership Model (McCauley & Van Velsor, 2004) used to support innovation with an emphasis

on diverse work teams, and global/ sustainable leadership models, with an emphasis on Organizational Citizenship Behavior (Lane & Maznevski, 2019).

Focus

Organizations have always faced challenges, but today change is faster than at any time in history. According to Sayles (2017), a myriad of experts and workers will need to collaborate, emphasizing the communication challenges between teams with multiple visions. Some organizational visions have looked to the past, relying on increasing amounts of data driven analysis for strategic decisions. As technology improves, the data appears limitless, at times overwhelming the human decision makers (Yang, Choi, & Lee, 2018). Gladden (2016) posits the ‘posthuman’ organization has arrived. The discussion of creating a management style inclusive of AI, social robotics, and human augmentation emphasizes the interaction between processes and humans, as well as the need to grow people in their new roles. Humans and non-humans interact in increasingly digital and virtual worlds, in our social culture, personal life, and work life. The use of new technologies to enhance information gathering and physical strength is changing the workplace including the leadership styles needed to manage the change.

Transactional leadership emerges in the effort to mesh human workers with technology, including robotic tools (Gladden, 2016; Siciliano & Khatib, 2016). At the same time, calls for more innovation and creativity indicate the need to support transformational models of leadership. Assessing the organizational theories, classical theories might be employed to ensure the smooth functioning of manufacturing processes, supply chain management, and repetitive duties. Many rote actions should fall to technological devices, including robots and analysis programs. Assistant robots and exoskeletons augment human strength while protecting human bodies from the wear and tear of physical labor. Artificial intelligence allows mass data gathering and analysis in faster timeframes. The enhancement of humans in the organization is part of the future management process as changes in the organization drive changes in occupations and duties. Resilient organizations are able to respond effectively, reinventing themselves through innovation and creativity.

However, history shows organizations and workers traditionally resist change (Namada, 2018; Yang, Choi, & Lee, 2018). As radical organizational change occurs, OB knowledge provides models of change and paths of individual growth. Retaining valuable employees, retraining workers, developing collaborative teams, and embracing new technologies are suggested models for the future (Gladden, 2016; Namada, 2018; Yang, Choi, & Lee, 2018). Inherent in the need to manage change is the need for creation of knowledge, organizational learning, and the building of trust of followers.

SOLUTIONS AND RECOMMENDATIONS

Organizational Behavior is a complex merging of multiple disciplines. The need to integrate qualitative viewpoints with quantitative approaches continues to challenge the field (Rastrollo-Horrillo & Martín-Armario, 2019). Much as a mixed-approach to research has become the accepted norm, a mixed approach to managing approach may benefit organizations struggling to modify organizational behavior and culture. According to Hornstein (2015) it is essential project management and organizational change are integrated within the organizational behavior model. Despite recommendations to use projects as a way to institute and manage change (Crawford & Nahmias, 2010; Parker et al., 2013; Söderlund, 2010). While project management and change management use different terminologies and methodologies, hav-

ing developed out of different parts of organizational behavior disciplines, they are complementary with mutually supportive disciplines. The success of the project is based on a wide array of factors and skills, and change management and project management should be viewed as multi-dimensional, combining traditional measures of project management and the broader field of organizational change management (Hornstein, 2015). The quantitative project management merged with the qualitative aspects of change management including culture building and communication, will allow a more inclusive approach to change, building a measurable yet innovative pathway to change.

According to Yang, Choi, and Lee (2018) organizations adapting to rapid changes in technology and the environment need to depart from the past macro-system focused view and recognize the individual-level factors influencing organizational change. Further discussion focuses on the need to consider “the multidimensionality of change behaviors in dynamic organizational environments” (Yang, Choi, & Lee, 2018, Pg.1659). Cross-functional collaboration enhances product innovation and development, while merging system-oriented change with people-oriented growth is vital to future growth of global organizations (Lin, Wang, & Kung, 2015). To spur innovation, diversity and horizontal organizational structures are preferred pieces of the organizational culture (Namada, 2018).

Lee and Edmondson (2017) discuss self-managing organizations as a means to flatten hierarchical structures and increase communication and knowledge sharing, while Luthans and Avolio (2007) advocate Positive Organizational Behavior, with criteria of hope, confidence, and resiliency. Otaghsaram and Hamzehzadeh (2017) argue applying a positive psychological approach to research, practice, and work supports a competitive edge for organizations. They call for a paradigm shift from negativity to positivity, as increasingly turbulent situations spur the need for the use of authentic leadership styles to create an organizational climate that emphasizes the individual and developing positive characteristics of people, much as Senge advocated in building resilient organizations.

A key tenet of horizontal or flat organizations is openness within the organization. Openness, a norm within contemporary societies and flat organizations, has introduced greater transparency of information, expanded accountability throughout the organization, and increased inclusion (Hautz, 2017). Openness stands in contrast to traditional organizational views of confidentiality, authority, and competitive advantage, changing the fundamental ways organizations function. According to Dobusch, Dobusch, and Müller-Seitz (2019) the previous bureaucracy and organizational culture sometimes limit the benefits of openness. Their study indicates a two-pronged approach to implementing openness, procedural and contextual, allows a more accurate assessment of the efficiency of organizational openness.

FUTURE RESEARCH DIRECTIONS

Rapid change within organizations will continue, driven by globalization, uncertain markets, and new technologies. Tied to technology is a need for a deeper understanding of the effect of virtual teams and workplaces on the organizational culture. The restructuring process influenced by new information technologies opens doors for new models of management to cope with new working conditions and styles. The need to provide cohesive tools that support interaction between virtual and traditional teams includes processes, evaluations, and an inclusive culture (Alsharo, Gregg, & Ramirez, 2017).

Furthermore, Peters (2015) calls for a better understanding of digital technology, the media, and organizational use of new technology. As digital technologies shape our personal and social lives, so too do they shape organizational culture and structures. The use of new technologies and their implications

on society and organizational transformation including innovation, learning, and communications is an area worthy of more exploration.

Granqvist and Gustafsson,(2016) point out the need for more understanding of perspectives on temporal institution work during times of change. In particular, they call for insights into how temporal maintenance work occurs, how synchronization and desynchronization affects institutional change, and how temporality acts as a source of institutional complexity. The expansion of current theories through temporal views might better inform innovation while integrating approaches to research across various disciplines. According to the European Group for Organizational Studied (2019), the concept of combining perspectives across levels from day-to-day activities to higher levels of the organization in research might help build understanding of time beyond ‘clock time’ to the social concept of time as used in organizing.

Future research is needed on the effect of diversity on knowledge creation and management focusing on communities within different socio-cultural contexts, including communities of practice (Manuti, Impedovo, & De Palma, 2017).). Diversity is still an intangible asset, mainly linked to a strategic use of human and social capital. Diversity is not yet fully defined, nor are the various aspects understood, especially in the context of innovation in AI, Deep Learning, and robotics. Olsen and Martins (2012) present a discussion of Diversity Management, indicating organizations do not understand how the context of their policies influences workforce diversity and outcomes, as well as calling for exploration into whether and how DM might adapt to environmental demands. Finally, organizations do not yet fully understand the consequences of new technologies. The need to explore the effects of an overload of diverse information on creativity, or the stress generated by constant connection to work and the lowering of personal interaction that supports innovation might help managers develop a culture that supports the highest level of creativity, diversity, interaction, and innovation (Oldham & Da Silva, 2015).

CONCLUSION

Global organizations face change on a large scale, using technology to create virtual teams, developing complex supply chains, promoting networks allowing asynchronous collaboration between developers, and the need for technology that can process vast amounts of data. With the advent of AI, robotics, and deep learning, organizations must manage the inclusion of technology in their teams, using the new knowledge to augment, rather than diminish, their people. Learning based organizations with positive and transparent organizational cultures will be situated to respond to the coming changes in all areas of the organization. OB must lead the way; ensuring leaders support innovation and change through the development of both technology and people, allowing new work models to emerge.

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KEY TERMS AND DEFINITIONS

Adhocracy: A highly informal organizational design that is organic rather than mechanistic. The configuration allows specialists to work in teams.

Authentic Leadership: A leadership model based on follower trust earned by the leader. The leader emphasizes honesty and positivity.

Benchmarking: Comparing products, processes, and people with competitors in a systematic comparison to imitate and improve on them.

Change Agent: Someone who supports, promotes, and enables change within a group or organization. Sometimes called a Change Champion.

Collectivism: Cultural influencing the degree of collaboration preferences to act in groups.

Decentralization: Decision-making is distributed throughout the organization, a flat or horizontal hierarchy.

Entrepreneurial Leadership: A leadership perspective where a leader strongly exhibits characteristics and behaviors of an entrepreneur.

Organizational Climate: The current work environment and atmosphere of an organization, as perceived by employees.

Organizational Socialization: The process that introduces new employees to the organizational culture.

Positivist Organization Theories: Based on research methods from the natural sciences, positivist researchers advocate knowledge produced from an accumulation of facts.

Practical Intelligence: An individual's ability to unravel everyday problems and find solutions. It includes the ability to get things done effectively and collaborating with others.

Visible Culture: A culture expressed visible with symbols and narratives.

Examination of Quality of Life in Workplace Environments

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INTRODUCTION

Understanding how to enhance satisfaction of employees in the workplace is of significance to managers, and quality of life is an important construct that relates to job satisfaction and overall wellbeing of employees. Quality of life is an estimate of an individual's health status, defined as satisfaction or happiness within eight dimensions: vitality, physical functioning, bodily pain, general health perceptions, physical role functioning, emotional role functioning, social role functioning, and mental health (Ware, Kosinski, & Gandek, 2000). Quality of life is a common measurement in healthcare, in determining the effectiveness of treatment on patients. But, quality of life in healthcare workers is often overlooked. Healthcare organizations are commonly known to be high-stress environments due to the life-or-death nature of the work. Thus, examining the quality of life in healthcare professionals is of significance, and is related to one of the Healthy People 2020 Occupational Safety & Health Objectives, which is to "increase the proportion of employees who have access to workplace programs that prevent or reduce employee stress" (Office of Disease Prevention and Health Promotion, 2017).

The objectives of this article are to identify and examine the factors that impact quality of life in healthcare professionals and to identify solutions and recommendations for how healthcare managers can assist in reducing the impact of these factors in the workplace. This topic is timely because the well-being of healthcare professionals is important to the effective functioning of the health system (Selanu, Thornicroft, Fekadu, & Hanlan, 2017). While there are many factors that impact quality of life, this article will focus on four factors that are most prevalent in healthcare settings: occupational stress, burnout, workplace violence, and employee well-being. Research has shown that occupational stress, burnout, and workplace violence all can have a significant impact on employee well-being and overall quality of life (Brandstatter, Job, & Schulze, 2016).

BACKGROUND

The Institute for Healthcare Improvement (IHI) introduced the Triple Aim- enhancing patient experience, improving population health, and reducing costs- as the model for optimizing performance in the health system (Berwick, Nolan, & Whittington, 2008). Recently, there has been increased interest in changing the Triple Aim to a Quadruple Aim, thereby addressing the goal of improving the life of healthcare professionals (Bodenheimer & Sinsky, 2014). This push for a change even further highlights the significance and timeliness of exploring the negative consequences that affect quality of life in healthcare professionals.

Often healthcare professionals find it difficult to seek help for their health problems for a variety of reasons, such as workload and the fear of stigma and adverse effects on their career (Brooks, Gerada,

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& Chalder, 2016). Particular types of healthcare professionals are even more susceptible to negative consequences that impact quality of life. For example, healthcare professionals working in an Intensive Care Unit (ICU) are at higher risk of stress, burnout, and anxiety (Vandevala, Pavey, Chelidoni, Change, Creagh-Brown, & Cox, 2017). Workplace violence is also an area of concern.

Healthcare managers have a pivotal role in healthcare organizations as they set the professional standard, oversee quality and training, and serve as role models (Maza, Shecter, Eizenberg, Segev, & Flugelman, 2016). According to the World Health Organization (WHO), “a healthy workplace is one in which workers and managers collaborate to use a continual improvement process to protect and promote the health, safety, and well-being of all workers and the sustainability of the workplace” (Burton, 2010). Thus, implications for how managers can assist in reducing stress, burnout, and workplace violence, and enhance employee well-being, will be explored.

FOCUS OF THE ARTICLE

Occupational Stress

Stress has been reported to be increasing in all full-time employees in the U.S. by as much as a 31% increase from 1983 to 2009 (Cohen & Janicki-Deverts, 2012). Stress can have a negative impact on individuals, such as mental health issues or burnout, and an impact on organizations, such as reduced performance and increased absences (Oginska-Bulik, 2006). Prior studies have surveyed healthcare workers and found that 28% reported stress to be a work-related health problem (Oginska-Bulik, 2006). In 2012, 63% of physicians surveyed reported they were more stressed than three years prior, and 34.3% reported being much more stressed than three years prior (Privitera, Rosenstein, Plessow, & LoCastro, 2014). A 2006 study by Oginska-Bulik concluded that there is a need for programs aimed to prevent work-related stress in healthcare organizations.

Occupational stress is the negative psychological response to job demands in the workplace and has been defined as a feeling of unease and discomfort that workers may experience when presented with extraordinary work demands and pressures (De Sio, Cedrone, Saruta, Ricci, Corbosero, Di Traglia, Greco, & Stansfeld, 2017). Occupational Stress has been reported at a prevalence of 52.7% in healthcare professionals (Kazmi, Amjad, & Khan, 2008). Other studies have also noted the significance of occupational stress and its relation to negative consequences in healthcare professionals (Gaither & Nadkarni, 2012). In a survey conducted in 2011, 87% of physicians reported that the leading cause of their occupational stress was due to paperwork and administration, and 63% reported that their stress is increasing (Bodenheimer & Sinsky, 2014). Healthcare managers should devise strategies to reduce the level of occupational stress and should provide support to healthcare professionals in order to help them deal with job-related stress (Sharma, Davey, Davey, Shukla, Shrivastava, & Bansal, 2014). If healthcare managers implement programs to reduce occupational stress in the workplace, the impact on quality of life in healthcare professionals could be significant. Intervention programs should be aimed at reducing an employee's experience of stressors (Awa & Plaumann, 2010).

Burnout

Burnout in healthcare professionals threatens the Triple Aim, as dissatisfied healthcare professionals are associated with lower patient satisfaction (McHugh, Kutney-Lee, Cimiotti, Sloane, & Aiken, 2011; Haas,

Cook, Puopolo, Burstin, Cleary, & Brennan, 2000). Burnout has been defined as “physical or emotional exhaustion, usually caused by stress at work” (Felton, 1998, p. 238). Burnout is typically assessed in terms of three dimensions that develop in response to chronic work-related stress: emotional exhaustion, depersonalization, and reduced personal accomplishment (Maslach, Schaufeli, & Leiter, 2001). Emotional exhaustion refers to the draining of emotional resources (Rasmussen, Turnell, Butar, Juraskar, Kirsten, Wiener, Patenaude, Hoekstra-Weebers, & Grassi, 2016). Depersonalization is characterized by negative and cynical attitudes towards patients (Demerouti, Bakker, Nachreiner, & Schaufeli, 2000). Burnout is associated with a reduction in motivation, job satisfaction, and job performance (Parker & Kulik, 1995). Burnout can occur when individuals fail to effectively control work-related stress (Langade, Modi, Sidhwa, Hishikar, Gharpure, Wankhade, Langade, & Joshi, 2016). Prior studies have identified a relationship between quality of life and job performance (Rastegari, Khani, Ghalriz, & Eslamian, 2010). Another study attempted to explore the relationship between burnout, occupational stress, and anxiety symptoms. The results of the study found a positive correlation, thus authors recommend burnout management in order to reduce the impact of occupational stress (Ding, Qu, & Wang, 2014).

Prior research has found that as many as half of all U.S. physicians meet the criteria for burnout syndrome (Shanafelt, Hasan, Dyrbye, Sinsky, Satele, Sloan, & West, 2015). In a study conducted by Shanafelt et al in the U.S. in 2012, 7,288 physicians completed a survey in which 45.8% of the physicians reported at least one symptom of burnout. The results of the study showed an approximately 10% higher level of burnout in physicians as compared to the general study population (Shanafelt, Boon, Tan, Dyrbye, Sotile, Satele, West, Sloan, & Oreskovich, 2012). In addition, a 2011 study by the American Academy of Orthopedic Surgeons reported that, out of 2,000 North American physicians, 87% described themselves as being in a state of burnout on a daily basis (Rosenstein, 2012). Other studies have reported that the prevalence of burnout among all categories of healthcare professionals ranges anywhere from 12.6% to 29.9% (Abdulla, Al-Qahtani, & Al-Kuwari, 2011; Abdulghafour, Bo-hamra, Al-Randi, Kamel, & El-Shazly, 2011). Emotional exhaustion, which is a component of burnout, has been reported to affect 20.1% of healthcare professionals (Johnson, Osborn, Araya, Wearn, Paul, & Stafford, 2012).

Burnout syndrome is a public health issue, considering its impact on quality of life (Gil-Monte, 2009). Since burnout is linked to patient safety and quality of patient care, examination of the impact on quality of life is warranted (Carta, Preti, Portoghese, Pisanu, Moro, Pintus, Perra, D'Oca, Atzeni, Campagna, Fabrici Pascolo, Sancassiani, Finco, D'Aloja, & Grassi, 2017). Particular specialties, such as pediatrics (Al-Youbi & Jan, 2013), oncology (Rasmussen, Turrell, Butar, Juraskara, & Kirsten, 2016), and ICU workers (van Mol, Kompanje, Benoit, Bakker, & Nijkamp, 2015), are at increased risk for burnout. Other studies have found burnout to be particularly prevalent in emergency department physicians, general internists, neurologists, and family physicians (Shanafelt, Boone, Tan, Dyrbye, Sotile, Satele, West, Sloan, & Oreskovich, 2012). In a survey conducted in 2014, 68% of family physicians and 73% of general internists reported that they would not choose the same specialty if they could start their careers over (Kane & Peckham, 2014). In a study conducted in 2011, 34% of hospital nurses and 37% of nursing home nurses reported burnout, compared with 22% of nurses working in other settings (McHugh, Kutney-Lee, Cimiotti, Sloane, & Aiken, 2011).

Burnout syndrome may be associated with negative consequences, such as anxiety (Ding, Qu, Yu, & Wang, 2014). Prior studies have found that healthcare workers have a greater risk of developing anxiety due to occupational stress (Fiabane, Giorgi, Sguazzin, & Argentero, 2013; Patel, Weiss, Chowdhary, Naik, Pednekar, Chatterjee, Bhat, Araya, King, Simon, Verdelli, & Kirkwoods, 2011). Anxiety is a psychological and physiological state that has been described as “a feeling of fear related to some uncertain or future event or mental distress that is caused by a threat to a person or his/her values” (Ding et al, 2014, p. 1).

Other research has investigated whether burnout and depression are essentially the same thing and cover the same symptoms. Findings suggest that while similar symptoms may accompany both burnout and depression, that burnout is indeed a distinct problem (Bianchi, Schonfeld, & Laurent, 2014). Managers may be able to more easily recognize symptoms of anxiety and depression, which could indicate potential burnout in employees. The challenge for healthcare managers is to understand factors that would increase or decrease an employee's response to burnout (Rafii, Oskouie, & Nikraesh, 2004). If managers can identify employees who are showing signs of symptoms of burnout, anxiety, and depression, they can potentially implement interventions that could have a positive impact on the employee's quality of life.

Workplace Violence

Workplace Violence, such as bullying and harassment, is an occupational hazard in healthcare organizations that can lead to negative consequences, such as burnout and mental health issues (Lin, Wu, Yuan, Zhang, Jing, Zhang, Luo, Lei, & Wang, 2015). Workplace violence is defined as incidents where staff have been abused, threatened, or assaulted in job-related circumstances which impacted their safety, well-being, or health (ILO, ICN, WHO, & PSI, 2003). The World Health Organization (WHO) categorizes workplace violence into 2 types, physical violence and psychological violence (ICN, PSI, WHO, & ILO, 2002). Physical violence is defined as beating, kicking, slapping, stabbing, shooting, pushing, biting, and pinching; and psychological violence is defined as the threat of physical force against another person or group that can result in harm to physical, mental, spiritual, moral, or social development (Zhao, Liu, Ma, Jiao, Li, Hao, Sun, Gao, Hong, Kang, Wu, & Qiao, 2015). Prior studies have identified a relationship between workplace violence and quality of life (Wu, Lin, Li, Chei, Zhang, Wu, & Zhu, 2014; Chen, Huang, Hwang, & Chen, 2010), and have reported the incidence of workplace violence in the U.S. to be 78% (Benham, Tillotson, Davis, & Hobbs, 2011).

In 2010, the healthcare sector employed approximately 18.9 million workers (13.6% of the total workplace) making it the largest industry in the U.S. (Bureau of Labor Statistics, 2011). Additionally in 2010, the healthcare sector accounted for 11,370 nonfatal workplace violence injuries, with approximately 67% of nonfatal violent injuries occurring in all industries (Bureau of Labor Statistics, 2012). Over the last eight years, healthcare professionals on average accounted for 62% of the nonfatal workplace violence injuries that required time off from work (Bureau of Labor Statistics, 2012). The risk of healthcare professionals experiencing an assault that requires time off from work is 4.5 times greater than that of the general workforce (Bureau of Labor Statistics, 2012). The literature also suggests that the number of assaults is greatly underreported by healthcare professionals (Hartley, Ridenour, Craine, & Morrill, 2015).

Workplace violence has been reported to be a major problem for healthcare professionals globally (AbuAlRub & Al-Asmar, 2014). Prior studies have reported the prevalence of workplace violence to be as high as 89% (Boafo, Hancock, & Gringart, 2016; Franz, Zeh, Schablon, Kuhnert, & Niehaus, 2010). A study by Boafo in 2018 surveyed 592 nurses and found that 52.7% of participants reported having been abused verbally, and 12% reported having been sexually harassed in the workplace in the previous 12 months (Boafo, 2018). Workplace violence should not be tolerated, and managers should both recognize the issues and implement strategies in order to reduce occurrence and discipline the culprits.

Employee Well-Being

Occupational stress, burnout, and workplace violence can all impact employee well-being. Negative experiences and stress from workplaces often spill over into employees' personal lives, which impacts employee well-being (Yoo & Lee, 2018). Employee well-being (emotional and psychological) can be defined as employees' attitudes and lived experiences within the organization (Diener, 2000). Employee well-being can be conceptualized as subjective well-being, which refers to an individual's own cognitive and affective evaluation of their lives in terms of satisfaction with certain aspects, such as job satisfaction (Pasamar & Alegre, 2015). The fast-paced, demanding work environment in healthcare, and increasing demand for learning and using the latest technology, can lead to significant occupational stress and burnout in employees that impacts employee well-being (Raya & Panneerselvam, 2013). Burnout, in terms of exhaustion, has been most commonly used as a measure for employee well-being (Petrie, Gayed, Bryan, Deady, Madan, Savic, Wooldridge, Counson, Calvo, Glozier, & Harvey, 2018). Higher levels of burnout and exhaustion are more typical of lower levels of employee well-being. Prior research investigating the link between workplace violence and employee well-being found that employees who had greater exposure to workplace violence reported lower levels of quality of life (Yoo & Lee, 2018).

Managers play an important role in employee well-being. Research has consistently shown that a good social environment in the workplace is associated with employee well-being (Daniels, Watson, & Gedikli, 2017). Prior studies have found that creating an organizational culture that supports employees in their work and family roles is important for employee well-being (Odle-Dusseau, Herleman, Britt, Moore, Castro, & McGurk, 2013). Other research examining the importance of different aspects of manager support in healthcare settings highlighted the significance of the role of management in using organizational and team-level interventions to promote employee well-being (Petrie, Gayed, Bryan, Deady, Madan, Savic, Wooldridge, Counson, Calvo, Glozier, & Harvey, 2018).

SOLUTIONS AND RECOMMENDATIONS

Research studies have noted that the well-being of healthcare workers is dependent on the quality of their work environment (Portoghese, Galletta, Coppola, Fince, & Campagna, 2014), which is within a managers span of control. Studies have found that social support from managers can modify a healthcare professional's response to negative consequences, such as burnout (Rafii, Oskouie, & Nikravesh, 2014). Managers should focus on how to reduce stress, burnout, and workplace violence. In order to control risk of burnout, healthcare managers should use strategies aimed at increasing an employee's sense of control and reducing employee workloads (Portoghese, Galletta, Coppola, Finco, & Campagna, 2014). Healthcare managers can improve workers' sense of control by promoting their autonomy in the workplace, as job autonomy is considered an important coping strategy for decreasing occupational stress (Karasek & Theorell, 1990; Hausser, Mojzisch, Niesel, & Schulz-Hardt, 2012). Other recommendations for managers include providing support to employees to assist them in better dealing with the demands experienced in the workplace, and providing employees with training to help them deal with challenges faced at work (Gauche, de Beer, & Brink, 2017). Managers can also implement training programs in areas such as stress management and conflict management. There is some evidence that individual-focused web-based interventions relaxation and mindfulness techniques are effective for supporting employee well-being and reducing occupational stress (Ryan, Bergin, Chalder, & Wells, 2017).

FURTHER RESEARCH DIRECTIONS

Additional research in the area could explore further ways in which managers can improve each of these areas in order to reduce the impact on quality of life in healthcare professionals. Future research should also examine the impact of stress and burnout in healthcare managers, and how the stress level of managers impacts the quality of life in healthcare professionals. A lot of emphasis in research is placed on the support that employees need from managers, but one area that has not received a lot of attention is the support that managers need in order to know how to support employee well-being. Further research investigating how best to train and support managers in creating a supportive culture for employees is needed.

CONCLUSION

Quality of life in healthcare professionals can be significantly impacted by negative consequences in the workplace, such as occupational stress, burnout, and workplace violence, which can in turn impact employee well-being. Improving quality of life in healthcare professionals can have a substantial impact on their job satisfaction, thus improving patient care delivery.

While there are many factors that contribute to quality of life, research has consistently studied the impact of occupational stress, burnout, and workplace violence on employee well-being and quality of life. Many researchers have noted the significance of the impact that issues such as stress and burnout can have on well-being and quality of life. The involvement of healthcare managers in identifying these issues and reducing their impact in the workplace may be the key to improving quality of life in healthcare professionals.

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KEY TERMS AND DEFINITIONS

Anxiety: A feeling of worry or fear that is associated with nervousness and restlessness.

Burnout: A state of physical or emotional exhaustion that is typically the result of stress.

Occupational Stress: Stress that is particularly related to a person's job.

Quality of Life: The overall well-being of an individual in terms of things such as physical health, life satisfaction, and job satisfaction.

Stress: Physical, mental, or emotional tension caused by a situation.

Well-Being: The overall physical, mental, and social wellness of a person.

Workplace Violence: Verbal or physical threats against a person in a workplace.

Coworking Spaces, New Workplaces

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INTRODUCTION

While technologies now allow the emergence of new collaborative working environments, these new organizational methods, new spaces and new objectives also refer to a set of issues and challenges that are not yet well studied. However, they bring significant results without necessarily being costly or complex to put in place. However, research on coworking spaces is emerging and increasing every year.

This is precisely the basis of the originality and purpose of this chapter. After defining coworking, the chapter presents the implementation of coworking spaces, as well as the advantages offered by these places for the benefit of entrepreneurs, businesses and employees, but also the limits.

The challenges related to the emergence of these new collaborative environments as new ways of organizing work are also addressed. We also bring a critical look at the reality of the coworking phenomenon.

BACKGROUND

Coworking spaces are part of the category of third places. The study of third places emerged from the work of the sociologist Ray Oldenburg in the late 1980s. The author describes new places of life, neither the house, “first place,” nor the company, “second place”. Oldenburg is one of the first researchers to have conceptualized third places and especially coworking spaces. In his seminal work “Celebrating the Third Place” (2000), he suggests the existence of these places which would be at the heart of the vitality of societies and indispensable to the smooth functioning of modern democracies.

Third places (Good place), correspond to spaces that are neither in the private or the public sphere, but having characteristics that are common to the private sphere and the professional sphere. These places were originally created to revive social interactions in North American cities that were in economic decline. Since then, different authors have added some criteria to the definition, making it broader and thus including other circumstances (Smits, 2015) and other countries. Therefore, to be considered as a third-place, this place must be:

- Neutral (therefore neither at home nor at the employer’s place), hence the third place (Oldenburg, 1989);
- Free access, therefore open to all without any restriction, especially as regards the type of activity done in this space (Oldenburg, 1999);
- Facilitating meetings and exchanges (the configuration of the place must be conducive to conversation, with the presence of meeting rooms in particular - or simply places of conviviality like that reserved for the coffee break or lunch (Guenoud, Moeckli, 2010);

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With these first elements, one could for example imagine that cafes providing free wifi (such as Starbucks) could be considered as a third place. However, this is not the case, because to be considered as a third place, two other elements must also be present:

- Frequency of use by the same users (also in fact, with this fourth element, Starbucks could represent a third-place for customers accustomed to come and work and exchange, Gershenfeld, 2005);
- And above all for a third place to be recognized as such, it is necessary that the knowledge (product, service or other result) that is produced and that emanates from the exchanges between the persons regularly present in the place subsists even after the end of the collaboration, even after the closing of the venue and the end of the meetings between the actors. And it is undoubtedly this element that differentiates places open to the public (such as Starbucks for example), from a third place conducive to work and knowledge sharing (Liefoghe, 2016).

FOCUS OF THE ARTICLE

Setting Up Coworking Spaces

Over the last 20 years or so, depending on the cities or countries, a new form of open space has emerged, the coworking space. The coworking movement, which is part of this evolution, originated in the mid-2000s in San Francisco, in the Californian world of Web 2.0. Coworking thus fits into the wider context of the development of “third places” (Oldenburg, 1999, 2000), places that lie between the place of residence and the place of work. This phenomenon continues to grow and in particular the coworking spaces have multiplied in many cities and villages across the world. Indeed, they can be found not only in the large capitals of the world (Paris, London, New York, Mexico, etc.), but also in many smaller cities and rural areas across the globe (Tremblay & Vaineau, 2020), and not only in industrialized countries, but also in what we refer to as developing countries (Mexico, Brazil, Senegal, Kenya, Maroc and others). Indeed, over time, these coworking spaces have emerged, first within metropolitan areas and then outside urban centers, including in remote rural areas, where they can contribute to develop economic activity.

There are several categories of creators. The creators of coworking spaces are for the most part self-employed workers who are working in these places. They have come together to unite their efforts and their means to find premises that can accommodate them.

Some coworking spaces have been created by government authorities in order to boost a territory with a loss of economic attractiveness (as in the Cantal region in France in particular). Others were created within the premises of a company to make the site profitable by renting some parts of it. At the same time, in Europe and North America, numerous Internet platforms and hotels (the Accor hotel group for example) offer their customers (business travelers) coworking spaces established within the hotel. In addition, some start-ups also make a part of their space available to a large public in order to facilitate coworking. We find this trend in Berlin where German start-ups provide digital services and platforms running for the benefit of coworkers. A process of communication around the existence of the place was therefore initiated, but often it was mostly word of mouth that was enough to attract other workers in the premises. The initiative for the creation of these third-places is individual and supported by private or mostly private funds

In the world, the number of spaces has indeed been multiplied by 32 in 10 years, by 12 in 6 years and by 5 in the last 4 years alone. Thus, in 2013, there were 2,423 spaces, and it is estimated there were 13,800 worldwide as of December 31, 2017 (Deskmag, 2017).

These workspaces are not, initially, spaces dedicated to work, they are places that have been partially diverted from their original function, such as cafes or libraries. In many cases they are also associated with the revitalization of certain deindustrialized zones and buildings in cities (Ananian, 2019). Often created by individuals, often self-employed workers who wanted to offer themselves access to meeting rooms, printers or other technological devices, they are hybrid spaces that offer better working conditions than those that one can have at home, in a workshop or at the office (Scaillerez, Tremblay, 2019, 2016a). However, over time, and especially around large metropolises in Europe, salaried workers also came to work in some of these spaces, when they found some closer to their homes. Finally, some countries or cities also support these spaces in order to facilitate access to work for individuals who have difficult access to the labour market, or cannot finance access to a private office, with all the necessary equipment. Thus, in some countries, such as France, local politicians have been interested in these spaces for various socioeconomic objectives, such as labour market integration and training for work (see various chapters in Krauss and Tremblay, 2019).

Hosting salaried or independent teleworkers for both economic and social reasons, collaborative workspaces are gaining popularity, and the numbers have exploded as we indicated above. But why this interest? The shared cost is less than what a self-employed worker would pay for renting his own office, and this gives access to better spaces, that are more centrally located, for many coworkers. They also allow to break the isolation of working at home and contribute to expanding professional networks, sometimes increasing contracts for workers and economic activity for cities. These coworking spaces are places where people gather to work, but also to interact in a friendly atmosphere. They are alternatives to the daily routine that many employees can experience in large firms in particular and can also offer many benefits to employers through the access to new networks, new ideas, even the development of innovative products or services (Tremblay & Vaineau, 2019, Scaillerez & Tremblay, 2016b).

In addition, some places are open primarily or exclusively to women. They indicate they want to promote women's entrepreneurship and also enable women to have a continuous professional career, without the need to interrupt or reduce it, by facilitating work-family balance via the coworking space. It is both to meet these needs and to contribute to its development that some coworking spaces have favored the sharing of values and help between women entrepreneurs. For example, *Soleilles cowork* in Paris is a space founded in 2011 by five women with the aim of creating a place of collaboration and sharing for the benefit of all entrepreneurial activities, but especially for women. This is a women-friendly space. To this day, out of 30 workstations offered, the space is attended by 40% men and 60% women. Some coworking spaces also offer coworkers the opportunity to come with their children who can be kept on site. This option is offered in many countries, we can mention the significant initiatives of *My outspace* in London, *Coworking Village* in Chicago or *Mamaworking* in Brazil. In these spaces, as many men as women come to work bringing their children. This allows men to play their role of father and women to continue their professional career. Of course these initiatives cannot replace regular daycare, so they can only be temporary options if there is no regular daycare service, but these initiatives do favor the reconciliation of social times for the benefit of both sexes.

However, they can also be oriented towards social economy or third sector initiatives, as is the case in a few coworking spaces in Montreal or in Paris for example. Coworking spaces seem to be conducive to the development of social entrepreneurship since the sharing of values and the collaborative exchanges between coworkers stimulate the professional activities of each and facilitate this type of business op-

portunities. For example, the co-working space Esplanade, in Montreal, is one of the most significant examples since their users share values related to the desire to counter economic decline, to find alternative modes in the face of neoliberalism, which increases their value, solidarity and professional support.

Some of these places are grouped by category of work or professional interests which lead to develop networks or relations with other coworkers (Scaillerez, Tremblay, 2016b). Whether the creators of these places want to establish a professional logic or not, there is an overrepresentation of categories of work and professional activities related to new technologies and the digital world (programmers, Web developers), writing and communication (editors, translators, freelance journalists, or similar professions in publicity or marketing) or creation (designers, architects, graphic designers).

Over the years, large real estate firms have become interested in this formula in order to revitalize some partially empty buildings in city centers. Indeed, companies such as WeWork, but also many real estate companies in various cities have looked towards this formula to rent spaces on a few floors in large centrally located downtown buildings. They often contract out to designers to develop very modern and attractive open spaces, and offer them on the office market. Collaborative workspaces are also beginning to be established in the peripheries located around large cities, and this highlights a possible positive effect of coworking spaces, that is that they can contribute to reducing traffic congestion and travel times for a good number of workers, which can also reduce pollution and greenhouse gas emissions (Scaillerez, Tremblay, 2016a and b).

Membership formulas are diverse and characterized by their flexibility. There are flat rates for office rentals by the hour, half-day, day, week, month, semester or “à la carte”, with a sliding scale. The time of attendance is also very variable, some packages offering rentals from Monday to Friday or only on weekends, with traditional working hours (8 am to 18 pm) or unlimited access (24 hours a day). Prices vary depending on the formula chosen, the length of the rental and the office you wish to occupy: cubicle, closed office, open space, mobile office or permanent office. In Quebec (Canada), the monthly costs to use a full-time floating office (five days a week) range from \$ 250 to \$ 400CAN (or about 300 \$US) before taxes. The difference in price from one place to another also depends on the nature of the packages offered, as well as on local real estate prices. The traditional packages offer at least an office equipped with all the necessary equipment (photocopier, printer, telephone, Internet access at high or very high speed, meeting rooms and videoconferencing). Most of the time, the coworker brings his or her own computer. These work places also offer spaces of conviviality like a place to rest, with comfortable sofas and chairs, as well as a kitchenette with a coffee machine, and even kitchen equipment (fridge, oven, etc.), all this favoring meetings and exchanges between the coworkers. Some offer additional packages, permanent or occasional services, such as a facilitator, animator or secretarial services, subject to some supplementary charges.

Coworking, a New Form of Work Organization

Coworking also brings important changes in the organization of work. It is a type of work organization that refers both to the sharing of a workspace, but also to a form of networking of workers within the same space, encouraging cooperation and exchanges in a specific space of work. These spaces avoid the potential isolation that can be experienced by someone who teleworks from home. They can also contribute to a better concentration than at the office and to facilitate meetings with other users of the place. Coworking spaces are thus considered as places of socialization for various individuals who benefit from the effects of networks produced in these workspaces. True communities can be formed through the creation of relationships of trust, mutual aid and shared values among project leaders (Fabbri, 2015,

2016, Garrett et al., 2017). It needs to be mentioned however that even if the objective of cooperation, network creation and creativity or innovation are often put forward by the initiators of coworking spaces, research has shown that it is not all individuals who want to cooperate, nor all spaces that lead to this cooperation. Indeed a few cases apparently show that some coworkers appreciate working in these spaces but do not particularly seek exchanges and networking with other coworkers (see chapters by Ferchaud and Krauss, in Krauss and Tremblay, 2019).

On the contrary, some collaborative workspaces have also been established in reference to a common identity, with the desire to create a community of belonging or collective identity, as is the case for examples in coworking spaces that refer to the social economy, third sector or associative activity. Users of these locations want to work in a place where they have affinities and common objectives or interests with others, which can lead to a common or shared identity, and thus lead to more interaction and collaboration with other coworkers. In some of these places, they come together because they share common values such as those of the social economy, which can be very strong in creating collective interest and identity (Tremblay and Vaineau, 2020; Scaillerez, Tremblay, 2019, 2016a and b). Collaborative workspaces naturally create a network where everyone has their activity and where, if necessary, it will be possible to use the skills, experience and even the network of these workers. This type of activity leads to a feeling of belonging to the same place, a desire to share, a climate of trust and a form of emulation between the coworkers.

Finally, coworking spaces are also places of life and animation. Most collaborative workspaces regularly organize, in various forms, meetings and activities for the benefit of its users or events around a specific theme. This brings animation to the place and promotes it to make other workers want to come there for their work or their activity. The objective is also to facilitate meetings between the workers who use these places while reinforcing the feeling that one belongs to the same place and to the same professional family (Scaillerez, Tremblay, 2019, 2016b), again with the objective of giving workers supplementary value for their payment to access the space.

To further facilitate the meetings and open the coworking spaces to more people, some organizations have set up:

- *networks* (such as the International Co-working Movement ; the League of Extraordinary Coworking Space (LEXC), a North American network of coworking spaces that promotes coherence and the quality of the place ; or in Quebec, the QC co-working movement.
- *tools*, such as maps designating all coworking spaces in a territory. We can cite in particular the map produced by coworking Quebec or another one developed in Europe¹.

Coworking and Entrepreneurship

Today, businesses, especially small businesses and self-employed, need to access new markets and increase their efficiency and productivity to adapt to the circumstances of increasingly fierce competition. This search for performance and markets leads them to rethink the organization of work and to seek greater flexibility (Scaillerez, Tremblay, 2016c). The type of philosophy found in a collaborative workspace, which is based on mutual support and sharing, and not only on financial (a company rents space for several workers) but also professional objectives (promoting networking, innovation, etc.) apparently presents many advantages from this point of view. Indeed, coworking spaces are intermediary places that aim to promote sharing and exchanges, thus creating communities where information and knowledge flow, generating as many opportunities for innovation and creativity (Tremblay and Scaillerez, 2019;

Scaillerez, Tremblay, 2017). This sociability can be at the heart of their performance and new markets or contracts through the possibilities of new formal and informal meetings and the creation of extended social networks. Undertaking in these places seems to correspond to our time when the mechanisms of solidarity compensate the uncertainties related to the future.

Coworking spaces can directly or indirectly support the development of the projects of the entrepreneurs they host and promote collaborative dynamics (Fabbri and Charue-Duboc, 2013, 2016) based on relationships of trust and / or cooperation. As mentioned above, this is not always the case, but indeed in many cases, the exchange of ideas and collaborative work do give rise to innovations of all kinds. This is often found in the context of socialized organization, even if some cases the question of private property is all the more acute when it comes to, for example, to file a patent, to evaluate the participation of different stakeholders. For the entrepreneurs and self-employed who chose a coworking space, the objective is often to develop one's project in an autonomous way, in the absence of any hierarchical relationship.

THE LIMITS OF COWORKING

Over the years, depending on the cities or countries, coworking has become a new way of organizing work based on a shared work space, set up with the aim of fostering exchanges and synergies between coworkers, and fostering creativity and innovation. It is thus generally presented as a real revolution in the organization of work. However, coworking covers very diverse realities, as has been observed in recent research (Krauss and Tremblay, 2019). Coworking indeed translates into a wide variety of situations, and the link with third places is not necessarily self-evident, since coworking spaces are more general workspaces (Fabbri, 2017). While these are workspaces that want to offer new types of spaces and working environments, as well as better working conditions in terms of work organization, and technologies, they can also offer an interesting balance between more autonomy and collaboration with others. Coworkers are not subject to any rigid work schedules and are masters of their own time and can take advantage of the other users present in the premises to develop their knowledge and their activities (Scaillerez and Tremblay, 2019).

The level of autonomy that is possible in these spaces is however quite contrasted depending on the type of work content, or work status (salaried or self-employed). Coworking spaces do not only attract people with a high propensity to create and innovate, but also people looking for work, which in this way create their own job as self-employed, or even nomadic workers who exercise a professional activity for a large company, or an association. All workers do not necessarily have a strong capacity or desire to innovate, but it is more common to find ideas in an open space, a place where it is possible to meet others, including for individuals who were excluded from salaried employment but have found in coworking a way to create their own job or economic activity. Indeed, the synergistic relationships mentioned above between coworkers belonging to the same workspace are not always present, and this is one of the limits of some coworking spaces. If you can talk with other coworkers about your project in the cafeteria, a coworking center usually consists of independent individuals, small businesses, associations, entrepreneurs or auto-entrepreneurs, and not all are interested in cooperation and synergistic types of relationships. The objective is not always to develop ideas or projects with others.

In addition, the methods of access to coworking spaces are different. Some have a selection process for access to the space, based either on the type of professional activity or on collective identity (territorial belonging, social economy, etc.), others do not. In this sense coworking spaces are very different depending on the country, region or city where they are located, but also depending on the creators' objectives.

Coworking spaces can be created by entrepreneurs who have identified a market opportunity, public initiatives that see this as an opportunity to create employment in their territory, or by large companies favoring a form of nomadic salaried work (i.e. working in different places at different times). Depending on the different scenarios considered, governance arrangements will also be different, more or less user-friendly, more or less market oriented. For example, for large companies, this can also be a way to reduce the fixed costs of creating office space. In the context of Covid-19, firms needing to adapt their work environments to social distancing might see in coworking spaces the opportunity to offer different working spaces to their employees, without needing to build or rent more space on a permanent basis. Coworking spaces can offer space for salaried workers, as is more often the case in Europe and Asia, and less in North America, at least to this day. For the owners of a building, this can be an opportunity to maximize the profitability of their real estate by offering for rent a new variety of office space, again which may be occupied by firms needing to adapt to social distancing.

FUTURE RESEARCH DIRECTIONS

In terms of scientific research, the main question for the coming years will be how these spaces adapt to a pandemic and post-pandemic context. As most have open spaces, there will surely be some adaptation, and at the same time, they can receive guests from companies wanting to externalize some workers in order to facilitate social distancing or to reduce transportation time for some workers. (Tremblay, 2020a,b) Comparative studies of modes of adaptation to Covid between cities and countries will surely be of interest.

Also, a lot of research on coworking only refers to one disciplinary field. Few multidisciplinary studies exist for the moment.

In addition, studies on the relationships between coworking spaces with innovation and entrepreneurship are developing, but research on the subject is scarce, which for the moment makes it impossible to deduce significant results regarding the impact in these two areas. One can even add that most research is rather uncritical to coworking spaces; a more analytical perspective would be welcome.

The possible limits, risks, and other dysfunctions that one could meet in this type of place should be investigated. Yet, even though coworking spaces are multiplying, others close their doors or go bankrupt each year, but there are too few studies to explain the reasons for these failures at the moment. Data explaining the reasons for these failures would be useful, but few creators or managers of coworking spaces report on these failures. However, entrepreneurial failure is also a reality and understanding the reasons for these failures would be interesting in order to improve the activities of coworking spaces and increase their viability. Still, the Covid and post-Covid adaptation remains the main research question for the future.

CONCLUSION

Working spaces continue to change, and the COVID-19 virus has strongly increased the percentage of telework from home in all countries. It has demonstrated that it is no longer necessary to work in the office building of the employer, or even during traditional working hours. The relationship between time, space and work has been radically modified with the COVID pandemic. Coworking spaces are part of this modification of work and arouse great interest for workers as well as firms by introducing a new

dynamic in working space, allowing people to work closer to home, not take public transit and remain master of their work organization and time.

In many industrial and emerging countries, coworking has become, over the last twenty years, a new way of organizing work based on a shared work space, set up with the aim of fostering exchanges and emulation between coworkers, to fuel creativity and innovation (Brown, 2017). The reality is however much more complex, and will continue to evolve in the post-pandemic context. Indeed, coworking designates a diversity of situations according to the territory in which it develops, but also the intention of the creators of the space and the coworkers themselves. Each coworking space has a history, a given trajectory, although it can be said that this new phenomenon of coworking is clearly part of a major transformation of the organization of work.

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KEY TERMS AND DEFINITIONS

Business Opportunity: Opportunities that can be offered to users in the same coworking space, provided that coworkers are open to this opportunity to collaborate together on a business project.

Collaboration: This is one of the major goals of a coworking space. It is an attempt to organize meetings between coworkers in order to encourage professional cooperation.

Community Manager: Person in charge of the management and animation of a coworking space. This feature greatly contributes to the success of a coworking space and its profitability. The job is however little recognized and low paid. It also happens that coworking spaces do not have the financial means to remunerate the function. The tasks are then entrusted to the founders of the place or to trainees or volunteers.

Coworkers: Users of coworking spaces. They are generally entrepreneurs or nomadic workers, and sometimes employees of companies, or even employees of public administrations. They use these places for several reasons such as improving their business opportunities, reducing their business expenses by sharing premises, fighting isolation, or better reconciling their private and professional lives.

Coworking Spaces: Sharing place to connect coworkers in order to facilitate their meeting and possibly to create business opportunities.

Networking: Opportunity created by the presence in the same place of several people with various professional activities and skills. Networking allows coworkers to pool their knowledge and clients to create new profitable business opportunities for each participant.

Sharing: We can consider that two forms of sharing can be found in coworking spaces. These places allow first of all an acquired sharing which is the sharing of premises and also professional equipment (photocopiers, printers, meeting rooms ...) and equipment of conviviality (collective kitchen, free coffee, rest room ...). They can also spark a second form of sharing, but that depends on the coworkers' will. Here, we refer to the sharing of the professional network, good practices between coworkers with related activities or exchange of ideas and development of common business opportunities.

Third Places: New workplaces that allow users to get closer to their home work by reducing the time and commuting distance between home and workplace, thus offering them a better work-family balance.

These third places can also allow remote work without staying at home. These places are inclusive (open to all) and seek to promote the sharing and improvement of working conditions, as well as user activity.

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ENDNOTE

- ¹ MAP OF EUROPEAN. SPACES OF COWORKING. By Irene León, Big Data Technician and Digital Analyst for FACE Entrepreneurship (pdf): link www.face-entrepreneurship.eu/images/Face/knowledge/88/Europe_Coworking.pdf

Jeans, Flip Flips, and Suit Jackets: The Mixing Bowl of Today's Business Attire

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INTRODUCTION

In a competitive nature to recruit and keep the most talented workers, companies are constantly evolving to meet different generations' needs and preferences. One factor, in particular, that has evolved overtime is the accepted norm for work attire. While there lies a wide spectrum of variables that determine a company's dress code, companies, as well as current or potential employees, have an increased awareness about work attire. Steve Jobs, Mark Zuckerberg, and Mark Cuban are successful people who believe in or wear casual attire in the workplace. Steve Jobs wore a black turtleneck religiously with jeans and sneakers. According to a Forbes article, Jobs not only felt comfortable in this clothing, but it also allowed him to focus less on his choice of attire, and more on work (Smith, 2012). Zuckerberg wears jeans and a t-shirt for similar reasons. Finally, Cuban passionately expresses his opinion against suits as he once stated in his blog, "I just could never think of any good reason for any sane person to wear a suit in the first place. Exactly what purpose does a suit serve?...Does wearing a tie make us work harder or smarter?" (Blog Maverick, 2007). Whether it is for marketing purposes, making a statement, or other various reasons (Clifford, 2011), employees, specifically millennials, have had an immense impact on the attire policy in the workplace.

This chapter utilizes the intrinsic business case study analysis to better understand work attire and its evolution, and offer recommendations for companies. The chapter first defines work attire and provides a literature review and useful theories on its impact in the workforce. Then, the author categorizes and details the three different types of work attire: business professional, business casual, and casual. Finally, the author analyzes three different companies that contain a variety of dress policies and represent each of the three categories mentioned prior. It is important to note that the topic, discussion, and purpose of the chapter is work attire, and the business cases incorporated in the chapter play a supportive role in understanding the topic. Arguments for and against different work attire and final recommendations are made based on the research.

BACKGROUND

Work attire can be defined in several ways, whether it is "the clothing (e.g. jacket, skirt, pants) and artifacts (e.g. name tag, smock, jewelry) that employees of an organization wear while at work" (Rafaeli & Pratt, 1993, p. 34), or "an assemblage of body modifications and/or supplements displayed by a person in communicating with other human beings" (Eicher & Roach-Higgins, 1992, pg. 15). Overall, it can be seen as nonverbal communication and expression in the workplace. Rafaeli and Pratt (1993) developed a framework for the study of organizational dress. This framework addressed how extra-organizational factors (societal and institutional standards) as well as intra-organizational factors (values and structure)

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significantly influenced organizational dress. In addition, dress can impact multiple factors, including first impressions (Davis, 1984), the way a person behaves (Adam & Galinsky, 2012; Davis & Lennon, 1988; Johnson, Yoo, Kim, & Lennon, 2008), as well as the way a person feels about him/herself (Peluchette, Karl, & Rust, 2006). It is important to note that there are various factors, outside of the company's policies and guidelines, that impact employee dress.

Several theories have been useful in explaining various influences and impacts that work attire can have on an employee, as well as other coworkers. First, in alignment with role theory, an employee may dress according to his/her part in the company in order to exemplify how he/she wants others to perceive him/herself. According to role theory, which was developed in the 1920s and 1930s through theoretical works of Mead, Moreno, Parsons, and Linton, people may behave in a predictable, context-specific situation based on social situations, hierarchical chains, and other factors (Biddle, 1986; Hindin, 2007). For example, a new manager in a company may dress more professionally in hopes to receive respect and set the level of expectation of appropriate attire for other employees. The manager may feel the need to dress business professional due to his/her role in the company. In addition, impression formation theory can help explain the impacts attire has on the workforce. Impression formation (Fiske & Neuberg, 1990) describes an impression made on a person's character based on available information, such as attire. In other words, employees may perceive one another based on the attire that he/she is wearing. This theory is especially important in relation to work attire policy when considering if a company is client-focused.

Defining and categorizing work attire can be difficult as there are countless options and interpretations. Eicher and Roach-Higgins (1992) declare "that systems for defining and classifying types of dress are frequently incomplete, and that the terminology used is ambiguous and inconsistent" (p. 13). For instance, many definitions of dress do not consider "body modifications, from skin coloring to perfumes and hairdress" (Eicher and Roach-Higgins, 1992, p.13). Colbert (2014) defined dress categories according to three attributes: color, material, and style of clothing. There are endless qualitative observations when analyzing a person's dress. Therefore, for the purposes of this paper, work attire will be strictly defined as the clothing, shoes, and accessories (i.e. jewelry, scarves, hats, etc.) both men and women wear in the workforce. Similar to the definition, the categories of work attire can be endless. To remain consistent within the scope of this paper, three categories of work attire are addressed for both genders: business professional, business casual, and casual. Each category will be discussed in further detail in the following section.

DRESS CATEGORIES

Business Professional

The business professional attire can be viewed as the traditional clothing policy that many corporations have adopted since the 19th century. More specifically, this is the attire that millennials are rejecting. Business professional can vary according to gender, but for simplicities sake, it can be viewed as the suit-and-tie, dress pants, suit jackets, dresses, and so forth. Many corporations require this type of attire, especially when interacting with customers. It is almost expected, unless otherwise stated, that interviewees wear traditional business professional clothing in the job application process. In fact, Mosca and Buzza (2013) establish three main effects in "dressing for success: maintain respect, establish credibility, and establish yourself as an authority figure" (p. 63). Many employees utilize this dress category also to establish strong first impressions. In fact, college students are taught that first impressions are made

within the first minute of interaction, and this can be critical for potential hiring success rates (Burgess-Wilkerson & Thomas, 2009). There are many studies that argue for the benefits of business professional attire in the workplace, which will be discussed in the following section.

Arguments for Business Professional

“Dress for success” has been popular advice for employees in the workforce. Employees should essentially dress the part, whether it is to be taken more seriously, impress for an interview, or dress for a desired position. “Dress for success” can even stem outside of the workforce. McMillan (2014) believes in encouraging undergraduate students to dress professionally for “better practice for the world and increase student opportunities” (p. 1). Professional dress can be very specific and send strong messages. Eicher and Roach-Higgins (1992) even note that “specific differences in color, structure, surface design, volume, or texture distinguish dress of males and females, differences in social rank and power can be made obvious” (p. 20).

Professional attire can be seen as an indication of conformity (Burgess-Wilkerson & Thomas, 2009). Thus, there can be less distractions in the workforce when everyone is dressed to the same code. A business professional dress code can limit any confusion on what to wear to work. McMillan (2014) states his students perform better when they dress professionally. There have also been concerns that work ethic will weaken when business professional clothing is not mandated. Business consultant Andrew Jensen notes that if an office has more of a traditional environment (i.e. not as relaxed), then casual dress would negatively impact the work ethic (Goodman, 2016); therefore, business professional would be the appropriate option. Moreover, attire can have a significant impact on the way employees work and think. Research shows that formal dress workers feel more powerful and are more adept to higher level of abstract thinking (Slepian, Ferber, Gold, & Rutchick, 2015; Goodman, 2016).

Finally, if a company interacts with clients or customers frequently, it is important to establish trust and create a good impression. Business consultant Andrew Jensen argues that “customers will judge a business’s productivity based solely on its level of professionalism” (Jensen, 2018). Therefore, attire communicates and sends strong messages about the employee as a person, as well as the company he/she represents.

Arguments Against Business Professional

Conversely, conformity is not necessarily always a positive aspect for employee dress attire. There should be a limit to which employees conform with the attire and workplace norms (Burgess-Wilkerson & Thomas, 2009). The word “conform” in itself may carry a negative connotation and limit the freedom of expression or individuality for an employee. Company morale may not be as high when restricting employees to a specific attire code, especially if competitors are allowing looser dress codes. Most businesses were relaxing their dress code by the mid-1990s (Kiddie, 2009).

Furthermore, this strict dress code is costlier to employees (Gutierrez & Freese, 1999). Besides the high-quality clothing that employees are expected to wear every day, proper maintenance such as dry cleaning is also another cost the employee has to bear. If an employee is not conducting an outside meeting or scheduled with a customer, it can be questioned why business professional attire is mandated. As stated earlier, Mark Cuban questions why a person has to wear a suit and tie in order to be successful. In alignment with this, it can be argued that an employee is more productive, happy, and creative when he/she wears clothes that are laxer than formal business attire (Goodman, 2016; Gutierrez & Freese, 1999).

Business Casual

In between the two extremes, a majority of employees play it “safe” by finding an option somewhere in the middle, or business casual. Shri and Nair (2009) define business casual as “dressing professionally, looking relaxed, neat and pulled together. A more pragmatic way of putting this would be that business casual dress is the mid ground between formal business clothes and street clothes” (p. 102). While a suit and tie may be too formal, open-toed shoes and tank tops may be too casual. Therefore, this category leans more toward the “conservative casual” type, and “looser business professional” type. Gragg (2004) does a nice job defining the business casual attire, which can consist of the following items:

- Nice jeans and a clean tee-shirt with no slogan
- Khakis and a company logo polo shirt
- Khakis and a nice polo shirt
- Khakis, oxford shirt, and blazer
- Dress pants and oxford shirt
- Dress pants and dressy shirt with a blazer, or a mid-calf skirt or dress for women with a blazer—unbuttoned on Friday’s

Many companies have adopted a business casual attire. However, it is not uncommon for employees to bring a suit jacket into work in case he/she needs to interact with a customer or attend an important meeting.

Arguments for Business Casual

As stated previously, this attire may be more appropriate and relevant if an employee does not have an outside meeting or is not scheduled with a customer. According to one study, people felt more productive in business casual clothes (Shri & Nair, 2009). Franz and Norton (2001) found in their study that performance outcomes were not negatively affected with business casual attire, and thus recommend to continue this dress code as long as employees desire it. A study based on a survey response showed that candidates enjoy wearing casual clothing at work as it makes them feel more comfortable, and can be viewed as an incentive to attract new employees (Gutierrez & Freese, 1999). Thomas Kiddie (2009) even noted that his decision to accept Bell Labs offer over IBM was the casual dress code. This middle ground attire is a “safe” call for employees, which still offers them some freedom. Business consultant Andrew Jensen notes that if the culture and office environment is already relaxed, then a more casual dress would not negatively impact the work ethic (Goodman, 2016).

Arguments Against Business Casual

Business casual can cause some confusion on the guidelines of what is acceptable to wear. Some employees may lean on the more conservative side of business casual, while others may take more advantage of the “casual” aspect, which engenders less conformity and more confusion. More specifically, Shri and Nair (2009) note that “business casual dress code has no generally-accepted definition; its interpretation differs widely among organizations and is often a cause of sartorial confusion among workers.”

Research also shows that there are gender differences in perception of business casual (Shri & Nair, 2009). Depending on what gender is in charge of regulating appropriate dress attire, this can be conflict-

ing. Rafaeli, Dutton, Harquail, & Mackie-Lewis (1997) conducted an in-depth interview with women to learn more about perceptions and efforts in choosing attire. The results demonstrate that many women dress to “be emotionally comfortable and confident in their current position” (Rafaeli et al., 1997; Sullivan, 1997, p. 91). Some women prefer to dress for the job they want, and business casual may be too casual for women who choose attire to help them achieve their organizational roles (Rafaeli et al., 1997).

Casual

The final dress category can be seen as the most relaxed and has the least amount of restrictions. Companies that allow a casual attire offer many options for the employee. Clothing can range from jeans, t-shirts, flip flops, and even tank tops to distressed jeans. The employee has much independence and authority in choosing what he/she wears to work. However, it can be difficult to clearly differentiate between the lines of business casual and casual. For instance, a conservative employee that dresses on the nicer side of the “casual” category and a person who dresses on the looser side of the “business casual” category can create a blur between the two attires. Therefore, it should be noted that there is a “gray space” between dress codes. Casual attire also tends to have more options in terms of the types of clothes to wear; therefore, it can be difficult to clearly establish what is and what is not acceptable in the workplace.

Arguments for Casual

Casual attire allows for many different options, offering employees more freedom to choose what to wear. Therefore, employees that have more options in choosing what to wear will help them be emotionally comfortable and confident in their job (Rafaeli et al., 1997; Sullivan, 1997). Employees should not feel uncomfortable or restricted in the clothes they choose to wear all day. Rather, their choice of clothing should allow them to feel comfortable and offer them more time to focus on work, and less on blistering heels or tight collared shirts. Companies have noted that casual dress even increases morale and productivity (Gardin, 1998; Gutierrez & Freese, 1999), and is considered an added employee benefit (Gutierrez & Freese, 1999). One of the most important benefits to casual attire is making the employees feel comfortable and happy. These two positive results can lead to an increase in productivity (Goodman, 2016). As seen in the prior examples of Mark Zuckerberg and Mark Cuban, it can be argued that what an employee wears does not define how successful he or she is going to be.

While specific roles may require the business professional attire, the Wall Street Journal makes an argument for the casual attire for many different business settings. The article points out that this new trend is not only for and about young people, but rather to showcase a unique and modern statement for the employees and potential customers (Binkley, 2008). Companies are gradually changing their dress codes, thus sending out an important message to employees and customers.

Arguments Against Casual

A concern for companies may be that “relaxed” clothing may mean “relaxed” employees, in that the urgency of getting the job done becomes nonexistent. A professor of Psychology at the University of Hertfordshire, Dr. Karen Pine, told Forbes that “when we put on an item of clothing it is common for the wearer to adopt the characteristics associated with that garment. A lot of clothing has symbolic meaning for us, whether it’s ‘professional work attire’ or ‘relaxing weekend wear,’ so when we put it on we

prime the brain to behave in a way consistent with that meaning” (Tulshyan, 2013). Similar with this notion is the blurred lines of professionalism in the workplace. In affecting employees’ performance and attitude, some argue that casual attire can lead to laziness and decrease in professionalism (Goodman, 2016). Companies are concerned that dressing casually will harm their professional image (Gutierrez & Freese, 1999). If a company frequently interacts with customers or clients, trust is also another important issue. Customers may be less trusting or cautious in a meeting with an employee who dresses casually. Therefore, the casual attire may negatively affect company performance in the client-oriented world.

Gardin (1998) notes four “taboos” that can occur when wearing too casual: short shorts, after-five attire, sheer blouses, and distressed jeans. She notes that it is not appropriate to wear the same clothes to work to “go out” in after work. She also argues that sheer blouses and distressed jeans can be distracting and make it difficult for coworkers to concentrate. The menu of various options can be overwhelming for women. More specifically, the emotional costs for women with relaxed dress codes “may lead to even greater stress for employees because they must learn new definitions of appropriate work attire” (Sullivan, 1997, p. 91).

Finally, besides the impression the attire will present to other coworkers, clients, or customers, employees may also face difficulty in understanding what is acceptable. As Gragg (2004) phrases it, everyone knew the “code” with business professional. It could even be argued that there is less room for confusion with business casual also. However, there is much more room for interpretation, and difficulty in understanding the “code” for casual attire. With the various and unlimited options, employees may feel overwhelmed and uncertain, thus increasing the stress level about work attire.

METHODOLOGY

This current chapter explores different dress policies via the business case study method. The intrinsic research method in this chapter does not aim on building theory or understanding a phenomenon, but rather provides insight into this topic. The selected business cases offer support for the three categories of work attire, and create a sound argument when ultimately making a recommendation to companies. Three companies were analyzed for this paper: American Eagle Outfitters, General Motors, and UBS. The author selected the following companies because they were significantly different from one another in regards to dress code policy, and each followed along with the three different spectrums discussed above. Each company has a unique or specific dress code, some vastly different from others. The goal is to provide information on companies with dress codes on a wide spectrum in order to offer a valid argument and recommendations. Information about each company will entail an overview of the business, how successful the company has been in the past, and its required (if so) dress code for the employees and its associated work attire category. Unless stated otherwise, information about each company has been retrieved from the company’s website. There are no hypotheses in this case study, but rather the author analyzes the different categories and makes a recommendation based on the research and presented companies.

BUSINESS CASES

Case 1: American Eagle

American Eagle Outfitters (AEO) is a retailer company that offers apparel to a variety of customers. Originally founded in 1977, AEO offers products to both men and women, ranging from teens to young adults. In addition, the company offers intimate products under the Aerie Brand. The company operates over 1,000 stores and ships to eighty-one countries through its online channel. AEO has its main headquarters located in Pittsburgh, Pennsylvania and its design and production office located in New York City, New York. For the purposes of this paper, it can be assumed that referring to AEO means both AE and Aerie sectors in the Corporate environment.

According to the work attire categories mentioned above, AEO falls under “casual” attire. Employees have significant freedom in their choice of attire. For instance, jeans, flip flops, tank tops, distressed jeans are all acceptable options. A casual attire can give employees more confidence and make them feel comfortable to be productive in the workforce. AEO’s website reiterates the importance of high morale and expression of individuality: “We believe that our associates are our most valuable assets and we want them to feel motivated and have the freedom to be themselves at work. We strive to be an employer of choice – a place where people are excited to come to work because they believe in what we do, enjoy working with each other, and have fun doing it” (American Eagle; Aerie: Who We Are). In addition, reviews for working at the company were positive from both Indeed and Glassdoor (American Eagle Outfitters: Pittsburgh, PA). Multiple reviews included the relaxed and casual atmosphere as a “pro” for working for the company (American Eagle Outfitters). AEO is just one example of a company that offers a casual attire for employees every day of the week.

Case 2: General Motors

General Motors, or GM is American multinational corporation. While the company has a vast array of services, it is most known for creating automobiles. The company’s goal has been aimed at advancing technology and transportation in order to bring the number of crashes, emissions, and congestion to a halt. GM is headquartered in Detroit, Michigan, where it employs almost 200,000 people. Innovation is at the heart of GM, and dress code is no exception. The company has evolved drastically with its attire policy for employees (Murphy, 2018). In prior years, GM held a strict and complex dress code policy that ran about ten pages long (Murphy, 2018). However, after bankruptcy hit the company in 2009, vice-president of global human resources at the time Mary Barra made drastic changes to the work attire expectations. From ten pages, Barra cut down the expectations to a two-word policy: “dress appropriately” (Murphy, 2018). Barra’s determination to improve morale and change the company culture resulted in her promotion to CEO in 2014. She gives much credit to the dress code as the “smallest biggest change” made at GM, which helped lead the company to a record sales year in 2014 (Feloni, 2015). Despite giving employees much freedom in expression, there were many different interpretations and much pushback from higher-level employees (Murphy, 2018).

According to the work attire categories, GM can be classified as a mix between business casual and casual. The company was once a business professional attire setting, but Barra’s changes allowed the employees to dress between the business casual and casual. It is not uncommon for employees to wear jeans to work, however, after some complaints by managers, it was decided that employees bring nicer

clothes to work in case of a meeting (Murphy, 2018). Therefore, employees may decide to lean towards a more casual style, and change when necessary.

Case 3: United Bank of Switzerland (UBS)

Union Bank of Switzerland, or UBS, is an investment banking company founded and based in Switzerland. This global firm provides financial services in over fifty countries, including the United States. In addition to private banking, UBS provides an array of services including wealth management, asset management, and investment banking for private, corporate, and institutional clients. Founded over one hundred fifty years ago, their strongest presence now lies in the United States. UBS's strategy is "focus[ed] on businesses that have strong competitive position in their targeted markets, are capital efficient and have an attractive long-term structural growth or profitability outlook." The company further credits its success to the talented and hard-working employees that comprise the company. Therefore, it is always important to keep morale high and create incentives for high-skilled prospective workers.

Similar to General Motors, UBS has seen some changes within the dress code. Originally forty-four pages long, the company's business attire is strictly business professional (Wachtel, 2011). As the company interacts with current and new clients every day, it is very important for the company to present a professional image. However, the forty-four-page document goes into much depth to outline detailed requirements, such as skin-colored underwear and how to smell nice (Wachtel, 2011). After much backlash and ridicule, the company decided to revise its dress code. The company revised to a more modest guide, compared to the detailed guide that told women how to apply make-up, men how to tie a tie, and reminded all to trim their toenails (Berton, 2010). Currently, the company does not have a formalized dress code for the staff, but rather leaves the decision to bankers' discretion as to what is appropriate ("Dress Code Draws Cool Reception", 2017).

DISCUSSION

After analyzing the companies above, it can be seen that there are various dress codes and policies enforced (or not) in the workforce. American Eagle Outfitters, General Motors, and UBS all offer unique dress codes, and some have altered it over time in order to stay relevant. While these companies lie on different ends of the spectrum, it is important to provide opposing views in order to make a sound argument. The recommendation in the following section is based on the above companies discussed and the prior research on employee attire in the workforce.

Recommendations

It is very difficult to recommend a "one-size-fits-all" approach. In fact, according to a study done on physician dress on patient perceptions, it was concluded that this "one-size-fits-all" approach is "improbable" (Petrilli, Mack, Petrilli, Hickner, Saint, & Chopra, 2015, p. 14). The study shows that there are many outlying factors, such as age, geography, and interaction, rather than just clothing, that impact patient trust, confidence, and perceptions (Petrilli et al., 2015). Likewise, with attire in the business setting, there are many additional factors that can impact morale, productivity, and performance. However, it is important to argue for guidelines that businesses can refer to when implementing, or considering

to change, new dress code policies. Overall, a more flexible dress code that offers the employee more freedom is recommended to all companies, but this chapter also keeps in mind certain situations.

First, it is important to establish if the company is customer-oriented, and if so, what message (i.e. appearance) the company wants to send to the customer. Attire can serve as a form of non-verbal communication, thus, it is vital to form good impressions. In alignment with impression formation theory, it is essential for client-focused companies to maintain a respectable and trustworthy reputation. While research has supported benefits to both the person and surrounding people of the person wearing professional attire, a too structured atmosphere can create an “impersonal” and “mechanic” experience (Barrick, Dustin, Giluk, Steward, Shaffer, & Swider, 2012). Therefore, it may not always be necessary to have business professional attire in the presence of customers, but it is important to keep in mind the drawbacks discussed earlier that can arise with a laxer appearance. If the company interacts frequently with customers or clients, it is advised that employees first match the customer’s attire or err on the more formal side when in doubt. Therefore, business casual to business professional would be advised in these situations of doubt. In alignment with role theory, an employee in a client-focused company can dress in a way that ties to the duties, expectations, and responsibilities of his/her current role. This more formal wear also is important in the face-to-face interview setting. If an interviewee has uncertainty on what is appropriate, it is recommended to err on the more formal side.

If the company is not customer-oriented, it is recommended to allow employees to express more freedom of individuality in their attire. As Millennials are gradually taking over the workforce, freedom in choice of attire will continue to have a strong presence. Therefore, employees can have the freedom to choose attire ranging from business casual to casual. According to prior research, there are numerous benefits to a more relaxed attire. In order to keep up with the competition in recruiting the best employees, companies need to adjust prior traditional habits and allow more freedom of expression to the employee. As seen in the provided examples above, companies have already started to focus on improving morale.

Second, unless the dress code is business professional, companies need to form clear guidelines that would eliminate any points of confusion for employees. For instance, a company with a casual attire policy could enforce no tank tops, skirts shorter than finger-length, or open-toed shoes. Whatever image the company wants to present, it is important to lay out a clear policy that addresses what is *not* permitted in the workforce. Instead of suggesting what is appropriate to wear to work, it is advised to allow the employee creativity and freedom, and only state what is not appropriate. By allowing an employee to dress creatively, it may cognitively help him/her to think more creatively as well (Slepian et. al, 2015). Although Barra’s goal was to allow employees the autonomy and responsibility to “dress appropriately,” that loose guideline may cause too much confusion and conflict as there are numerous interpretations of what would be considered acceptable. However, it is important to be mindful when creating guidelines, as an extensive and thorough review (i.e. 10 pages) can become a drawback.

Finally, it is advised that companies stick with the dress code for all days the employee works. For instance, it is not recommended to have business casual Monday through Thursday, and casual “jean day” on Friday, or “casual” summers. This can cause change in employee attitude, performance, and motivation in the workforce (Goodman, 2016; Sullivan, 1997). Businesses should be consistent and stick with one attire, and outlined in a policy if necessary. It is recommended that businesses create a change in the dress code policy that aligns with the culture, or vision of the culture, of each company. Drastic changes can cause significant shifts in employees and the environment.

FUTURE DIRECTION FOR RESEARCH

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As evident in the chapter, attire can be difficult to define. There are several variables that comprise an employee's attire. Opportunities for future research include analyzing work attire beyond the strict clothing and accessories of an employee. For instance, hair styling, makeup, tattoos, and so forth should all be considered for the overall "look" for the employee. Therefore, research on productivity, performance, motivation, and morale can all be better judged according to the whole "look" of the employee.

Next, there is opportunity to study how work attire impacts other variables. Future research, for instance, can expand into how casual dress can impact the hierarchy and managerial style in a business. Longitudinal studies or even comparison studies of different firms can be analyzed to determine differences that might originate from work attire. There must be constant awareness from a business perspective in what the current trend for employees is, and also what direction it will take in order for businesses to be successful and recruit the best candidates.

Managerial Implications

Each company identified in the chapter represents one-way employees adhere to proper work attire. It should be noted that not all dress codes in the workforce have been addressed. The research conducted by the author only provides a small framework for future research. Therefore, the small number of firms could be a limitation. However, the author believes that the companies represent varying options of attire, and that the recommendations could be transferrable to other industries, subject to further study.

Other implications include the blurred line between the work attire categorizations. It can be a challenge, and a matter of interpretation, to distinguish between "business casual" and "casual." This confusion between the categories can make it difficult to clearly define a company's attire, and more importantly, recommend what should be the appropriate attire. Furthermore, it is difficult to make a sound argument for a company without prior knowledge of the current business culture. For instance, if a company has a current traditional and stricter environment, changing the dress code to more casual may have a larger impact on performance compared to making that change to a company that has a current relaxed culture and environment. The author made recommendations based on the research and from an external look at each company.

Overall, the research provides insight into the transformation of attire in the workforce, and also offers direction of how companies can change in the future. It is possible that attire will continuously change in the workforce in the immediate and long-term future.

CONCLUSION

It is vital for companies to continuously evolve to meet employees' preferences and needs. In a fast-changing work environment, companies need to stay in tune with competition, the current trend, and preferences in order to recruit and retain the best employees. Work attire is one variable that different generations have seen evolve over the years. Companies need to first establish the "look" they want to convey to other employees, potential customers, and the public before deciding on an appropriate work attire. Second, companies should allow more freedom to their employees if possible. Flexibility in options for the employee and freedom in choice of attire can pose as a desirable quality for a company, especially to Millennials. Although there can be conflicting issues with any work attire policy, it is important to

establish important guidelines from beginning. An increased awareness into the work attire evolution and willingness to adapt is crucial for employee morale and success of a company.

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KEY TERMS AND DEFINITIONS

Attire: An outfit, look, or style that creates the visual appearance of a person.

Business Casual Attire: Attire that lies somewhere in the middle between business professional attire and casual attire. Many interpretations of this category exist. Outfits generally consist of a more comfortable and relaxed feel compared to business professional attire.

Business Professional Attire: Formal, conservative, and clean-cut attire that typically consists of suit jackets, ties, blazers. The material usually is, or appears as, good quality.

Casual Attire: Relaxed attire that can have multiple interpretations. The clothing usually consists of jeans, flip flops, and other relaxed items.

Customer-Oriented Company: A company that interacts with customers on a frequent basis.

Dress Code Policy: The guidelines, which can range in depth, a company provides for the employees on the appropriate, and sometimes not appropriate, attire in the workplace.

Work Attire: The clothing, jewelry, shoes, and any other accessories that create the style, dress, and overall look of an employee.

Is Psychological Contract Relevant in the Healthcare Sector?

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INTRODUCTION

Businesses in the present digitized millennium considers the skilled and competent knowledge workers along with their complex bundle of values as the assets of an organization and the main key to innovation and growth. Commitment, engagement, involvement and integrity of the employees are the values that lead an organization towards sustainability and progress by creating long-lasting relationships with external and internal stakeholders (Robert, G. E. et al., 2012). It is beyond doubt that, high customer experience and business value is achieved through well-trained, committed and competent employees, who are the ones coordinating between customers and organizational goals. It is crucial for any organization to maintain positive interpersonal relationships with the employees in order to achieve its ultimate goals (Patrick & Priscilla, 2019). Psychological contract explains the root of existence of contemporary employment relationships in modern workplaces (Maria Tomprou, 2011) leading to values of commitment, engagement and empowerment among the employees irrespective of the nature of job and industry. The dynamism in the business environment, depreciating labor market and organizational transitions has made it challenging to retain talented and productive employees in the fast-booming Healthcare sector.

Globally, healthcare sector is projected to grow at an annual rate of 4.1% in the period between 2017-2021, up from simply 1.3% in 2012-2016 (Economic Survey report, 2017-18). Robust growth mandates committed employees and effective talent management programs. This is where Psychological contract becomes an inevitable key to enabling organisations balance the increased expectations of healthcare professionals (doctors, nurses etc.) and maintain commitment and contributions as per organisational goals. The concept of psychological contract has captured the attention of researchers as a framework for understanding the employment relationship (Coyle-Shapiro, Jacqueline A-M. & Parzefall, M., 2008), managing mutual expectations, needs, commitment and reciprocal contributions as per organisational standards contributing to talent management and growth (Taylor & Tekleab, 2004).

India is expected to rank amongst the top three healthcare markets worldwide in terms of incremental growth by 2020 as per the SEPC report. According to a study by National Healthcare Retention and Registered Nurse Staffing Report, the average hospital turnover rate in 2017 was 18.2%, which is the highest recorded turnover in the industry for almost a decade (Wells, M., 2015). The rising turnover rate of employees in healthcare industry is possibly due to lack of work engagement, lower job security and personal safety of healthcare professionals, lack of training and professional development, less adoption of newer technologies, challenging work-life balance and high stress levels in the hospitals (Warrier, 2017).

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The high stress levels, challenges and accountability involved in the job roles mandates psychological contract to exist as a talent retention strategy. The healthcare professionals need to deal with patients who may be upset or scared, the doctors are often required to disclose tragic news to patients and their family members that leads to critical attacks on them. Safety, security and stress of the healthcare professionals is a major concern in an emerging country like India, raising constraints for doctors and nurses to perform their job better. Healthcare professionals do not often have a choice in their day-to-day lives and find it difficult to find social support from the hospital management. This impacts their psychological contract adversely leading to burnout, low commitment, poor behavioural outcomes and degrading healthcare services offered to the patients. Psychological contract describes the understandings, beliefs and commitments that exist between an employee and employer (Patrick, H., 2008). It is important to identify the determinants that affect the psychological contract of professionals in healthcare sector and to identify the reasons beyond it as well as consequences. The ultimate outcome is retention and undeterred employee performance.

Psychological contract involves informal assumptions and perceptions of the workplace relationships that exists between leader and worker (Chang, 2007). Although these contracts are rarely written down formally and explicitly, they have a powerful impact on employee motivation and performance leading to enduring commitment and reducing turnover intentions (Conway et al., 2011; Zhao et al., 2007). Relational contracts, a form of psychological contract have been found to deal with the maintenance of quality of emotional and social relationships between employer, employee and peers (Chang et al., 2013). Extant researches have revealed that psychological contract improves the relationship between employer and employee; leading to engagement, productivity and in some cases better workplace (Naidoo et al., 2019). As stated in Equity theory, the variable 'Fairness' is an important dimension of psychological contract, which leads to sustenance of healthy relational and transactional contracts, as employees need to perceive that they are being treated fairly in order to develop the feeling of commitment (Strong, E. V., 2003). Researches have revealed that there is often breach in psychological contract. It can be observed in weekly working life due to factors like excessive workload in combination with a lack of job resources to cope with these job demands (Bal, 2016).

This chapter deals with the concept of psychological contract, its antecedents, consequences and the relevance of psychological contract in healthcare sector. The main aim of this chapter is to highlight the importance of psychological contract in motivating and retaining healthcare professionals (doctors and nurses) and developing a secured work environment for them. The study throws limelight on the trends and status of the healthcare professionals in India. The intention is to communicate to healthcare management in India that a key strategy to prevent the growing rate of brain drain and encourage healthcare professionals to take up long-lasting career in this country is to retain them through the development of psychological contract.

BACKGROUND

Evolution of the Concept of Psychological Contract

Levinson et al. (1962) first introduced the psychological contract theory, which has continued to evolve, and has more significant practical implications in management and organisations presently. Psychological contract is the perception of a mutual agreement between two parties (Argyies, 1962; Levinson, 1962; Rousseau, 1998). According to Rousseau (1995), "the psychological contract consists of individual

beliefs regarding terms of an exchange agreement between individuals and their organization". Psychological contracts are individual beliefs in a reciprocal exchange of obligations between the individual and the organization. Restoration of the relationship can involve the re-establishment of stable patterns of interaction over time, often accompanied by active efforts at open communication (Rousseau, 1989). Psychological contract has drawn the attention of researchers to understand the relation between employer and employee (Coyle-Shapiro, Jacqueline A-M. & Parzefall, M., 2008). It is related to greater job satisfaction, productivity, and reduced turnover than other contracts (Kotter, 1973). Employees are more likely to stay in an organisation for a longer duration, if they are promised certain benefits by the employer in terms of both monetary and non-monetary forms (Ellershaw, 2014).

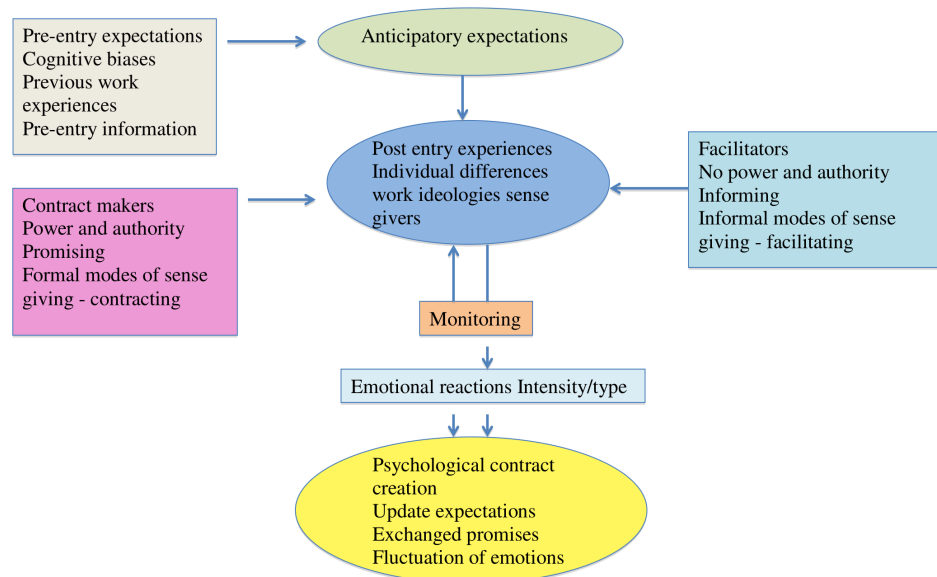
Employees with transactional contract recognize only financial benefits as their motivators and are less loyal and maintain short-term commitment. Individuals who perceive higher psychological contract breach will intend to show decrease in job satisfaction, organisation support, commitment and intention to stay with the organisation (Nichole, 2013). Researchers identified nine factors such as inclusive welfare, trust and commitment, transactional relationship, initiative, employee involvement, reciprocity, sense of belongingness, growth prospects, and work-pay continuum that determine the commitment of an employee through psychological contract (Bhattacharya, 2018). The inclusive welfare factor has been considered the most important which includes components like job security, skill development, rewards, performance appraisal, and growth opportunities. The healthcare professionals undergo high stress at workplace, which ultimately is not shared among the colleagues, possibly due to nature of their job roles involving individual accountability. Bal et al. (2013) asserted that stability in work engagement, turnover intention and employer obligations tends to be much stronger for high tenure employees than for their low tenure counterparts, and mainly determined through the degree of psychological contract built between the employee and management.

Psychological contract depends on various socio-demographic factors like marital status, designation, years of experience in total as well as in the current organization (Bhattacharya, et al., 2018). According to (Najjum et al., 2016) the transactional factors, relational factors and organizational support has an effect on healthcare professionals' level of commitment. In addition, poor pay and rewards, lack of support from the employer and poor work environment were noted as key factors that were likely to affect their commitment and hence adversely impacting the quality of healthcare service delivery. According to Vantilborgh (2016), employees perceiving high demands and low resources were the ones who were more likely to report that their organization is not fulfilling its obligations. Undeterred commitment of an employee, high engagement, behavioral outcomes like trust, integrity, bonding, and overall performance are the outcomes of psychological contract (Ballou, Nichole Simone, 2013).

Figure 1 illustrates a model of psychological contract. This model explains the psychological drivers and external drivers resulting in the process of building psychological contract. The anticipatory expectations of employees like pre-entry expectations, cognitive bias and previous work experiences influence the post-entry expectations, individual expectations and work ideologies, mediated by the influence of facilitators like contract makers, power and authority and promises leading to emotional reactions. This further leads to psychological contract creation, updated expectations, reciprocated exchange of promises and emotional fluctuations (Maria, 2011). This psychological process of relational and transactional contract building is complex and mediated by various external and internal variables.

The social exchange theory (Homans, 1958; Blau, 1964 and Gouldner, 1960) offers valuable insight into the foundational theoretical roots of psychological contract. Homans (1958) described in one of the primary theories of social behavior stated social behavior as 'exchange'. Social behavior often involves social exchanges, where people are motivated to attain some valued reward for which they must forfeit

Figure 1. A model of psychological contract
(Source: Maria, 2011)



something of value (cost). Individuals choose those alternatives from which they expect the maximum profit and value. Employees choose those alternative outcomes that promise better long-term outcomes, job security, and choose alternatives that promise the greatest financial gains for the least financial expenditures.

Visualization of Social Exchange Theory -

Exchange = Trade something of value (cost) for something needed/valued (reward)

Rewards – Costs = Positive Outcomes (profits) or Negative Outcomes (net loss)

Inequity = Cost > Reward or My Costs > Your Costs or My Rewards < Your Rewards

The Social exchange theory includes the factor- 'the Quality of work life', which when fulfilled can invariably increase morale and motivation among employees and lead to positive attitude towards jobs and the organization (Seyda, 2018).

Figure 2. Social exchange theory
Source: (Şeyda, 2018)

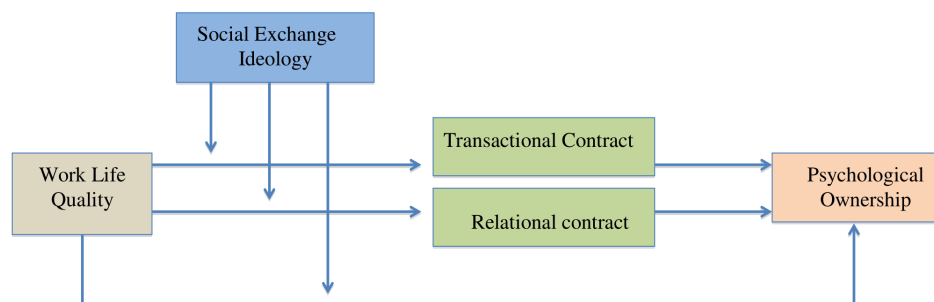
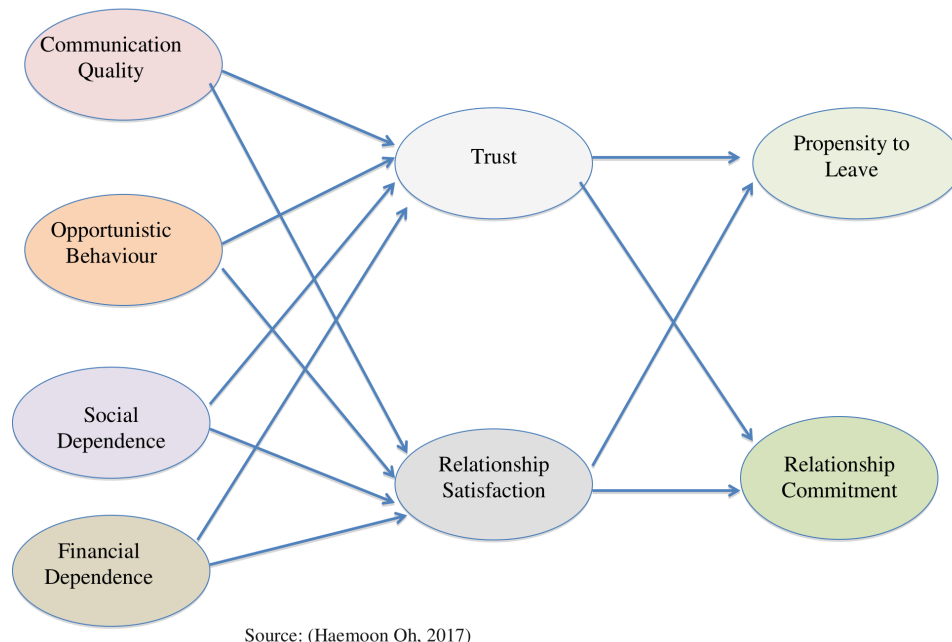


Figure 3. A Proposed model of social exchange theory and an extension
Source: (Haemoon Oh, 2017)



The study conducted by Haemoon (2017) claimed that satisfaction may be a more powerful explanatory variable than trust for non-economic, psycho-social dimensions of organisation relationships. This is related to the development of psychological contract. Thus, various researches have provided clear views on the concept of psychological contract (PC), its antecedents and causal factors as well as its outcomes.

Trends in Indian Healthcare Sector

In the current scenario, Healthcare sector is gaining rapid momentum due to growing demand for high quality healthcare services. Global health care expenditures are expected to continue rising and increase at an annual rate of 5.4 percent between 2017-2022, from USD \$7.724 trillion to USD \$10.059 trillion. Quality healthcare services require well-trained professionals comprising of nurses, doctors and administrative staff, who are committed and competent in their job roles beyond expectation. An aging workforce, rising demand for healthcare services, moral and well-being concerns are driving shortage of appropriately skilled healthcare staff in both developed and developing economies (Deloitte Global Health Care Outlook, 2019).

As per the recent Economic Times report, the long-term outlook of the healthcare sector is stable with annual revenues projected to grow at 12-14 per cent over the next five years. Despite having 5 million professionals employed in the healthcare sector in India, it continues to have scarcity of skilled workforce with figures being below those of Sri Lanka, China, Thailand, UK and Brazil, according to a World Health Organisation database. This data has placed the country into the status of 'critical shortage of health-care providers'. Bihar, Jharkhand, Uttar Pradesh and Rajasthan are the worst hit while Delhi, Kerala, Punjab and Gujarat compare favourably (Bindu, The Hindu, 2019). India plans to

establish 200 new medical colleges in the next 10 years to meet the projected huge shortage of 6 lakh doctors (Madhav, 2013).

The Indian Healthcare sector has become largest sector in terms of revenue and employment. Indian Hospital Industry stood at US\$ 61.79 billion during the FY2017 and is expected to reach US\$ 132.84 billion by 2022. But India spends 1.02% of gross domestic product (GDP) on public health care, lower than most low-income countries, which spend 1.4% of their GDP on health care. Indian healthcare sector has established number of multispecialty hospitals and healthcare groups and the Indian government have focused on providing better facilities. Indian Government has shown a great interest in the development of telemedicine and started investing in this segment to provide better healthcare facilities in rural India. Medical tourism from the Sub-Saharan countries is expected to grow by nearly 20% in the future (Economic Times, 2019). Indian public health care is under-financed, short-staffed, particularly rural areas are poorly affected. According to a study conducted by a private body, India will need to invest a minimum of Rs 8 lakh crore over the next 20 years to establish two million new patient beds in the healthcare organisations. These Health care organizations are supposed to plan for the future by undertaking comprehensive workforce planning, establishing a robust talent pipeline and focusing on retaining their current employees. India is expected to face an acute skill gap of 12.7 million in the field of health care by 2022 if sufficient measures are not taken up to tackle the challenge of talent management and retention.

There is a skill gap among healthcare professionals such as the inadequate ability to adhere to standard hospital procedures, inadequate ability to think differently and the tendency to have a limited thought process, inadequate communications skills, less knowledge of basic languages needed to communicate with multiple set of patients. There is shortage of medical technologists, surgical and intervention technology connected health professionals, medicine connected employees, medical laboratory professionals and radiography (Manju Chhugani, Economic Times, 2015). India's ratio of 0.7 doctors and 1.5 nurses per 1,000 people is dramatically lower than the World Health Organisation's (WHO) global average of 2.5 doctors and nurses per 1,000 people. Estimates suggest that our country needs an additional 1.54 million doctors and over 2.4 million nurses today to match the global average. There are 70% of complaints due to medical negligence and wrong treatment against private hospitals and government hospitals (Durgesh, Times of India, 2017). The key problem is lack of clear communication about this skill gap and lack of staffs in the hospitals.

Estimates state that a premier public institution like AIIMS spends over one crore rupees to train a single doctor. Firstly, in India there is need to improve salary structures for public health staff, which further enhances staff retention and make the public healthcare system more attractive to professionals. Secondly, the government must work towards expanding the number of seats available for healthcare professionals across the board. Thirdly, a mismatch between skill availability needs has to be adequately addressed. Developing healthcare human resources for India would need an active and seamless coordination for resource planning, course development, skilling, training, employment, emoluments and compensations (Karan Thakur, 2017). Thus, in such a scenario focus on psychological contract development emerges as significant HR strategy facilitating building up of a committed, satisfied and skilled workforce.

How Does a Psychological Contract Impact Behavioural Outcome?

The organisation's care and value for employees positively influences their job-related outcomes and behaviours. There is a growing need to identify to what extent employers are concerned about the employees, in order to meet expectations and ensure procedural justice in the administration of rewards in an era of

labour shortage, growing demographic dividend and the role of employee share ownership in retaining key employees (Flood, 2001). This would allow investigation of the impact of different socialization processes and employer strategies on the psychological contract to be studied in-depth. Employers can earn the trust of their employees and employees will be less likely to perceive a contract breach in the first place and more likely to retain their trust despite possible changes or breaches in the employment agreement (Robinson, 1996). Psychological contract violations are likely to have a pervasive negative impact on employee attitudes and behaviours, including increased neglect of in-role job duties, reduced willingness to engage in voluntary behaviours supportive of the organization, and increased attempts to leave the organization altogether (William, 2000).

The psychological contract also influences the employees with positive outcomes, which will result in desirable behaviour at the workplace. Employees with high initial trust in their employers may have overlooked or forgotten actual breaches by their employer, whereas employees with low initial trust may have actively searched for or remembered incidents of breach, even when no actual breach occurred (Robinson, 1996). Psychological contract fulfillment results in increased employee performance both in terms of in-role and citizenship behaviour (Turnley, 2003). An effective measure to improve quality of service and productivity of human capital mandates a strong psychological contract fulfilment policy as such efforts can motivate employees to arrive at work early, be productive to meet expected production levels, use time effectively, encourage voluntary contributions at work, as well as work to meet deadlines (Jones, L. A. & Mildred F. K., 2017). Training effectiveness designed to improve skill deficiencies in psychological contract fulfilment, behaviour modelling, and the development of skills and abilities, competence in collecting information related to employers' interests, skills, and personalities is critical for the effective application of Psychological contract fulfilment (Noe et al., 2014).

Research Objectives

To be a successful in healthcare sector it's important to be the best in providing healthcare facilities to the patients in the hospital by sourcing and retaining competent healthcare professionals. In order to source and manage best healthcare talent, it is necessary to meet the expectations and needs of the professionals, besides gaining their trust, loyalty and dedication. The current study believes that there is a major gap and this issue could be addressed by understanding the psychological contract among the healthcare professionals. The aim of the paper is to identify the antecedent variables that determine psychological contract amongst Healthcare professionals, leading to their undeterred commitment and performance. This study would also help to determine the significant influence of socio-demographic factors, psychological factors and organizational factors on the psychological contract of doctors and nurses and highlights the significant influence of psychological contract on their behavioral outcomes and healthcare service quality. This chapter intends to answer the question whether psychological factor is useful in healthcare sector and can be practically applied to tackle the challenge of skill gap, attrition and brain drain.

METHODOLOGY AND DISCUSSION

Human Resource (HR) experts, doctors and senior nurses from four Private Hospitals located in Bangalore were interviewed for the study. A qualitative analysis was adopted using Case based approach and content analysis design approach to analyze and provide better insights into psychological contract in the

health care sector. Primary data was recorded from focus group interviews of senior Human Resource (HR) professionals of healthcare organizations and senior doctors. Purposive sampling technique was considered for the study. Experts were identified based on experience and position in the Healthcare organization for the study as they offer an effective way to gather perspectives on psychological contract. The interviews were semi-structured in nature using the telephone as well as face-to-face. These methods help to disclose the experiences of psychological contract between employer and employees.

Table 1 presents the information of four cases of private healthcare organizations in Bangalore along with their profiles and participants details. These hospitals were identified based on the following criteria – registered hospital; having a prominent brand, logo and established in the market; active in social media with the registered website. These companies are well recognized in terms of implementing various strategies of psychological contract fulfillment, employee motivation and received appreciations at the national and international level. The data was collected from three HR managers using a semi-structured interview method (two face-to-face and one telephonic interview). The respondent details and company details are anonymized.

The participants were interviewed for 30 minutes in various aspects. Interview procedure initiated with the collection of the archival documents of the hospital activities and relevance of psychological contract. Based on the information gathered from both internal and external sources, sets of open-ended questions were framed to interview the participants. They were interviewed on various aspects of psychological contract – personal opinion about the idea of psychological contract (expectations of both employer and employees) at the workplace and the perceptions about factors determining psychological contract. The interview and discussion were carried out in English.

Figure 4 depicts the overall data gathering and a collection procedure for the study from four Healthcare sectors. The study adopted content analysis technique for qualitative analysis of the data collected through interviews (Berg, 2001). It started with reading and understanding the entire interview descriptions and narrations. Secondly, the study examined the data to identify the patterns and similarities within the data. Later, researchers refined and combined the common themes and were thematically mapped and grouped for conceptual consistency. From the previous literature works, comparisons were made between academic and practitioner approaches on psychological contract to develop a holistic framework.

The archival documents and other information sources clearly stated that the four hospitals have fully accepted the idea of psychological contract. All of them have adopted different approaches to psychological contract fulfillment and meet the expectations of employees. The Human Resources (HR) staff of private hospitals believe that understanding the expectations of doctors and nurses will definitely benefit and yield better outcomes. One HR manager stated that providing career growth opportunities enhances desirable behavior at the workplace. Another hospital stated that providing better equipment and skilled doctors and nurses would help them to be more effective at the treatment of patients. Most believe that behavioral outcomes are positive with quality customer/patient service, when they focus on achieving higher psychological contract among healthcare professionals through better work environment, skill enhancement through training and other HR benefits. The study identifies which factors are common and consistent in making the psychological contract relevant and successful in healthcare sector, various factors involved is vital and exhibits different levels of success in the process. The analysis of interview responses reveals the factors that build psychological contract and yield employee behavioral outcomes.

The four key variables of psychological contract that emerged through the analysis of collected data are as follows – a) Reciprocates, b) Career growth, c) Employee welfare and security, d) Trust and commitment.

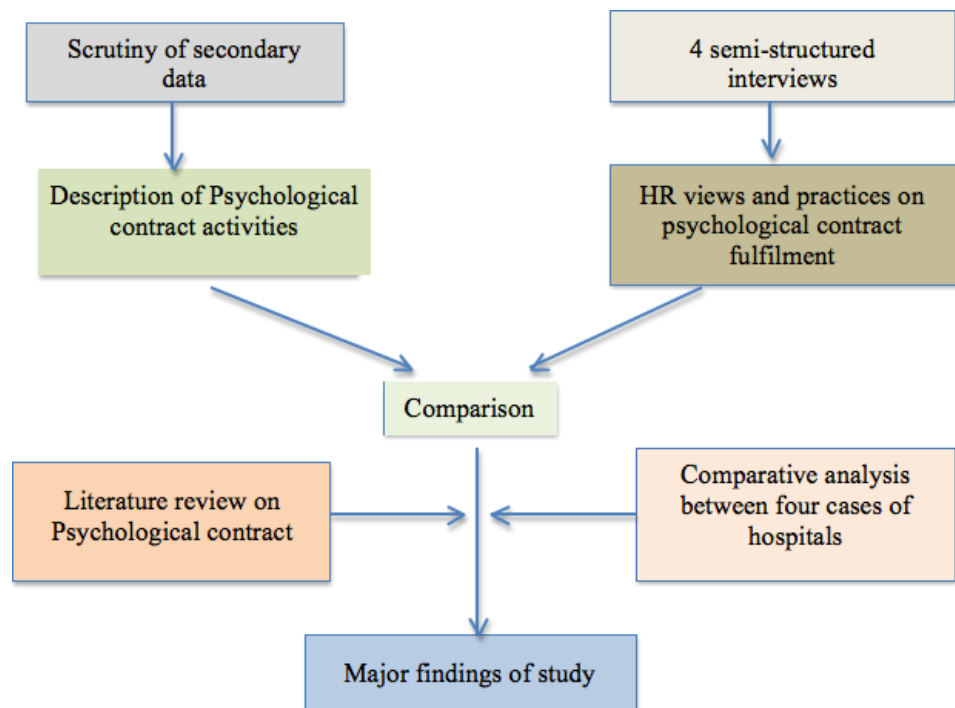
Table 1. Profile of the company, participants and interview type

Code	Profile	Participant proof	Interview type
Hospital A	Ownership: Private Limited Established: 2016 Corporate office /Headquarter: Bangalore Total employees: 26000 Area served: National	Designation: HR Experience: 6 Years Location: Bangalore	Face to face
Hospital B	Ownership: International private healthcare company Established: 1996 Headquarter: Kuala Lumpur, Malaysia Revenue: \$2 million Total employees: 120098 Area served: Global	Designation: HR Experience: 8 Years Location: Bangalore	Face to face
Hospital C	Ownership: Corporate Established: 1983 Headquarter: Chennai Revenue: 2,332 million Total employees: 81798 No of hospitals: 70 Area served: Global	Designation: HR Experience: 11 Years Location: Bangalore	Face to face
Hospital D	Ownership: Trust, Healthcare Headquarter: Bangalore Total employees: 23000 Area served: National	Designation: HR Experience: 11 Years Location: Bangalore	Face to face

Source: Compiled by authors from website of respective hospitals and personal interview with each respondent.

Figure 4. Data collection and analysis process

Note – Revised from “Biswan & Suar, (2018)” for the study



ANTECEDENTS OF PSYCHOLOGICAL CONTRACT

Reciprocates: Psychological contract is an unwritten agreement encompassing beliefs and expectations between the employer and employee. The employers reciprocate the needs of its employees. It makes healthcare professionals to be loyal at the workplace, as the doctors and nurses work hard and make sacrifices in daily life.

Employer has to understand the expectations of the employees and reciprocate to it. Same would be reciprocated through loyalty, commitment, trust and undeterred performance.

We provide induction program to new comers. Try to understand the expectations of employees and provide regular training and support (Manager of hospital A).

We know the importance of monetary benefits based on performance, performance-based promotions, intimation of benefits as per the eligibility, enroll for benefits as per the eligibility which ultimately satisfy the employees and implement the same (Manager of hospital B & D).

Healthcare professional's engagement is about managing relationships between doctors, nurses, administrative staff and more importantly patients in an efficient and effective manner. The better the relationship between each one of them, more satisfying is the experience for each healthcare staff and hence higher the engagement levels (Manager of hospital C).

The psychological contract variables of autonomy (delegation of power, accountability and authority), involvement (engagement), and clarity of organizational goals influence job satisfaction indirectly through psychological contract breach; performance feedback directly and indirectly, through psychological contract breach and affects job satisfaction (Hartmann, 2015).

Employee Welfare and Security: Psychological contract fulfilment for higher productivity should pay focussed attention to the provision of job security, safety at workplace, good benefits and incentive packages, and provision of identity and worth for employees in the healthcare sector. Such measures will ultimately develop and sustain the efforts and contributions of employees (Lewis, 2017).

We provide fair compensation, equal opportunity, a safe and healthy workplace specially to deal with patient's aggressive behaviour and other monetary and non-monetary commitments to adhere to human rights policies. This invariably reflects our belief that the success of this hospital is directly linked with employee satisfaction and well-being (Manager of hospital A, B).

Employees are provided with welfare facilities which included healthcare insurance, pension plans, performance bonus, maternity and paternity leaves, vacations and Paid time off, sick leave, salary and benefits. Various initiatives are been taken by the hospital management to ensure work life balance is maintained by the Doctors and nurses. We have a good doctor: nurse: patient ratio and ample human resources to tackle emergency situations and avoid work overload and employee stress (Manager of hospital D).

As part of the employee welfare program, 98% of our employees are administered through an Annual Health Check. This is believed to develop higher commitment and ownership among the employees as a reciprocate behavior to the welfare policies" (Manager of hospital C).

Career Growth: Psychological contract is believed to be the result of well-crafted HR policies of career growth and development. Better opportunities to grow and develop in one's career provided in the organization, provides motivation to the employee to keep contributing with higher commitment and loyalty.

It is imperative for every employee to go through relevant growth and development interventions to broaden their skills and competencies and to help them progress further in their career (Manager of hospital A).

Management conducts monthly and yearly tracker of all internal and external training programs. On the job training is conducted to ensure that employees perform their job safely and efficiently in their respective work environments. Competency mapping is done and anybody (Doctor, nurse, lab managers or administrative staffs) are not allowed to take up specific job roles till they achieve the required competencies (Manager of hospital B).

Skill development and learning, career growth and opportunity, challenging and interesting work and organising new activities that expose professionals to diverse competency enhancement platforms is focused to lead to employee motivation, trust, ownership and commitment (Manager of hospital C).

Our nurse's focus on patient safety and the prevention of any harm to patients, platform to learn new skills in nursing field such as about new equipment, new technologies in medical health are provided (Manager of hospital D).

Providing better career growth and welfare facilities definitely adds competitive edge to healthcare professionals and boosts their confidence in order to provide quality services to patients and to be dedicated. This eventually leads to psychological contract fulfilment on either sides.

Consequences of Psychological Contract

Employer contract fulfilment features an important result on employees' perceived support, commitment and organisation citizenship behaviour. Employees tend to balance the relationship between the variables through reducing their commitment and their willingness to engage in organizational citizenship behaviour when they perceive their employer as not having fulfilled its part in the exchange process (Coyle, 2000).

Trust and Commitment: According to researches, majority of healthcare professionals look forward to improve the quality of work assigned, but few indicated that they can easily leave the hospital, if they get another opportunity elsewhere (Najjuma, 2016).

The aim of the hospital is to grow in a transparent and accountable manner, which develops trust and commitment among employees. (Manager of hospital A).

Engaging with our key professionals and materiality process helps us in deciding on issues to focus, in order to mainstream sustainability into our decision-making (Manager of hospital B).

As we are continuously conducting satisfaction surveys, grievance redressal, open forums, various committees, which understand the employee's expectations and meet them, we expect the values of trust

and ownership to be integrated within our organizational culture and behavior of our skilled healthcare professionals (Manager of hospital C).

Healthcare professionals are committed towards hospital management and constitute very efficient team players with growth orientation by fixing self driven targets (Manager of hospital D).

We provide job security, safe work environment for the doctors and nurses in our hospital, thereby facilitating in the development of long-lasting loyalty and commitment (Manager of hospital A, B, C, and D).

Providing safe and secured working environment fulfills the safety needs of employees as per Maslow's Need Hierarchy theory (Maslow, A., 1943) and would allow the doctors and nurses to work in focused manner.

FUTURE RESEARCH DIRECTIONS

The study has strong practical implications in strengthening the relationships by identifying the factors of psychological contract. The study creates an awareness among the management in healthcare sector to provide more time and scope in order to help professionals to handle the stress at workplace by providing supportive network and clear understanding of employer and employee expectations enabling psychological contract fulfilment. This study states that care and value for the healthcare professionals will positively influence job related outcomes and behaviours. Healthcare sector are using different ways to develop the psychological contract of its skilled professionals through practices and techniques for differentiating themselves from the competitors in terms of satisfying the needs of professionals, providing safe working environment, better rewards, resources at workplace and effective HR policies (Fasolo, 1995; Wayne et al., 1994, 1997). It has strong practical implications in terms of developing commitment, loyalty, trust, dedication towards high quality service to patients, positive behavioral outcomes, job satisfaction, motivation and better performance. Doctors and nurses who develop the values of ownership and commitment are most valuable assets of any hospital.

But the question here is to understand to what extent does the employer safeguard the needs and expectations of its doctors and nurses, provide best in the industry compensation, suitable equipment and resources and manage scarcity of human resources through training and caring for skilled workforce. This is among the few studies exploring potential employee behavioural outcomes due to various psychological contract variables (reciprocates, career growth, employee welfare, trust and commitment) of healthcare professionals. According to (Vantilborgh, 2016) employer should react quickly to prevent negative affect from causing psychological contract breach perceptions, by investing in job resources to stimulate positive affect. This is done by a successful long-term strategy to build enduring personal resources that prevent psychological contract breach perceptions.

Future research should try to capture employees Psychological contract levels and their behavioral reactions following a Psychological contract breach as a causal source, and employees' contributions and expected reactions when a Psychological contract breach is perceived (Griep, 2018). A detailed investigation supported by empirical evidence about the level/degree of psychological contract and breach caused due to various factors may provide better information and this can also be considered under future research.

CONCLUSION

From the qualitative interviews, it has been observed that HR departments association is responsible within the hospital. In-depth understanding can be done by conducting empirical research and involving doctors and nurses in the surveys, which may give strong support to the argument. This study has made an attempt to understand the view of HR managers about the term psychological contract and its relevance in the healthcare sector. The observed characteristics of psychological contract have been described. HR managers believe that psychological contract is a process of understanding the expectation of both the parties in the healthcare industry for better understanding and smooth working.

During the process, employees try to build a psychological contract with the employer based on reciprocates, career growth opportunity, employee welfare, trust, commitment, safety and security features of the psychological contract (Katou, A.A., 2013). The psychological contract fulfillment will help the healthcare professionals to be motivated and maintain accentuated work engagement. There is a need to understand implied expectations of the professionals in healthcare, which leads to job outcomes such as job performance, work behaviour and job security. Psychological contract discharge is likely to originate from successful practices like fulfilling the expectations of employees, providing training and learning activities, trust employees, flexi-working hours, career advancement, safety at work which is requested by the healthcare professional in order to work peacefully. It will reduce turnover, increase the level of satisfaction and commitment. According to (Mensah, 2018) employer should attempt to understand and discharge the expectations of talented employees so that employees can reciprocate with positive outcomes. Finally, the study would like to set a path for more research in association with psychological contract fulfilment and strategies for better understanding the variables of psychological contract among healthcare professionals.

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KEY TERMS AND DEFINITIONS

Psychological Contract: The psychological contract is the unwritten set of expectations of both employee and employer at the time of employment contract.

Psychological Contract Breach: Psychological contract breach arises when employer fails to meet the expectations of employees.

Psychological Contract Fulfilment: Psychological contract fulfilment is created when the employer keeps the promises of employees.

Organisational Citizenship Behaviour: Organizational citizenship behaviour deals with positive and desirable behaviour of employees that benefit the team and encourage greater organizational functioning and efficiency.

Reciprocates: Reciprocates means both the parties' employer and employee enter into agreements mutually, making the obligation of one party corresponding to the obligation of the other.

Relational Contract: Relational contract the contract that gets affected based on relationship of trust between both the parties (i.e., employer and employee).

Transactional Contract: Transactional contracts focus more on explicit elements in which employees are less career oriented, lack of trust in employer and greater resistance to change.

Imbibing Organizational Health Practices With Ambidextrous Approach as a Solution to Higher Education Institution Staff Turnover Predicaments

15

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INTRODUCTION

In the era of globalization and internationalization, high education institutions (HEIs) have been challenged to cope up with high competition whose labor market and determinants require severe strategic and transformational plans. And this can be done by opening up borders to both national and international levels with an intention of attracting skilled human resources who can ably help these institutions provide solutions to humanity in general. To stay competitive and sound, fundamental strategic business plan must be laid to enhance excellent academic achievement coupled with performance by both staff and students (Zakuan, Yusof, Saman, & Shaharoun, 2010). To achieve these strategies, managers of these institutions are required to imbibe organizational health practices using both ambidextrous and sine qua non approach since these are the only ways through which attraction of highly qualified staff can be achieved while reducing staff turnover. The issue of organizational health practices is taken as a cornerstone for acquisition of quality services and products in an organization. World over, institutions that have so far realized what the forces of demand dictate in the academic arena have opted to imbibe these forces and gain competitive advantage through highly qualified staff to help them attain high and extra ordinary levels of performance at the same time providing needed human resources to the world market. This is done to ensure that HEIs from faculty level change their operational mechanisms so as to remain compatible with the changing market scope. For HEIs, to survive in the era of volatility, there is need to ensure that elements related to task contingency, intellectual stature development and favorable working conditions of both talented and highly skilled staff and take care of since they are bedrock and cornerstone for institutional survival and failure to use both the left and right hand approaches for an institution's survival may be in jeopardy (Douglas & Selin, 2012). By adopting strategies that address the global concerns, leaders of HEIs must be aware that the forces that lead to turbulence within these institutions are mostly shaped by political, social, religious and economic hegemony of super powers whose sole aim is to control the spectrum of human development and behavior (Douglas & Selin, 2012; Frontiera, 2010; Meyer, Bushney, & Ukpere, 2011; Miiro, 2016b; Miiro & Otham, 2016). Even though universities are re-structuring their ways of operation and infusing the global changes into their culture and policies, a lot is still desired in terms of imbibing organisational health practices so as to recruit and retain highly qualified who must in turn, attract a big number of students with high levels of performance both at national and international levels. It is therefore imperative to note, that imbibing organisational

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health practices in HEIs operations is not only a necessity but it is a way through which rebranding of institutional approaches towards staff welfare can be realized. Conversely, leaders must take care of organisational health practices by using both the right and left hand approaches without its due diligence employees cannot survive longer in an institution.

Moreover, this challenge of not being swift with new demands of time towards staff employment can be attributed to the traditional manner through which many of the university employees in influential positions have remained rigid while forgetting the dictates of the time (Meyer et al., 2011). Thus the purpose of this paper is to expose the readers to ways through which organizational health (OH) and how its nine (9) dimensions can be imbibed in HEIs to curtail the staff turnover predicament.

BACKGROUND

Staff Turnover

Staff turnover has of recent turned into cancerous especially in HEIs. Moreover, it is unhealthy due to unpleasant effects that normally affect the usual operation of an organisation. This is experienced through loss of talented staff who are normally envisaged as would be future leaders. It curtails the smooth growth and customer trust whenever it happens in a work place. For staff to leave an institution, is a natural behavior and it may sound nice while in the actual sense it affects the corporate image of an institution.

Turnover can be termed as staff mobility around the labour knowledge market. Today, many professionals from the academic arena are moving from one university to another at both national and international levels due to several reasons. This kind of gesture, poses a lot of challenge to HEIs' sector due to the fact that there is an increased number of people with diverse background that want to join this sector with several purposes that relate to growth, exposure, creativity and live not only usefully but also reflectively and responsibly.

In the face of HEIs, challenges of staff moonlighting, loss of highly qualified staff to private sector have been experienced because of qualified personnel looking for higher pay and better conditions of working. Moreover, there are also different factors that push and pull individuals to different working places. In a study conducted by Owence, Pinagase, & Mercy (2014), it was found that poor systems, presence or absence of good team, innovative culture, poor leadership, excessive workload, poor career opportunities, burnout, frustration and disillusion and better pay lead to staff turnover in South African HEIs. Also in a quantitative study done on 4651 employees by Erasmus, Grobler, & Plessis (2015), it was established that employees with low performance levels had resigned. However, the same study recommended that organisational citizenship, leadership style, supervision, organisational climate and compensation should be given due attention so as to influence staff stability. In a study conducted by Figueroa, (2018), it was realized that Biological characteristics (ex. age, education), prior experiences, human resource roles, structural features and staff expectations plus self-development were the factors for staff turnover. Meanwhile, Musah & Nkuah, (2013) found out that the lack of motivation in Ghana HEIs which is also a key element of OH was the influential factor for staff turnover. Conversely, in a study done in Tanzania by Demetria & Mkulu, (2018), it was opined that staff mobility was due to low remuneration, leadership style, lack of proper job description, security and poor mechanism of staff development. Moreover, a study conducted in Uganda by Ddungu, (2014) found out that low professionalism and empowerment levels were the causative factors for staff attrition in HEIs.

Basing on the issue raised above pertaining to staff turn over, it can be observed worldwide HEIs face serious challenges of staff turnover. Moreover, the causative factors seem to be the same though their magnitude differ from location and level of different of development. But all the situations can be taken as being unhealthy for the employees, the customers and the institutions themselves. For this matter, this paper unpacks the model of OH as an ingenuity that requires both ambidextrous and sine qua none approaches to curtail staff turnover predicament.

OVER VIEW OF ORGANIZATIONAL HEALTH

Organizational health is a management aspect that has of recent attracted several studies and research. Through these efforts, many researchers have provided different meaning to the concept. For instance it is derived from occupational health. Organizational health can be termed as the ability of an organization to align its strategy, culture and a clear vision with an aim of providing quality services and excellent products to outcompete other organizations on the world market (De Smet, Schaninger, & Smith, 2014; Franciska & Welly, 2013). The amalgamation of these key aspects of key elements of organisational health should rhyme with the financial input and employ performance. It implies that when institutional leadership commit themselves to attracting staff input beyond performance, they are likely to attain staff commitment, willingness to perform beyond supervision, citizenship and the gaps of losing staff will be closed (Yücel, Doğanalp, & Kaya, 2013).

Also for HEIs to attain a competitive advantage, they must be ready to keep their staff with necessary skills to accept the changing demands while putting into consideration issues of acceptance to change which leads to innovative ideas and strategies (Hussein, Mohamad, Noordin, & Amir, 2014). The essence of organisational health is to ensure that priorities are stated and geared towards achievement of institutional goals. Scholars argue that to achieve higher levels of performance, key performance indicators must be set in line with employ satisfaction to avoid absenteeism while targeting high levels of productivity coupled with cultural practices, collegiality and emotional factors.

Moreover, in Uganda HEIs staff seem to hold institutions at ransom to the extent of showing that they have the carte blanche to determine policies and if not supported, they can turn against any leaders of the institution. Meanwhile the paper unpacks the nine elements of organisational health elements as enshrined in the findings of Keller and Price, (2010) as mechanisms for addressing staff turnover if imbibed in HEIs sector using ambidextrous and sine qua non approaches.

Leadership

Leadership is the pivot and steering of institutional activities in that when an institution suffers from challenge a leader can see opportunities where others reach deadlocks for him he finds solutions. It is one of the key aspects of institutional management that should not be given to any one without through scrutiny and revision of one's history. World over many institutions have suffered from myopic and egocentric tendencies due to leadership. It is therefore imperative that supervisors of institutional affairs take key note and self-sacrifice on who should be at the helm of all decision. Especially in Africa many higher institutions are still lagging behind due to leadership vacuums. Whoever reaches at PhD level or professorship thinks that he or she is a leader without examining himself or herself of what he or she is capable of. Since leadership plays an important role towards organisational health, it should be given due diligence and respect for future prosperity of institutional agendas, mission and vision.

A leader should be able to listen, prepare himself or herself before meeting others, be ready to listen and avoid saying “No” all the time without listening to others. A leader should be ready for advice and at the same time set committees for think tanks. Unnecessary talks and jokes should be avoided since some of the followers learn a lot from their leaders. A leader should be a servant who moves extra mile to understand how business move within an organization and at the same time take note of the reports generated with firm actions and strategies that can lead to change institutional cooperate image. Leaders should stop sitting in offices every now and then without reaching the ground and inspect how things are done and what challenges are faced by change agents and hustlers.

It is therefore important to note that knowing leadership is not enough. It also requires imbibing strategic leadership styles with positivity so as to harness talents and sustainable leadership practices. When this practice is done well, staff will be willing to learn and exchange ideas that lead to innovative strategies and change with all their efforts. However, when leaders differ or divert from the common goals, their followers and members of the institution normally reduce their efforts towards supporting them. Accordingly, respecting them and ensuring that the integrity of the institution is protected should always remain at heart. It is a shame for the workers of an institution to embark on their leadership and while forgetting that whatever they say or write puts the corporate image of an institution at risk. Therefore, to curb this kind of practice and attitude, leadership should put in place avenues that help staff to develop their skills and knowledge in order to come up with innovative ideas. The gesture of increased staff development and skills enhancement among employees should be supported with all intuitional structures and systems knowing that without it, staff support towards administration will remain a myth and hence killing the spirit of innovation and learning

Innovation and Learning

Innovation and learning is done by accepting diverse ideas and strategies that emanate from different units and levels of staff with an aim of moving an organization to higher horizon. To achieve this aspect of OH, there should be proper ways of facilitating staff to engage them in research and publication that leads to new knowledge and ideas that can help the future generation attain fabulous living (Yücel, Doğanalp, & Kaya, 2013). Through innovation and learning there will be willingness to accept diversity and at the same time unlearn old habits that do not suit the current and new generations to come. Being able to adjust and act accordingly to new trends with an open mind ready to learn from newness and then be ready to move and think in novel ways, is a sine qua non gesture that helps an institution and its staff reposition themselves on the world market (Miir, 2016b). To achieve these practices, it needs an ambidextrous approach that enables staff to come up with ways that lead to institutional economic development and resumption of which in the end may lead to provision of solutions to challenges of the community hence leading to consultancy services. Without moving in this direction, HEIs will continue to displace themselves and fail to cope up with customer needs and at the same time remain passing over irrelevant information that does not lead to skills development and provision of solutions to human challenges. Innovation should be categorized into technology, services, products and these activities should be coupled with entrepreneurship skills that help learners to come up with ideas and insights that lead to both self and community development. Findings from a study conducted by (Jafarzadeh, 2015) revealed that acquisition of knowledge, information distribution and interpretation coupled with strong memories are the key segments that drive both the conscious and unconscious trends of organisational change. It means that for such elements to be achieved, organizations will require a conducive culture

and climate as modes of the work place. Thus, culture and climate should be good and sound enough to attract and retain staff of higher qualifications.

Culture and Climate

Culture can be defined as the way organizations do their business, for example the formula, the goals and mission. Whatever business that is done must suit within the set customs and goals of an institution (Vilcea, 2014). Since HEIs are a specific organizations with specific cultures, their staff at all levels must embrace the true needs of the new generation and it is future breeds so as to remain relevant to both the internal and external stakeholders. The internal stakeholders are the staff, students and alumni whereas, the external are the government, quality assurance control agencies, employers and parents (Douglas & Selin, 2012; Franciska & Welly, 2013; Vilcea, 2014). However a conducive culture cannot be attained without favorable climate. Climate is defined as the characteristics and identity of an organization from others. It involves the way members interact, perceive and conceptualize, their dimensions, source of influence and shaping of behaviours, the way of interpreting situations, attitude and norms that shape their culture (Carlfjord, Andersson, & Nilsen, 2010; Chandra, 2014; McMurray, 2012).

Meanwhile, in the age of increasing environmental change coupled with increasing dynamic and controversies that affect life of both individuals and organizations, HEIs should invest in staff while capitalizing on the more experienced and old staff since many of them have vast experience on how management of business should be done. But to aspire and inspire future generations, leadership should always encourage the old and experienced staff to imbibe into themselves the heart of unlearning, relearning, learning, contextualizing, actualizing and then form a foundation of synthesizing new dimensions and trends that are a sine qua non to the existence of their institutions on the world market.

Moreover, this approach should be encapsulated with ambidextrous rigorous training to help both the shakers and hustlers in facilitating organisational business be on one page in terms of input and output. While doing training and refresher courses to the staff, members are exposed to change as an integral nature that requires constant generation of new knowledge that addresses new organisational challenges, its customers and the surrounding. Through knowledge generation, more involvement of students and staff in several business of educational institutions shall be realized other than putting emphasis on discipline management.

Furthermore through imbibing OH, organizations with staff who sit on several committees for years without training shall be shunned. For instance, members will be updating themselves on the new trends of management of both students and staff. Understanding culture and environment is done through learning and accepting differences. Staff should be encouraged to unlearn, learn, re-learn before actualizing and contextualizing issues that lead to new policy formulation and implementation in HEIs.

Nevertheless, orientation should be given priority for both staff and customers before accusing them of violating rules and regulations. Punishing in most cases does not change behavior but tolerance, counselling and guidance may be the best options towards reform of human beings. Man is bound to mistakes but before inflicting punishments through research, discussion and analysis of the magnitude of what he is or she has done is important if HEIs are to empower change agents to society. To ensure sanity and conducive environment, there is need to have smooth collaboration and networking within organisational structures and systems so as to ease customer gains and quality assurance.

Control and coordination are the ability to assess institutional performance and risks putting into consideration the challenges and opportunities. Through this process institutional leadership and their staff should rhyme their activities with job description, and psychological empowerment as dedicated

towards achievement of staff commitment (De Klerk & Stander, 2014; Mendes & Stander, 2011). However control and coordination cannot be achieved without imbibing systems, with clear job roles and at the same time employ staff with competences that lead to quality working environment. Health organization do not stall activities or act in adhoc manner, staff are orientated and trained often to suit the demands of the time. Procrastination of activities should be avoided to ensure that time is not wasted and systems are not abused. Through this ambidextrous process, structure can function effectively and systems may be automated to answer customer concerns without delays.

Without taking control and coordination of activities as a sine qua none element, many organizations in all spheres of business have lost touch with customers and their funders to uncoordinated ways of running business. This can be experienced when members of the same group give different and varying information on a certain aspect of organisational element when approached by an outsider. When such scenarios happen they are clearly indicating that there is absence of clear communication channels with the outside world which in the end may lead to conflict of interest, unintended expenses and uncoordinated activities (Glenn, 2008; Hamid et al., 2011; Husain, 2013; Miir, 2016a; Miir, Othman, Sahari, & Burhan, 2017; Miir, Othman, Sahari Nordin, & Burhan Ibrahim, 2017)

External Orientation

External orientation is the qualitative engagement of customers and other stakeholders and others in the process of transforming the institution. Given the nature of market dictates and recipe spectrum, the external forces that pressurize change in mode of operation do not leave HEIs as isolated organizations due to the fact that they have a lot of attachment and influence on the way business should be conducted in the outside community (Mitchell & Nielsen, 2012). It is therefore important that these educational institutions avoid closed systems that do not give the true picture of what these institutions are offering.

A strong relationship with external forces should not only focus on what customers want but they should put in place ties that lead them to their competitors, business partners, policy makers and community to help them understand the nature of human resources needed in the market. This is because these stakeholders shape the market dictates without clear relationship and interaction with HEIs which can lead to irrelevance of either party when it comes to products and services.

Furthermore interacting with the outside community helps HEIs to understand what is not offered by sister organizations and then capitalize on how to rebrand and blend her services against their competitors. It can also act as a catalyst to examine the nature of graduates given to society, their level of performance and ability to change lives and innovate in line with the market demands. Without tracer studies and benchmarking countries like Uganda where many institutions remain enclosed without understanding where their alumni are employed shall remain isolated while at the same time providing the same ingredients for years.

Conversely the best way is for these organizations to have a shared vision, with forums of meeting and make themselves understand to develop products that are in line with the markets demands whereas at the same time providing consultancy to the challenges of the community. With this kind of strategy, these organizations shall be able to take on the market, shape it and dictate the kind of services, products and human resources that should be trained.

Meanwhile, HEIs should also take a lead of advising the regulatory agencies and councils for quality standards before new policies come up. For instance; in Uganda NCHE comes up with regulations tailored with high costs(De Smet et al., 2014). This tendency of commoditizing every activity kills the

nature of voluntarism, nature of humanity and the end of it all value for money and deadlines may not be adhered to.

The actual work of these enemies is to stress continuous improvement of quality and services among HEIs and in line with the vision of the country, customer demands and market dictates and at the same time avoid wastage and efficiency in their systems and structures. In a research done by Franciska & Welly, (2013) revealed that organisations that adhere to this kind of practice surpass others in terms of quality services, high levels of performance even though, they may be not be excellent in nature however, when they stick on health practices with leadership archetype mode attaining excellent levels becomes easy.

Organisational health is a pinnacle and precursor of all institutional activities without which business may be crippled down. Therefore, leadership must ensure that staff efficacy, timely performance evaluation and accountability are functional, efficient and effective are imbibed in both ambidextrous and sine qua none ways. This is due to the fact staff have a lot of influence on total quality, management and quality assurance. When staff are lackadaisical in nature they tend to do things at their pace without focusing on a bigger picture of an institution. Therefore leadership must pay greater attention to this aspect bearing in mind that no one wants to associate with failure. Weak staff yield kakistocracy in systems and structures. For HEIs such scenarios should not be called for since they impact a lot on societal development and vice versa. To attain institutional goals there should clear communication channels, commitment with distribution of power, favorable utilization of resources, knowledge sharing, collaboration and networking to secure favorable working environment and proper planning for transformation purposes that can lead to attraction of highly skilled staff and their retention.

To supplement the above element, there is need for infused proper communication channels into our working behavior. Communication should be used as a process of delivering information and data to the right offices. Through this process effective and efficient means of executing institutional business will be attained without struggling with the systems and structure. Without proper channels of communications; rumors, distortion and misinformation can mislead institutional business and drag the system into a state of quagmire. It is therefore important for leadership and institutional staff to ensure that their tongues and hands are used to pass over rightful information with good intention. Communication channels sometimes are manipulated and misused by self-seekers to inform customers of what is not worth while forgetting that they are shooting themselves in the feet. Public relations officers and the corporate image's officer should always have their ears open to address all the unclear situation before the media can take on the lead. Customers in this case, students must be listened to and have their concerns addressed without delay. Through proper communication channels institutions shall be able to keep in touch with both the internal and external community. Communication of the real life business must reach the community while well packaged to attract their attention and trust. Lecturers and administrators must understand that tongues and hands create and destroy societies therefore their use in downplaying institution's business must be discouraged to avoid self-seekers. In the same vein leaders must be able to learn from their enemies because it is not true that whatever they say is wrong. Platforms must be availed to help people speak with respect and sense while airing out their nerves and anger.

Meanwhile, through communication, networking and collaboration within and outside the world may be achieved. This can be done through direct links at both personal and group interaction. Members can set up strategies of implementing decisions at all levels when information is understood, communicated and implemented well. For HEIs institutions that do not give due diligence to this aspect of organisational management will still lag behind and have their activities either sabotaged or jolted down. In a study done by Guidetti, Converso, & Viotti, (2015), it was found that managing educational institutions is not an easy task due to the many activities that surround its efficiency for instance management of parents

concerns, customer, discipline, low salaries whereas the energy exerted is too much. It is therefore important that management and staff keep themselves informed of what is taking place in and outside the institutions and thus communicate effectively and efficiently putting into consideration that what they say and do must be accounted for.

ACCOUNTABILITY

Under the term accountability, the stated job description and key performance indicators upon which staff understand their designated responsibility, have the authority and are responsible for the results. Accountability can still be taken as a management terminology used as a framework for measuring employ performance with a focus on the stakeholder's interest (Harrison, Rouse, & De Villiers, 2012). It is a ground under which a staff of an organization takes responsibility of his decisions, actions towards execution of institutional duties. In this case staff are given autonomy and powers to execute duties within their dockets on behalf of the chief accounting officer however at the end of the year or contract, each person must show tangible results that must act as a basis for salary increment and renewal of his or her contract. Before reaching this period, staff's performance can be on scene basing on the way work is done daily.

Absentism in this situation is uncalled for and staff are supposed to write officially whenever they feel that some time should be given for off duty. In areas where staff do not perform well, organisational systems should give that kind of staff a leave and subject him or her to training and renew his skills and knowledge to cope up with the technological demands.

However, some institutions tend to ignore some people especially in big posts even when there is a lot of misconduct in the management of organisational business. This kind of attitude does not only dwindle the progress of an organization but it also yields bad behavior and attitude among other staff and hence ruin the corporate image of the entire organisation. To arrest this kind of embarrassment within organisational performance, staff who are seated in influential positions of an institution should be required to give mini reports on the progress of their departments and units for close monitoring.

Auditing of services and products should also be done critically with verification of the organizations daily expenditure on units to examine whether performance and expenditure on departments is commensurate with staff performance levels. In this era, HEIs should lay down policies that help to streamline the mode of operation and offer of services. The new generation calls for systematic evaluation of institutional systems, structures, values and at the same time recruit skilled human resources with rigor and vigor attached to high pay that attracts their commitment and diligence towards change. Through taking this direction, institutions shall be able to change from management theories to performance management and meet the necessities of the time (Annan-prah & Coast-ghana, n.d.; Carrera, 2010; Sokol, Gozdek, Figurska, & Blaskova, 2015). Without imbibing accountability into institutional operations, the mission and vision of an institution may be lost or ignored. For smooth running of organisational business, there is need for regular staff training, workshops, attending conferences, regular meetings and annual staff evaluation. Failure to implement accountability through use of modern systems for instance, key performance indicators, balance score card model, international organization for standardization (Iso) framework institutions are likely to fail in achieving their agendas. Moreover, when there is employment of ambidextrous and sine qua non approach, institutions will have clear direction defined with achievable mission, vision and shared values.

Direction

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Direction is a clear sense of focus where an institution is strategizing to get. For an institution to achieve its targets there should be a clear vision, mission and stated values. In that whenever any plan for pushing the institution ahead in terms of networking and collaboration must fit within the stated vision and mission. However, as time changes with new dynamics that shape up life, the vision, mission structures, systems and shared values must be revisited to bridge the gap and at the same time address the necessities of the time.

Organisations that take long to review their ways of doing things tend to lose customers and also fail to cope with strategies that lead to quality management achievement. It is therefore important to note HEIs are capitalized on teaching and learning therefore their combined efforts towards integrating customer concerns and with skilled human resources that meet the market demands are a must do without which they may cease to exist (Leary, Walker, Shelton, & Fitt, 2013). Likewise just and reliable methodologies of teaching and testing learner's ability while relating to professionalism must be employed in order to remain relevant to the new trends of the time (Adamu, 2014; Hargreaves, Halász, & Pont, 2007; Moreno-Murcia, Silveira Torregrosa, & Belando Pedreño, 2015; Moreno-Murcia et al., 2015; Wößmann & Hanushek, 2007).

Furthermore staff development and training should be also revisited to ensure that the skills and knowledge tend to address institutional objectives. This is because staff play a central role in the management of organisational affairs when ill skilled and poor attitude personnel are positioned at the center stage of all activities a lot of damage both intended and unintended plus sabotage may be encountered.

Moreover those who do work according to the expectations of the organizations should be rewarded and praised for purposes of raising their morale and encouraging others to copy from them (Harrison, Rouse, & De Villiers, 2012; Leary et al., 2013; Leithwood, Day, Sammons, Harris, & Hopkins, 2006). Defining the direction without infusing the willingness to lead the walk, talk and at the same time show the way. It is very unlikely that an institution will move especially when it is full of employees with diverse backgrounds and experiences. It is therefore imperative that organisational leadership becomes firm and support whoever moves into the desired goal of an institution since it's the only option for survival in the competitive world.

Motivation

Motivation is the availability of enthusiastic drives that attract employees to invest extraordinary efforts to deliver results. This should be done through provision of meaningful values that require to be revisited all the time to suit the demands of the time. In addition, inspirational leadership career development opportunities should be strategized to motivate staff that move on with academic development and career growth.

Meanwhile, financial incentives, rewards and recognition should be tailored to work done and results showed by any member of an organization. In systems where staff work and they are not appreciated in anyway, morale for moving extra miles get killed. In moments where junior officers are placed in high offices orientation and management of human resources skills should be done to avoid frustration and embarrassment of elders, departments that deal with finances should always address staff concerns quickly.

Over questioning and writing on staff requisition even when what is requisitioned for is clear dwindles staff efforts towards positive perception of institutional programs implementation. Without clear and well stated systems of staff motivation, strategies of staff development and capabilities of acquiring

reasonable human resources will be frustrated and killed mysteriously. Since motivation is a complex aspect in the management of universities, for managers to achieve the targets and set goals, motivation should be the top priority and its strategy must be laid down in white and black to achieve improved organisational performance (Zlate & Cucui, 2015).

In addition, Kuchava, Allay, Georgia, & Allay, (2016) state that motivation of staff in HEIs both public and private is a key to drive staff to more productivity and high performance levels leading to job satisfaction. It implies that institutions with clear motivation strategies achieve plausible results from their staff due to their levels of satisfaction, care and zeal to provide quality services. When an institution puts in place clear mechanisms of motivation for both intrinsic and extrinsic demands, staff will be subjected to key performance indicators at the same time evaluated through the use of proper appraisal standards of job performance. By employing of these modern management practices, HEIs will have the audacity and the nerve to attract skilled and experienced staff who will ably compete the world of academia

Moreover, to achieve capabilities and proper tools of securing highly qualified staff leadership style, the level of trust, awareness, and openness to discussion and communication play an important role (Blašková & Blaško, 2013).

Capabilities

Capability is the availability of skilled human resource who can be able to execute the designated duties to achieve strategy in the competitive market. At the time when some countries still lag behind in education and transformation of their countries, educational institutions through their leadership and staff should come to an understanding that time of attaining and developing high skilled labour is not an option but a must do (Miir, 2016b). For instance; in most of African countries the methods of teaching used to not suggest any future development. This is because students study under threatening environment, lecturers are moonlighting, many imparters of knowledge are used to dictation of notes to students, independent to individual reading and reasoning is not yet given due respect. And it is because of this reason and others that many of their graduates do not have true skills of survival and job creation (Miir & Othman, 2016). Adopting the modern ways of teaching and learning with an aim of helping students to attain skills of critical thinking, logic and reasoning. HEIs' human resources needed to address the challenges of Y generation and generations to come must be opted for rebranding their teaching skills, employ wisdom and other technological ways of imparting knowledge. Talents with quick mindset and reasoning should be nurtured and created in abundance to bridge the gap that many educational organisations are going through especially in Africa. Staff with master's degree and have not been in research and writing should stop teaching students at postgraduate diploma. Students at postgraduate must be exposed to all style of research and publication writing with an agenda of developing them into experts (Miir, 2017). Many countries suffer brain drain and lack of experts due to lack of proper ways of retaining them and at the same time facilitate their efforts of attracting others and better levels of academic development. Furthermore, for organizations that endure to survive in the era of change, they should also put in place strategies of attaining staff commitment towards high level of performance (Miir, Othman, Sahari, & Burhan, 2016; Miir, 2018, 2018). Attracting staff with high qualification is important but also gaining their moral, commitment and quality products and services is the main agenda that must be paid greater attention to (Yücel, Doğanalp, Kaya, Prof, & Yücel, 2013). Since employee welfare and organisational effectiveness are always intertwined and their separation causes disastrous effect to organisational survival, HEIs leadership should always be more vigilant and put in place all avenues that lead to staff stability. Institutions that do not lay a firm strategy of securing commitment from their staff and at the

same time attract others from sister institutions as a necessity for survival, they are bound to poor quality products. This kind of practice and strategy of ensuring OH implementation, should be accompanied with firm decisions and their implementation strategy should be penned down and followed in order to improve staff development, identification, retention, replacement and nurturing to avoid any vacuums that can be brought with either natural or artificial factors (Kaweesi & Miro, 2016).

FUTURE RESEARCH DIRECTIONS

The ultimate goal of implementing OH elements as espoused in the model of Keller and Price (2010) is to achieve quality services, products and customer satisfaction. This can be achieved through staff stability, innovation and development. With future researchers therefore, emphasis may be centered on issues like organisational health and customer satisfaction, organisational health and total quality management, safety, security, business continuity, performance measurement and accountability, HEIs staff stability and community change. It is therefore emphatic that managers of these institutions play an important role towards stabilizing their staff by attending to key issues that relate to OH so as to compete favorably in the knowledge economy. Also the new world order of HEIs will focus more on staff influence towards customer service and community change due the needs of the time that are focusing on sustainable development goals. All the above will still not be achieved without proper strategies that focus on organisational health elements efficiency and effectiveness to curtail staff turnover.

CONCLUSION

It is therefore important to note that while imbibing OH model into HEIs operations through the sine qua non and ambidextrous approach to avoid situations that can lead to staff turnover, all avenues employed for its effectiveness should ensure that all organisational health elements relate with one another to ensure smooth delivery of organisational business. More so this approach should be coupled with new trends of digital transformation, virtual connection, agility approach, quantum leadership, cloud leadership and being on top of trends. By adopting these trends, HEIs are likely to consolidate their developed staff and at the same time attract potential skilled human resources

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KEY TERMS AND DEFINITIONS

Ambidextrous: Application of management process using both right and left hand with an aim of causing positive change.

Imbibing: To absorb the new trends of organisational health into HEIs management practices.

Organisational Health: Organizational health is the ability of an organization to align its strategy, culture and a clear vision with an aim of providing quality services and excellent products to outcompete other organizations on the world market (De Smet, Schaninger, & Smith, 2014; Franciska & Welly, 2013).

Sine Qua Non: Is the application of essential management practices in day to day of running institutional business without an organization is bound to fail.

Leader Ambidexterity in Research Teams

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INTRODUCTION

Universities are increasingly developing an awareness about their so-called third mission, in which a scientific-economic paradigm is present (Chang et al., 2009). The institutions realize the importance of transferring knowledge to industry and society, with the possibility of exploiting the knowledge generated inside universities. The ability to combine conflicting demands that require different activities at universities, such as research publication and research commercialization, is an important challenge that must be addressed to effectively transfer knowledge and technology from universities to society.

Universities as organizations promote the transfer of knowledge and technologies to different industries, providing an adequate institutional framework and structure to researchers. We recognize the importance of this structure and the difficulty at the organizational level to cope with tension that requires research and entrepreneurial orientations, but we focus this study on the factors that have an influence at the micro-level of a leader of a research team. Because the main units at universities that develop knowledge are the research teams (Bayona-Sáez et al., 2002), in this study we analyse the ambidexterity of a leader of a research team. Research teams and specifically their main researchers must deal with dualities that arise if they want their research to become commercialized.

The ambidexterity concept shows the importance of coping with this tension, as studied from organization learning literature (e.g., March, 1991), management and strategic literature (Ghemawat and Ricarti Costa, 1993), and innovation studies (e.g., Jansen et al., 2006; Smith and Tushman, 2005). Ambos et al. (2008) interpret the concept in the context of universities as the ability to simultaneously produce knowledge-focused research or scientific contributions and property-focused research or commercial contributions. Chang et al. (2016) define individual research ambidexterity as “the ability by which academic scientists can simultaneously achieve research publication and research commercialization at the individual level”. We analyse this concept in the case of the main researcher of a research team, who acts as the leader of the team.

The aim of the present research is to determine the antecedents that make it possible for the main researchers to successfully achieve both research and commercialization activities. First, the concept of ambidexterity is presented and then translated to the university context. Next, we review the ambidexterity literature to propose the antecedents that must be studied at the level of an individual leader of a research team. Then, we present the methodology and illustrate our framework with an analysis of two research teams at different Spanish universities that have achieved academic as well as commercial results. Finally, we present our results and derive our conclusions.

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BACKGROUND

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Ambidexterity

The literature on management, innovation, and organization has discussed the contradictions that managers must reconcile to be efficient and effective, to develop incremental and radical innovations, to focus on the short- and long-term, or to cope with variation and stability. March (1991) outlines these contradictory firm demands in the concepts of exploration and exploitation in organizational learning. Exploration refers to risk taking activities, variation in learning, experimentation, flexibility and discovering, while exploitation means refinement, efficiency, and learning by doing. His seminal paper on the necessity of balancing both activities has been highly studied, and the later concept of organizational ambidexterity reflects the organizational capability to achieve exploration as well as exploitation. The difficulty in achieving ambidexterity is the conflicting demands of exploration and exploitation. Exploration requires variance-increasing activities and distant search, whereas exploitation is rooted in variance-decreasing activities and local search (Smith and Tushman, 2005). The importance of the concepts ambidexterity, and exploration and exploitation has grown in the literature and has been applied in different areas, while a variety of definitions have proliferated as Gupta et al. (2006) recognized. For example, in distinguishing between exploration and exploitation, Baum et al. (2000) focus on the distance of knowledge and variation, thus providing closed definitions to March's original concepts (March, 1991) and to Smith and Tushman's (2005) explanations. Other authors centre their definitions on the differences in the innovative output achieved, such as Benner and Tushman (2002) or He and Wong (2004). After reviewing a variety of definitions, Li et al. (2008) propose a framework that integrates different perspectives to better understand these differences. The authors distinguish between the 'function domain' and 'knowledge distance domain'. Whereas in each step in the value chain the organization can create familiar knowledge (exploitation) or more unfamiliar knowledge (exploration) ('knowledge distance domain'), "the 'function domain' regards each function on the value chain as unique in its type of learning" (Li et al., 2008: 118). Considering science, technology and product market knowledge as a sequence in the value chain, the early stages correspond to exploration during which organizations search for new knowledge, while the last steps have more exploitative characteristics for applying that knowledge (Li et al., 2008). In this sense, the next section explains the consideration of exploration and exploitation in this study, which agrees with this conceptualization of differences in the 'function domain'.

Furthermore, the three major approaches identified within the literature at the organizational level to achieve ambidexterity are the temporal, structural, and contextual (Gibson and Birkinshaw, 2004; Tushman and O'Reilly, 1996). In the temporal view of ambidexterity, organizational resources are concentrated in exploration or exploitation at different times, since periods of exploitation are followed by periods of exploration. Structural ambidexterity is achieved by organizational mechanisms, formal structures and coordination mechanisms, by concentrating some units on exploration and others on exploitation and then coordinating the units (Tushman and O'Reilly, 1996). We follow the third approach, contextual ambidexterity because it applies to the individual level, on which this study is focused. Contextual ambidexterity means to simultaneously achieve exploration and exploitation by building systems in which individuals could develop ambidexterity and make their own judgements about dividing their time between the conflicting demands for alignment and adaptability (Gibson and Birkinshaw, 2004). In this sense, we concentrate on the individual level of ambidexterity.

Ambidexterity at Universities

Research publication and commercialization require the development of very different abilities and tasks (Ambos et al., 2008; Chang et al., 2016). Academia rewards knowledge dissemination while industry demands ownership and control of intellectual property rights in different ways, which also means a delay in the possibility of publication of the findings that underly the commercial output (Ambos et al., 2008). Academics develop their routines and abilities while performing scientific research, which are highly linked with their professional evolution and opportunities for career development. The transfer of knowledge to companies in the form of patents, licenses, spin-offs, spin-out companies, and other ways of technology transfer require that academics, and more specifically, the leaders of the research teams, develop other types of abilities that are contradictory with their usual behaviour (Ambos et al., 2008), and divide their time and efforts between research and commercialization. In this sense, ambidexterity refers to the ability to simultaneously produce knowledge-focused research or scientific contributions and property-focused research or commercial contributions (Chang et al., 2016).

We focus on the main antecedents of achieving this ambidexterity at the individual level, specifically at the level of the leader of a research team. Although recognizing the importance of the context and the structural support from universities in other levels of analysis, such as the full organization, departments and other formal structures, the attention of this research is on the individual level. Ambidextrous managers are considered to be one of the most relevant elements to promote ambidexterity (Mom et al., 2009; O'Reilly and Tushman, 2011). Managers acting as a leader of a group represent a key element since they are going to be in charge of directing both the exploitative and explorative efforts.

Specifically, our research is based on the concept of individual research ambidexterity proposed by Chang et al. (2016: 9), which is defined as “the ability to which academic scientists can simultaneously achieve research publication and research commercialization at the individual level”.

Antecedents of Individual Ambidexterity

Ambidexterity at the level of a leader and/or manager has been studied in the management literature. To achieve organizational ambidexterity, individuals play an important role (Gibson and Birkinshaw, 2004), and specifically managers or leaders must address the contradicting dualities. Mom et al. (2009) define ambidextrous managers as those that organize contradictions, can multitask, and can refine as well as renew their knowledge and abilities. Chang et al. (2016) analyse, at the individual level, the ability to recognize opportunities to exploit their research opportunity, whereas Chang et al. (2009) propose networking and personal entrepreneurial capabilities as the main antecedents. Ambos et al. (2008) are more centred on individual scientific excellence, the embeddedness in academia and the motivation to pursue commercial outputs. Together, these antecedents compose the framework proposed in this study to analyse the ambidexterity of the leader of a research team; we will now analyse this framework.

Networking

Personal networking, both inside and outside the organization and the team, has been recognized in the literature as one of the main characteristics of ambidextrous leaders (Cao et al., 2010), especially in a university context (Ambos et al., 2008; Chang et al., 2009). Networking means creating interactions between academic scientists, and between academics and firms and other organizations (Ambos et al., 2008; Chang et al., 2009). A network provides information and knowledge that could have a potential

value (Cao et al., 2010). This gives the leader a deeper understanding of the internal and external situations, which provides more opportunities for a comprehensive picture of how to explore and exploit (Cao et al., 2010). Links with industry actors provides opportunities to understand their needs as well opportunities for financing projects or other commercial outputs (Chang et al., 2009; Jensen et al., 2003). Connectedness with other academic researchers provides opportunities to enhance their research as well as meet members that may possibly be needed for future projects. Additionally, it is important to know potential candidates to include additional human resources in their laboratories and teams. This network provides possibilities of incorporating new knowledge and experiences outside the team's usual trajectory (Chang et al., 2009).

Entrepreneurial Capabilities

Considering that the entrepreneurial process comprises discovering, evaluating and exploiting opportunities (Chang et al., 2009; Shane and Venkatraman, 2000), which includes proactiveness and risk taking, ambidextrous leaders must have entrepreneurial abilities. The importance of entrepreneurial capabilities has been shown in a variety of areas. The Council of the European Union has even included entrepreneurship as a key competence for lifelong learning, considering it as “the capacity to act upon opportunities and ideas, and to transform them into values for others” (Council of the European Union, 2019: 23).

To overcome the difficulties in the process and to be able to cope with the ambiguous environment, this ability must also include a strong motivation to obtain commercial applications for their research (Chang et al., 2009; Chang et al., 2016; Gibson and Birkinshaw, 2004). These time-consuming processes could be detrimental for the scientific production (Chang et al., 2016; Smith and Parr, 2003); therefore, leaders must be conscious of the risk it implies.

Paradoxical Thinking

The literature has stressed the importance of ambidextrous managers addressing conflict and having paradoxical thinking (Gibson and Birkinshaw, 2004; Mom et al., 2009; Smith and Tushman, 2005). It implies motivation and the ability to be sensitive to, to understand, and to pursue a range of seemingly conflicting opportunities, needs, and goals (Mom et al., 2009). In fact, the ‘paradoxical’ view of ambidexterity considers the simultaneous achievement of exploration and exploitation and their mutual reinforcement (both/and), as opposite to the trade-off view (either/or) (Gibson and Birkinshaw, 2004). According to Mom et al. (2009) and O'Reilly and Tushman (2004), managers continuously must cope with contradictions which implies that “they have the motivation and ability to be sensitive to, to understand and to pursue a range of seemingly conflicting opportunities, needs, and goals” (Mom et al., 2009: 813). In the context of the leader of a research team, this means that he or she must integrate contradictions regarding the different tasks, processes, norms and routines that research publication and research commercialization require (Chang et al., 2016). Paradoxical thinking is a fundamental trait to manage those contradictions (Smith and Tushman, 2005). Moreover, managers must also reconcile conflicts regarding the team's long- and short-term goals. For example, sometimes a long-term goal could be focused on developing totally new knowledge and processes that could result in a patented solution, but it is common that younger members of the team need short-term results in terms of publications necessary to continue with their careers. Therefore, managers must resolve these conflicting demands between the long- and short-term and between differences among the team's members. Paradoxical thinking implies embracing contradictions instead of choosing between contradictory goals (Smith and Tushman, 2005).

Multitasking

The development of exploration and exploitation also means performing diverse tasks and activities. In this sense, ambidextrous managers must accomplish multiple tasks within the same period (Mom et al. 2009), representing different roles (Floyd and Lane, 2000; Sanchez et al., 1996). They must recognize the strategic direction and ratify and monitor its development but also command the deployment of resources (Floyd and Lane, 2000). Moreover, they usually develop nonroutine activities in the more creative side of their tasks but must also implement routine activities (Adler et al. 1999). In the context of the leader of a research team, the tasks and even the roles to perform exploration and exploitation show clear differences, since the process of developing a patent or another commercial goal must support other relationships, such as with firms, as well as different processes, norms, and regulations to have success with a commercial output.

Refining and renewing knowledge and abilities

The literature also emphasizes the need for ambidextrous leaders to refine their knowledge and skills through reliability-enhancing learning activities, while simultaneously renewing their knowledge with variety-increasing activities (Holmqvist, 2004; McGrath, 2001; Mom et al., 2009). These processes require managers to acquire diverse knowledge and information from different sources, engaging in local and distant searches (Mom et al., 2009).

Scientific Excellence

Although we propose that leaders must be ambidextrous to produce commercial and also academic outputs, concentrating too much on the academic aspect could be detrimental to obtaining industrial applications. Strong academic excellence means also having academic influence, and it can only be achieved by being embedded in academia, which also means having a higher commitment to certain norms and behaviour (Ambos et al., 2008). Academia defines what is valuable and rigorous research, and it could be detrimental to deviate from these norms to obtain commercial applications. Academia usually rewards the academic aspect; therefore, a reduction of the commercial results could be expected (Ambos et al., 2008). Researchers with higher commercial results are usually different from researchers that traditionally focus on producing academic results (Ambos et al., 2008).

After the review of these antecedents, the next sections illustrate the framework with two real examples.

ANALYSIS

Methods

After proposing the framework for leader ambidexterity in research teams, we analyse the framework in two research teams that have made scientific as well as commercial contributions. This research constitutes an initial approach to further develop the empirical part in future with more data and over a longer period in a full case study. Case studies are an inductive-based methodology (Eisenhardt, 1989; Yin, 2009) suitable for answering how and why questions (Yin, 2009) and has been used in similar contexts

(e.g., McKelvey et al. 2015). The examples in the present research are designed to illustrate the proposed theoretical framework of leader ambidexterity in research teams.

The decision about the number of examples to include in the research was based on the recommendation of having more than one case to have literal replication, that is, for predicting similar results (Yin, 1994). The aim is to illustrate the theory.

The selection of the specific examples was made according to their suitability for the theoretical framework (Eisenhardt, 1989; McKelvey et al., 2015). Accordingly, we select two research teams from different Spanish universities and different areas of research. The areas are purposefully selected to include fields where the demands of commercial research are relevant. Specifically, we search for scientists with results in terms of published scientific papers as well as transference to industry. We search for academic leaders that have a specific sensitivity to the commercial aspect, since it is more difficult to find. The two selected cases reflect as a mission of their team and/or as a personal goal on their webpages the necessity of transferring knowledge to society.

We focus on the individual as the unit of analysis since our aim is to illustrate the antecedents of leaders' ambidexterity in research teams. Therefore, we contact the two main academics who coordinate research teams with knowledge- and property-focused research.

Data are collected during March and April 2018 through semi-structured interviews with the leaders that are recorded, transcribed and analysed, and completed through the collection of secondary data obtained from public sources including the universities' webpages, the research teams' and institutes' webpages (of which they are members), news, the Web of Science, Scopus database, and published patents. Having primary and secondary data allows us to have different sources of evidence (Yin, 2009). In the interviews, both authors are present, and both analyse the results to increase objectivity in the interpretation. The protocol for the interviews includes semi-structured questions to get information about the antecedents in a fluent manner. Following other studies that use interviews for data collection in case studies (e.g. Bonesso et al., 2014), we reformulated questions from previous empirical studies that analyse and/or measure ambidextrous leadership and different antecedents (Ambos et al., 2008; Chang et al., 2009, 2016; Mom et al., 2009). An example of a question is: How often do you collaborate with other research teams? The interviews last on average one hour.

The leaders are also contacted after the interviews by mail or phone to confirm some data. Furthermore, after interpreting the examples, analysing results, and redacting the final manuscript of this research, the two leaders read the final document. Two members of the research team of the second leader interviewed have also read the final manuscript and confirmed that it reflects the leader's orientation towards research and commercialization.

Presentation of the two Illustrative Examples

After choosing and contacting the research teams, we obtain the collaboration of two scientists that act as coordinators of research teams from two different Spanish public universities. Both universities have research excellence and promotion of knowledge transfer as strategic objectives. The first (in which the first leader presented undertakes his work) is more active in promoting transference with specific structures (institutes and research centres) and a detailed budget for transference. Nevertheless, its global budget is also higher than in the second institution, which has more limited resources.

The selection of these teams is based on their special sensitivity to the transfer of knowledge, that they have both types of outputs (commercial and academic), that they belong to different institutions and research areas, and that they agree to participate in the present research. The selected leaders are in

the areas of Information and Communication Technologies (referred to as Leader 1) and Chemical and Advanced Materials (presented as Leader 2).

Leader 1

The team that Leader 1 manages, conducts theoretical and experimental research to develop basic metrology and specific and accurate measurement devices for radiofrequency and microwave. The institute where Leader 1 performs research has the mission of improving society through the transfer and application of knowledge from research in the field of Information and Communications Technology. The institute has a specific organizational structure inside the university to promote research and commercialization. It gives support to researchers with an adequate infrastructure to promote both aspects of research and transference. The research team led by Leader 1 is composed of more than 14 researchers.

The leader is a full professor and has published 86 papers in journals belonging to the Scopus database, has developed 4 patents, and has promoted more than 50 contracts with industry.

Leader 2

Leader 2 coordinates a team that analyses polymers for energy applications, coatings, composite materials, biomaterials and technologies of corrosion, electrochemical characterization and material spectroscopy. The team was founded in 2010 with the mission of generating and transferring applied knowledge in the area of advanced materials to improve the innovation capacity of the industry. It is composed of six researchers and two technicians, and several Ph.D. students and master and undergraduate students from the same university. They collaborate in an established way with other research groups at other universities that specialize in different areas, such as clinical, chemistry, proteomic and biotechnology.

Leader 2 is a full professor with 65 scientific papers (according to the Scopus database), as well as many other publications. He participates in the subject Master's Thesis, where master's students must develop a professional oriented project in industrial engineering. The leader also appears as the inventor in 6 patents (4 of them licensed or in exploitation), and a promotor of 2 spin-off companies, and the principal researcher of 50 contracts with industry. The team was able to promote one of the first International Organization for Standardization (ISO) standards proposed by Spain (ISO 17463:2014).

Results

The results are presented following the structure of the theoretical framework, analysing results from the characteristics/antecedents of the leaders' ambidexterity.

Interactions

Both leaders stress the importance of creating a network outside their research groups. Table 1 shows the main statements from the interviews that outline the relevance of these networks. While *Leader 1* stresses both aspects of these networks (i.e., industry and academia), Leader 2 gives more relevance to the industry aspect of a network. Regarding contacts with academia, Leader 1 seems to be equally concerned about the interaction with academia and industry, specifically organizing an academic international conference with the goal of reinforcing their network and creating new contacts. By contrast, Leader 2 only remarks that once they have created a research structure with another research team that belongs to a different

Table 1. Examples of quotes from the interviews regarding the importance of networks

Networking (Ambos et al., 2008; Chang et al., 2009)	
Leader 1	Leader 2
“We organize an international conference to maintain our relationships and to create new ones.” “We have a network of contacts with research groups from other countries, contacts with research groups in other areas at the university and also a network of contacts with companies.” “A network is very important, and it takes much time to build a network. Once the companies know what you are doing, when they have a problem or a new challenge, they contact us.” “Previous contacts allow us to develop new ideas, new developments.”	“Collaboration with other groups that specialize in different areas in an established way is critical for the success of the research lines.” “The team who develops patents consists of two research groups from different universities.” “We carry out virtual and face-to-face meetings with the full group, which includes teams from other universities.” “We collaborate with researchers in other areas.” “The team members themselves belong to different knowledge areas and we must try to find a common language.” “I am in contact with firms that know the necessity of patents.” “It is impossible to transfer a patent... if you don't know which need the market has, the firms are who know the needs.” “The firm gives us the need and we develop solutions to solve this need.” “The firm gives us more contacts.” “We create a network of industrial contacts through this first contact.”

university, the important thing is having industry contacts. However, Leader 2 recognizes the necessity of collaborating with other researchers, but with an exploitation-oriented goal—they collaborate with studies in other areas as needed to develop a patent. Moreover, data analysed from other documents (i.e., publications or the Web) show that Leader 2 also maintains a collaboration with researchers that belong to other institutions where he has been previously employed.

Regarding the interaction with industry, both stress its importance and share the idea that firms are the starting point to develop a patent when they communicate a need or a problem, because it is from this moment that teams start to perform research to solve the challenge, a process that could, in turn, end with the development of a patent. Furthermore, in both cases, it is the leaders of the teams who create and are the visible interlocutor with firms. Leader 2 stresses this point by claiming that he is the person who is in contact with companies.

Entrepreneurial Abilities

Both leaders share a strong motivation to serve society through the development of knowledge with practical applications. In fact, we select both leaders because this motivation clearly appears in their main webpage or as a mission of the institute they manage. In the interviews, Leader 1 demonstrates how they are required to know all the phases to successfully achieve a commercial application (Table 2). In addition to the mission that appears for the group, Leader 2 also includes in his professional webpage his goal of transferring the group's developments to the productive sector. In the interview, Leader 2 recognizes the difficulties of being centred on transferring knowledge to the productive sector and the risks they assume, because it requires more time and money and could be detrimental for their own scientific production.

Paradoxical Thinking

The results show the importance of addressing contradictions for both leaders (Table 3). Paradoxical thinking is necessary to develop a solution according to Leader 1. In the interview with Leader 2, his

Table 2. Examples of quotes from the interviews regarding the importance of entrepreneurial abilities

Entrepreneurial abilities (Chang et al., 2009; Chang et al., 2016)	
Leader 1	Leader 2
“As leaders, we propose the areas or topics of research.” “Our projects with firms are development projects in which we must discover a new solution for a problem.” “Some contracts with companies require patenting the development.” “Previous contacts allow us to develop new ideas, new developments.” “We are strongly oriented to carry out both basic research and contracts with companies (that allow commercialization).” “Contracts provide us more resources to continue our research.” “We must act as a seller in some sense.”	“I am the person in the team who is in contact with firms to discover opportunities.” “It’s a risky decision to develop a patent, in terms of money, time and my own career.”

role of managing contradictions and conflicts among the team clearly surfaced. Both stress the necessity of coping with different demands for the long- and short-term. They must also possess this paradoxical thinking to be able to find a solution to problems not yet resolved in their development projects.

Multitasking

Regarding multitasking, both leaders fulfil multiple roles of teaching at the University, performing management tasks as leaders of their teams, being a chair director (Leader 2), and being researchers and developers of their projects from the initial phases to the end. Some statements in the interviews also outline their multiple tasks (Table 4). As leaders of the research teams, they must align the team members to achieve the objectives in an efficient way. As directors, they must also be involved in management tasks, in obtaining and managing resources for the institute, and must also work with companies to establish long-term relationships with them. In the entrepreneurial characteristic, we have also outlined how they perform diverse activities.

Table 3. Examples of quotes from the interviews regarding the importance of organizing contradictions

Organize contradictions and paradoxical thinking (Mom et al., 2009)	
Leader 1	Leader 2
“We have new ideas and develop new knowledge that we must ‘sell’ in terms of projects, papers or contracts with firms and have some procedures that we must follow. Additionally, firms contact our group to solve problems that do not have a current solution, and we develop new solutions. Our projects are development projects.” “As a leader, I must think of the long-term; my decisions have consequences on the work of my team.” “Some issues require prompt consideration, whereas others are less vital. I must prioritize tasks and make decisions within the group.”	“We continuously need to manage contradictions among the team because we belong to different areas of knowledge where the language is different, and it is different from the firm’s language.” “We focus on the long-term. The process to develop a patent is very long in this area, but we also need to obtain more short-term goals regarding the project itself (different phases) and regarding the younger members of the team because they need publications to advance their careers.”

Table 4. Examples of quotes from the interviews regarding the importance of performing multiple tasks

Multitasking (Mom et al., 2009)	
Leader 1	Leader 2
"We must teach in our classes, create new knowledge to carry out basic research, and apply this research; we also have other academic positions."	"I am the person who is in contact with firms." "I need to understand their language." "I think of the ideas for how to develop the project."

Refining and Renewing Knowledge and Abilities

We outline in Table 5 examples of the statements both leaders made regarding the necessity of acquiring distant knowledge. To develop new projects, they need interdisciplinarity, which Leader 1 remarks is addressed with their approach to other knowledge areas based on their contacts as well as inside the team. The leader said that it is important to understand the main principles as the leader, but that specialized people are also needed to execute the full projects. Leader 2 even remarks the solution comes sometimes by breaking the established rules of a given area.

Scientific excellence

Regarding scientific excellence, both leaders have a high number of published papers in the Scopus database (Table 6) which includes Scimago Journal Rank (SCR). Table 6 also shows the H index and the total number of citations received by both leaders. Table 6 also includes data from the Web of Science for one of the most cited researchers in each area, although the Web of Science only provides the ranking of the Highly Cited Researchers in more generic areas. It does not provide this list in each of the specific sub-areas of both leaders, which would be more realistic for comparison. Of course, the figures of the top scientists are higher, but the numbers of both leaders demonstrate high research-oriented results. Furthermore, both are full professors, which means that they have achieved at least the minimum level of excellence for this position. Leader 2 clearly realizes in the interview that academia has its own rules and that following them, until now, means to not give value to the transference to industry; therefore, concentrating on the commercial aspect is a risky decision for his own career. In this case, the leader has assumed these risks because he has been convinced of his main role as providing useful output to society.

In general, these results illustrate the importance of factors proposed to achieve ambidexterity for the leaders of the research teams. Both leaders are ambidextrous and need to manage the tension between both activities to have success from both aspects.

Table 5. Examples of quotes from the interviews regarding the importance of refining and renewing knowledge

Refining and renewing knowledge and abilities (Mom et al., 2009)	
Leader 1	Leader 2
"When we need new developments in other areas, we know who can help us within our network. For example, we have contacts with other areas that help in analysing materials." "In our team, some members are approaching different areas of knowledge, so they must learn new skills and knowledge."	"We must understand other areas of knowledge because our projects are interdisciplinary." "We enter other areas." "We need to break the rules of different areas to find a solution." "We need to enter new areas of knowledge to develop our projects and we enter like elephants in a china shop." "Breaking the rules often gives up new ideas."

Table 6. Information concerning the number of publications and citations

Scientific excellence (Ambos et al., 2008)	
Leader 1*	Leader 2
86 papers in SJR H index = 11 Total number of citations = 425	65 papers in SJR H index = 19 Total number of citations = 1091
<i>Data for a researcher that appears in the list of Highly Cited Researchers in the area of computer science**</i>	<i>Data for a researcher that appears in the list of Highly Cited Researchers in the area of chemistry</i>
H index = 55 Total number of citations (excluding auto-citation) = 25,976	H index = 46 Total number of citations (excluding auto-citation) = 7,280
*Data concerning the leaders were extracted from the Scopus database **Data concerning other researchers were extracted from the Web of Science database	

SOLUTIONS AND RECOMMENDATIONS

To transfer knowledge and technologies from universities to the productive sector, research teams and their leaders must address the tension generated by the different abilities and resources needed to achieve research- and commercialization-oriented results. The ambidexterity literature helps us to identify the clues for ambidexterity at the individual level of the leader.

The factors reviewed in this study are illustrated with two empirical examples in which the importance of these factors has been shown. The establishment of a network within academia and with industry, entrepreneurial abilities, paradoxical thinking, multitasking ability, and prioritizing the refinement and renewal of knowledge and abilities have been showed to be important characteristics for achieving ambidexterity. Specifically, the determination of the leaders to achieve exploration and exploitation, i.e., their entrepreneurial capabilities, is one of the main factors to successfully transfer knowledge and technology to industry. Contacts with firms are also crucial since they begin the process of producing commercial-oriented research when firms propose a need or a problem without a current solution. The importance of creating a network outside their research teams has emerged as a crucial factor. The initial process for an innovation often begins with these contacts. The data show that the leaders have a high number of publications, which demonstrates their scientific excellence. Ambos et al. (2008) propose that this factor has a negative influence at the individual level in regard to achieving commercial-oriented outputs because time restrictions cause scientists to develop some specific routines; scientists with higher commercial results are usually different from researchers who traditionally focus on producing academic results. Nevertheless, the authors also recognize other studies in which a positive relationship exists between academic excellence and commercial outcomes because the best scientists are also likely to have more abilities to commercialize their own knowledge (e.g., West 2008; Zucker et al. 2001). We need to study this factor more deeply by comparing our results with the best researchers in a specific area with a higher scientific excellence and with scientists that have more commercial-oriented research.

The results clearly show that the process of achieving individual ambidexterity in the context of leaders of research teams is difficult. One determining factor according to Leader 2 is the context in the sense that for career development exploration and exploitation have not had the same value until now. This conclusion also confirms the results from Ambos et al. (2008) in the sense that the tension at the individual level is high. To advance in this sense, universities should provide the same support for both activities.

FUTURE RESEARCH DIRECTIONS

This research topic could be broadly amplified. An interesting factor to take in account would be the other individuals conforming the Research Team and their contribution to the ambidextrous environment or their opinions about the leadership style. To complete the analysis, we must also focus on some developments made in the teams and examine them in detail over a longer period, in order to devise a complete case study. As well, it would be useful to increment the sample of subjects and analyse more cases to find differentiating factors in the leaders. Comparisons with researchers in other areas could also provide a more complete picture of these factors. Another point to take in account for future research would be to provide an analysis on the valuation by the universities with regard to exploitation and exploration tasks and how they are appraised in the University context.

Some of the theoretical concepts included in this study, such as entrepreneurship or paradoxical thinking, require further analysis. A study of the literature that first introduced and then focused on these constructs, along with an analysis of the similarities with the dimensions introduced by each one, could represent a theoretical advance to avoid terminology confusion.

CONCLUSION

We contribute to the ambidexterity literature by proposing and analysing factors affecting the achievement of ambidexterity at the individual level in a specific context. We also contribute to the technology transfer topic by applying ambidexterity to the transfer of knowledge between universities and industry by reviewing and illustrating the more important individual aspects.

The factors analysed in this study contribute to a better comprehension of the importance of specific traits and characteristics leaders must develop to address the dualities required to successfully transfer their knowledge into the productive sector and not only through academia. It could be an interesting starting point to encourage commercial results from research projects at universities by considering the factors analysed in this study and the difficulty to achieve both research- and commercial-oriented results at the individual level. For universities that want to improve their transference to society, it is important to realize the necessity of developing stronger supporting structures, formation and recognition of the two types of results so that scientists can overcome the drawbacks of achieving individual ambidexterity. The so-called third mission of universities is increasing in importance and providing support for individual ambidexterity is crucial in the sense that individuals and the leaders of research teams are those who are producing knowledge and could transform it into applications for society.

Regarding limitations of the present research, although we select examples to ensure we have two leaders with results in the two aspects of ambidexterity (exploration and exploitation), we do not compare our results with cases of superior researchers in the same area for a better understanding. It could also be useful to compare our results with other leaders that only concentrate their efforts on one of the aspects of ambidexterity to analyse the differences. Moreover, our data are based on interviews with the leaders and secondary sources. Performing interviews with the network of contacts and with other members of the research teams could add more value to the results. Another limitation is that we focus only at the individual level, but interactions with variables regarding the organizational level could provide a richer analysis. Future research should address these questions.

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KEY TERMS AND DEFINITIONS

Ambidexterity: Capability or ability to effectively combine exploration and exploitation activities.

Contextual Ambidexterity: Type of Ambidexterity obtained by the alignment of all the different elements of the organization towards specific tasks in order to foster exploration and exploitation at the same time.

Entrepreneurial Capability: The ability to identify opportunities and aligning the suitable resources and efforts to seize these opportunities.

Exploitation: Activities or actions oriented to develop the existing capabilities/objectives.

Exploration: Activities or actions oriented to develop new or innovative capabilities/objectives.

Paradoxical Thinking: Being able to cope with contradictions, to think on situations with a whole and integrative perspective.

Structural Ambidexterity: Type of ambidexterity managed through two different units in the organization each one focused on exploration or on exploitation only.

Innovation Management Capabilities for R&D in Pakistan

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INTRODUCTION

Today major issues are: unpredicted global business climate in every business sector. The significant emergences of domestic and international business dynamism, challenging business competition, rising growth in knowledge driven economies with all comprehensive technological tools have browse innovation and innovative capabilities as major instrument that used to compete global business dynamism. Number of studies and publication in context of evaluating effectiveness of innovation management capabilities on R&D activities particularly during the developing on National innovation system (NIS) (Naqvi, 2011) for the developing economies like Pakistan,

A national innovation system- as theoretical framework- is generally translated as a specific cluster or range of linkages among the factors implied in innovation processes, and interrelationship among these factors determines the performance related to innovation process (i.e. innovation efficiency) (Freeman, 1987; Metcalfe, 1995; Nelson, 1993; Numminen, 1996). This interpretation attracts many researchers to draw their conclusion on new structure of knowledge based economies in case of both developing and developed economies (Correa, 1998; Foray, 1994; Lundvall, 1998)

Innovation capability influence imperative stake in developing R&D activities in recognized to confront the uncertain business environment and counter domestic and global business competencies, it encourages firms to reduce their production expenditure, starched the business potential and excel societal source of revenue (Pannirselvan et al., 2016; Sorooshian et al, 2013). The existing circumstances recognized as knowledge era, and the global business challenges experience to “Knowledge revolution” drive by the accelerating growth of scientific and technological progression (Gilani, 2015a)

Pakistan has made inspiring pace towards creating an advance infrastructure for R&D through aggressive policy with potential financial backing but the expected targets could not be accomplished. It finds quite reluctant to R&D and innovative activities developed through academia, while some limited momentum adds up from the private sector (Naqvi, 2011). Developing capabilities in various sectors consider as significant step to superimpose the innovation effectiveness (Lau, 2010), In this context, number of scholar’s have understood such innovation capabilities considers as key factor to influence overall innovation effectiveness that impact on R&D spending specifically translating into innovational design with respect to market environment (Paolo Landoni, 2016; Yam, 2011).

In holistic view, there is certainly a problem with determining innovation inputs and outputs, particularly in context of a dynamic business environment. There are few other complex issues for instance: Emergences of domestic and international business dynamism, and challenging business competition, rising growth in knowledge driven economies. In general narrative all the estimations related to innova-

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tion inputs explicitly and implicitly comprise of elements that depends on R&D spending (or developing the circumstance for increasing R&D spending) (Jankowska et al., 2017).

There are comparatively unexplored literature regarding criteria for general decision guideline about involvement of innovation capabilities as useful under limited expenditure and lack of empirical evidence regarding supportive indicators to cater policy making in order to propel research and development (Dimitrios Kafetzopoulos 2015; HaoJiaoa, 2016; Mei-Chih Hu, 2016; Samson, 2014; Yam, 2011; Zhu, 2014). However, there are more investigation and in depth emphasis required on relationship among the dimensions and criteria's of innovation capabilities and their influence to R&D to draw a general guideline that helps decision makers to develop policies by using these criteria's to strategies R&D configuration in order to expend and achieve business competitiveness (Alberto Di Minin 2012; Hosseinia, 2016; Martin, 2015)

In contrast developed economies, finite research is being done on R&D with science and technological advancement in Pakistan (BPTC, 1998; Naim, 2001; Qureshi, 1998) but specifically with angle of innovation and technological advancement system in Pakistan. Pakistan council of Science and Technology (PCST) highlights Science and Technology (S&T) Indicators (Gilani, 2015b) over a period of time. One of research purpose is to evaluate S&T significant drivers with a specific dimension of innovative mechanism in order to screen progressive national innovation initiative. But due to the instable government political drawback creates difficulties for sustaining R&D activities (Naqvi, 2011).

BACKGROUND

Developing innovation capabilities consider as an expensive and uncertain process. From business perspective, in general argument innovation can be describe as a complicated systemic process of developing new conceptual ideas- start with the procedure of their development, process of their modeling, and commercial application- using technical knowledge, technological capabilities, and comprehensive firms resources (W. Artz, M. Norman, E. Hatfield, and L. Cardinal., 2010; Karlsson, 2015a). Similarly, number of firms used innovation an instrument for consistent growth because it drives to influence number of complex functional strategies such as (marketing, production and product). Number of experts and scholars figure out innovation capabilities as crucial enabler of business competencies and recognized as essential indicator to the overall productivity and business growth (Karlsson, 2015a; Subrahmanya, 2012). In general, firms accomplished their innovation process by either developing in house innovation capabilities through concrete internal R&D process or by acquiring R&D capabilities through external collaboration. The initial aim to strength a extensive progress in technological drivers that retain the existing process capabilities and starched the product range with minimum production cost (Ganotakis, 2011).

Most of the innovation literature argues that innovation is the most essential resource for firm's accomplishment and survival (Abbing, 2010; Cho & Pucik, 2005) in dynamic business environment Innovation capabilities are consider as significant drivers for influencing innovation (Teece et al., 1997) and regard as the foundation of firms transformation to conceive competition, new market opportunities and external circumstances (Guan & Ma, 2003; M.Elmquist & Masson, 2009). Accordingly, there have been numerous and extensive discussion on innovation capabilities, which direct to various approaches to classify such capabilities.

There are various approaches to characterize innovation capabilities in prior studies are twofold. One has to observe the capabilities from the holistic angle for instance from outcome perspective, in which innovation outcome can be split into various components. For instance: Sulistiyani and Harwiki (2016)

translate innovation capabilities as ‘product with enhance quality’, innovative product and advance production strategy. Plessis (2007) suggested three main dimensions related to innovation capabilities based on innovation management, product and process. Similarly, According to Adam and Comber (2013) interpretation they suggested innovation capabilities were based on three factors: improve product quality, product innovation and potential market growth

An innovation capability is a significant and indefinable input character that is crucially linked to R&D. The process of Innovation management requires adequate investment in order to drive retainable R&D activities (Czarnitzki, 2011) because R&D enhance firm’s existing knowledge strength that can utilized to generate new product range or used as for the purpose of process modification (W. Artz, M. Norman, E. Hatfield, and L. Cardinal. 2010., 2010). Similarly, number of scholars and expert identified in house development of innovational capabilities as key enabler to internal R&D that retained the firm’s performance without disclosing the firm’s potential capabilities (Conte, 2013; Hall, 2002; Karlsson, 2015b; Pellegrino, 2014.). In general perception innovational capabilities consider as driving instrument to R&D that not only sustain the R&D activities during dynamic business environment but support R&D as influences firms to absorb potential knowledge spillovers form external collaboration. This advocate that R&D with concrete innovation management capabilities consider is crucial gauging factor for quantifying firms absorptive ability (Gallie, 2012)

But in case of acquiring capabilities externally as most of the firms may no longer to retain and rely on their in-house R&D capabilities or firm’s internal capacity unable to aligned their operational activities with respect to the changing behavior to business environment, Because of the lack of availability skill set, lack of retaining the innovational capabilities due to higher cost, with low product range due to the short lifecycle, and incompatibility due to the complex technological constrain (Berchicci, 2013; Bergman, 2010).

This organizational shift from in- house R&D activities on toward open innovation external R&D encourage to create range of new product and modified processes with minimum cost factor. Furthermore, the core advantage of such acquisition is to distribute the risk and cost associate during the develop of innovation capabilities internally and exploiting economics of scale (Colombo, 2011; Hagedoorn, 1990; Nieto, 2010; Peltier, 2012; Pullen, 2012). Similarly, innovation capabilities also defined as abilities to measure innovation effectiveness for national innovation mechanism precisely based on outcomes for product innovation, market growth, new production system, and product quality. Akman and Yilmaz (2008) suggested innovation capabilities as proficiency for the in-depth understanding towards organizational internal culture and external situation that acknowledge to them. Lawson and Samson (2001) suggested innovation capabilities as competency to transform knowledge in to new product or process

CURRENT CHALLENGES IN CASE OF PAKISTAN

Approximately, 26% of overall GDP and 45% of total employment is obtained from agriculture sector till 2010, now the economic scope shifted towards the service and manufacturing based economies. It also adds significantly to Pakistan exports and to excel as potential supplier of raw materials to manufacturing sector. Also Major portion of countries population approximately 66% living in rural density and directly and indirectly connected to the agriculture sector. The agriculture contributes around 20.8% as compared to manufacturing sector which add around 24.3% while the service sector shares more than half of the GDP approximately add up around 54.9%. But from previous two decades Pakistan GDP growth pattern is 6.4% clearly represents that Pakistan has to join in with at least average economies

Table 1. World economic outlook (IMF, 2016)

Real GDP				Consumer Prices			Unemployment		
Projections				Projections			Projections		
	2015	2016	2017	2015	2016	2017	2015	2016	2017
Pakistan	2.5	3.1	3.5	5.7	5.2	4.8	-	-	-

cross the region (China 9.8% and India 7.4%) (Economist, 2007), But due to the economic instability because of the regional politics Pakistan GDP growth decrease up to 6.1% in year 2006 and it remain stagnant at rate of 3.1 year 2016 as show Table 1 (IMF, 2016).

According to Pakistan Science and Technology Council, STI policy 2015 (Anwar-ul-Hassan Gilani 2015) Pakistan has established comprehensive infrastructure 160 High Education Institute (HEIs) and these keep rising along with 100 R&D organizations. But unfortunately due to the distributed financial mechanism and different organization structures there has been no coordination and protocol exchange mechanism among these institutions. At current circumstance without proper coordination R&D activities deteriorate specifically when there has been no correlation among knowledge, Innovation and Technological capabilities. According to STI, 2015 indicator overall National innovation system productivity remain low and not reach to predicted projection as compare to the other regional economies, the situation getting even worst according to global innovation index (GII, 2015) (Soumitra Dutta, 2015-2016) Pakistan rank 131 position out of 141 countries and similarly according to the global competitive index (GCI, 2015) (Schwab, 2015–2016) Pakistan made up 129th mark among 141.

Eighteen-year publication data defines the rising and falling pattern in research publication from 1996 onward Pakistan, which can be the accredited to the significant rise in the R&D spending, as show in Table 2. Pakistan frequently emerges in the category as ‘rising stars’ for accomplishing maximum citation of scientific publication in number of fields (UNESCO, 2016).

The existing innovation capabilities development structure in Pakistan acquires major funding from the government agencies. As according to the current available statistics accumulate by Pakistan council of Science and Technology the Gross expenditure on R&D in Pakistan is float in between 0.29% to 0.59%

Table 2. Scientific publications in Pakistan

Years	Scientific publications in Pakistan
2007	4156
2008	5032
2009	6285
2010	7437
2011	9021
2012	9675
2013	8932
2014	9069
2015	9375
2016	10863
2017	13101

Table 3. Gross domestic R&D expenditure

GERD(\$ millions)	2005	2007	2009	2011	2013	2014	2015	2016	2017
Pakistan	2043	4097	3119	2471	2454	-	-	-	-
India	26532	32866	39402	48063	-	-	8532610		
Malaysia	-	-	5400	6457	-		15058344		
Turkey	4617	7049	8867	11246	13315				
Japan	128695	147602	136954	148389	160247				
Israel	6966	8749	8507	9523	10774				

of their GDP (Table: 3) shows the amount total spend with respect to the percentage of their GDP. The major contribution in gross domestic expenditure came from the government side which around 83%. While the contributor includes private funding non-profit agencies, business firms and the universities with 1%, 3%, 10% respectively, if further looking in detail the R&D major portion is used to spend in agriculture sector consider recipient of major source of funding followed by defense, Health sciences, industrial production and engineering and technology in a respective other (Muhammad Bashir, 2014). These statistical indicators illustrate that long way to go for developing more advance innovational capabilities that required more funding agencies particularly for the private sector need to jump in to promote domestic R&D. Furthermore, allocation of investment fund needs to distribute equally to create balance in innovation structure (Muhammad Anwar ulHaq 2014).

Pakistan remain bottom in the region with all the significant instruments used for measuring innovation capability according to GII, 2016 (global innovation index 2016), Pakistan face a serious challenges as compares to their regional counterparts regarding to acquires knowledge and technology output. Pakistan place at 89th position in out of 140 countries, the innovation and capacity output indicating unit basically comprises on country overall ability to have capacity for innovation, quality of scientific research institute, company spending on R&D, university and industry collaboration in R&D and availability of engineers and scientist with overall knowledge impact actually influence research and development

Particularly when developing the new knowledge based economy, Similarly India place at 42nd out of 140 countries with slightly higher GDP growth spending on R&D. While on the other hand Malaysia and Turkey is more progress middle income economies that place their mark 20th and 41st out of 140 countries, In case developed economies Israel and South Korea mark their position 03rd and 6th respectively.

FUTURE RESEARCH DIRECTIONS

Under the light of statistical data that shows the present status of Pakistan internationally: in order to boost or improve the international standing of Pakistan National innovation mechanism extensive efforts must be paid on “human capital”, “institutions”, “scientific output”, and “creative output”. While, government target 2025 vision and implement certain process for reconfiguration of current innovation mechanism as main dimension to accomplish the vision. As innovation consider as continuous process and according to present situation no country attempt to claim its saturation without adding any new approach to improve innovation at national level in long term perceptive. Similarly, to this Pakistan have a positive and supportive infrastructure but due to the lack of overall innovation policies may redeem the expected vision.

Table 4. Present status of Pakistan in global innovation index

Pillars of GII	2011	2012	2013	2014	2015	2016	2017
Global Innovation Index	26.8	23.1	23.3	24	23.1	22.6	23.8
Institutions	46.7	39	40.2	40.1	37.1	37.1	38
Human capital & research	14	10	7.7	9.8	12.8	13	12.8
Infrastructure	19.5	20.9	19.8	22.2	23.1	26.5	29
Market sophistication	28.1	23.4	29.6	35.8	35.8	35.7	38.3
Business sophistication	24.7	28.3	21.1	19.3	22.5	25.3	29
Scientific outputs	17.5	18.1	19.7	21.9	20.2	19.6	18.9
Creative outputs	36.3	25.6	26.3	23.2	19.6	15.9	17.4

The R&D activities in Pakistan mostly practiced among the public sector research organizations and in few universities. The initial structure of R&D mechanism in public sectors organization based under federal and provincial ministries depend upon under which authority the public sector organization serves. The public sector research organization basically involve in research of Advance agriculture science and development, science and technology, Advance medical sciences, life stock, civil and water resource, Advance engineering science, Energy Management and Advance bioengineering (Muhammad Anwar ul Haq 2014). In public sector research institute majority of R&D activities belongs to agriculture science and development more than 40 organizations currently active in this sector. While, approximately 19 public sector R&D institute involve in conducting research in science and engineering. There are less 6 institutes involved in conducting research in Advance Medical science and biotechnology (Technology, 2009). However, in spite the higher number of research institutes belong to agriculture Pakistan unable to reached with self-reliance in agriculture sector. There is huge rectification also required in Medical science and Engineering sector due to the lack of connectivity among the universities and enterprises that are not as much active to carry out internal R&D activities.

CONCLUSION

The initial perception on efficiency related to national innovation structure is directly linked with fundamental theory of productivity. An innovation mechanism (more related to policy development) is designated as proficient based on some precise parameter for instance: when the similar magnitude of effort exerts for innovation inputs firms were expected to have same amount of innovation outputs; similarly, when less effort has made for innovation input same amount of innovation has been drive at outcome.

Developing innovation capabilities with systematic approach in Pakistan has understand over period of time but still need aggressive approach. In effort to established comprehensive systematic approach regarding to develop innovational capabilities require aggressive policy formulation which needs a comprehensive contribution of all stakeholders from government body to private sector. Still more options need to discover other domain of research field and develop supportive structure to encourage private R&D firms to carry out research activities and R&D investment to industrial scale as most as Pakistan need to adopt the same approach as other emerging economies do by implement R&D incubators as to provide interconnectivity in between the academia and industrial sectors

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KEY TERMS AND DEFINITIONS

Capability: The approach which enable broad spectrum of fields, most significantly in creative thinking, economical welfare, and social policies this reflects individual's wellbeing and social planning.

Innovation: It refers to the act of developing new idea, technique, or product.

Innovation Management: Innovation Management is ability to managing innovation practices, starting at the initial stages of conceptualization, to its final stage of successful implementation.

Knowledge Management: Knowledge management describe as process to encourage knowledge growth, extensive sharing of knowledge among the function of organization.

Pakistan: It is a country in Asia, along the Arabian Sea and Gulf of Oman and it is bordered by India, Iran, Afghanistan, and China.

Research and Development (R&D): It refers to the activities for betterment of existing technology, knowledge and/or products.

Technology Management: Technology management is set of management disciplines that allows organizations to manage their technological fundamentals

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<https://www.igi-global.com/book/encyclopedia-organizational-knowledge-administration-technology/242894>

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